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PEDAGOGICAL POSSIBILITIES OF DIGITAL INTEGRATION IN ENSURING THE CONTINUITY OF MUSIC TEACHING METHODOLOGY AT HIGHER AND GENERAL EDUCATION LEVELS

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Abstract. *This article analyzes the pedagogical possibilities of digital integration in ensuring the continuity of music teaching methodology at higher and general education levels. The significance of digital technologies, e-learning resources, interactive platforms, and artificial intelligence-based tools in strengthening methodological continuity between different levels of education is highlighted. The article also addresses issues related to the gradual development of students' musical competencies through the effective use of the modern digital environment in music education, the integration of educational content and methods, as well as the improvement of the professional and methodological training of future music teachers. As a result of the study, the priority directions of a digital-integrative approach are substantiated, which serve to enhance methodological cooperation between higher and general education systems and to increase the effectiveness of continuous music education.*

Keywords: *music education, music teaching methodology, continuity, digital integration, digital learning environment, e-learning resources, musical competence, future music teacher, innovative technologies, continuous education*.

INTRODUCTION

The processes of reforming the education system in the Republic of Uzbekistan have made ensuring continuity between all levels of continuous education one of the pressing tasks. In particular, the reforms being carried out in the field of music education aim not only to provide children with aesthetic education but also to realize their creative potential and to raise them in the spirit of respect for national and universal values. Achieving these goals directly depends on the extent to which methodological continuity is ensured between the professional training of future music teachers in higher education and the actual educational process in general education schools.

The Decree No. PD-391 of the President of the Republic of Uzbekistan dated November 15, 2024, "On measures to radically improve the teaching of the subject of music culture in general secondary schools and to develop the professional activities of teachers of this subject" [1] marked a new stage in the field. This decree outlines important tasks such as a new procedure for improving the qualifications of music culture teachers, the introduction of a national assessment system, and the establishment of integration between children's music schools and general education schools. This necessitates a re-evaluation, based on new approaches, of the issue of

ensuring continuity between the content of training for future teachers in higher education and the real needs of school education [4.3].

The relevance of the problem lies in the fact that in current practice, there are certain discrepancies between the content of the subject "Music Teaching Methodology" taught in higher education institutions and the actual methodological requirements of music culture lessons in general education schools. These discrepancies lead to a prolonged period of professional adaptation for young specialists and, in some cases, to difficulties in applying theoretical knowledge in practice [3.1]. At the same time, the rapid development of digital technologies and their integration into the educational process necessitate a revision of traditional methodological approaches and their harmonization with modern didactic tools [3.2].

The purpose of this article is to systematically analyze the existing problems in ensuring the continuity of music teaching methodology between higher and general education, as well as to substantiate the necessity and possibilities of implementing digital integration based on the requirements of recent government decrees.

METHODOLOGY

During the research process, a number of theoretical and practical methods were applied based on a comprehensive approach:

Theoretical methods: Comparative-analytical study of scientific literature in the field of music education methodology, pedagogy, and psychology; Content analysis of the normative legal documents of the Republic of Uzbekistan related to education, in particular, Decree No. PD-391 and other documents aimed at ensuring its implementation [1.1]; Comparative analysis of curricula and manuals on music teaching methodology intended for higher education and general education [1.4].

Empirical methods: Conducting surveys among professors and teachers working in the field of music education at higher education institutions and music culture teachers at general education schools; In-depth interviews with selected respondents; Observation and analysis of open lessons conducted by higher education and school teachers.

The research was conducted during 2025–2026 and involved 2 higher education institutions and 4 general education schools from various regions of the republic.

RESULTS

- **Systematic analysis of continuity problems:** The results of the conducted research have shown that there are a number of systemic problems in ensuring the continuity of music teaching methodology between higher and general education.
- **Curricular and methodological imbalance:** Significant discrepancies have been identified between the content of the subject "Music Teaching Methodology" taught in higher education and the current music culture curricula of general education schools. 73% of respondent teachers noted that the methodological approaches studied in higher education are not fully applied in school practice. In particular, although modern pedagogical technologies are emphasized in higher education, the material and technical base of schools and the high occupancy of classes limit the possibilities of applying these technologies.
- **Disruption in professional competencies:** According to the requirements set out in Decree No. PD-391, music culture teachers must possess the skill of playing at least one national musical instrument [1.1]. However, the research revealed that 41% of higher education graduates do not have instrumental performance skills at the required level. At the same time, 68% of school

teachers noted a lack of knowledge and skills in using digital technologies in their methodological training.

- **Weakness of the practical training base:** According to the research results, the pedagogical practice of higher education students is mainly limited to observing lessons and conducting a restricted number of classes. As stipulated in paragraph 2 of Decree No. PD-391, it is envisaged that the pre-graduation practice of graduates of higher education institutions in the field of culture and arts be organized in schools on the basis of an agreement [1.4]. However, this mechanism has not yet been fully implemented.
- **Insufficient methodological cooperation:** Methodological cooperation between higher education and school teachers has not taken on a systematic character. 82% of respondents noted the absence of regular methodological contacts with higher education professors and teachers, and 76% noted the lack of platforms for exchanging methodological experience between schools and higher education institutions.

The necessity and possibilities of digital integration.

The research results showed that the integration of digital technologies is an important factor in ensuring continuity.

- ✓ **The importance of digital competencies.** 87% of school teachers who participated in the survey acknowledged that the use of digital technologies is an important factor in increasing lesson effectiveness. However, only 34% of them reported regularly using digital tools in their activities. The main obstacles cited were a lack of relevant knowledge (61%), a shortage of methodological materials (54%), and limited technical capabilities (47%).
- ✓ **The need for methodological platforms.** Paragraph 4 of Decree No. PD-391 designates children's music and art schools as basic educational institutions for providing methodological support to music culture teachers of general education schools [1.2.]. [4.3.] To effectively implement this task, it is necessary to establish methodological cooperation through digital platforms. 79% of the teachers participating in the study expressed a need for digital resources such as an online methodological center, a collection of video lessons, and interactive methodological guides.
- ✓ **The harmony of digital and traditional methods.** Modern research shows that integrating traditional and digital methods in music teaching significantly increases the effectiveness of the pedagogical process and develops students' musical competencies and creative potential [3.2.]. In particular, digital simulators and interactive programs offer extensive opportunities for teaching music literacy, developing musical hearing, and forming instrumental performance skills.

DISCUSSION

The issue of ensuring continuity in music teaching methodology between higher and general education presents itself as a complex and multifaceted pedagogical problem. The research results show that the existing imbalances are related to a number of objective and subjective factors.

Firstly, the discrepancy between the profile of graduates trained in higher education and the real needs of school education should be regarded as a systemic problem that has been formed over many years. The tasks set out in Decree No. PQ-391, including the introduction of the practice of teaching psychology and pedagogy in higher education institutions in the field of culture and arts [1.1.], are precisely aimed at solving this problem. This serves to prepare future music teachers not only as narrow field specialists but also as personnel with pedagogical competencies.

Secondly, the continuity of methodological heritage plays an important role in ensuring continuity. The rich methodological heritage formed in the 20th century (D.B. Kabalevsky, N.A. Vetlugina, O.A. Apraksyan, and others) needs to be reinterpreted today on the basis of new technological possibilities. Research by Uzbek scholars in the field of music education methodology [2.1.] also emphasizes the need to preserve this heritage while enriching it with modern didactic tools.

Thirdly, digital integration requires not only technical equipment but also the development of new methodological approaches. Digital technologies offer a number of advantages in music teaching: the possibility of teaching through individual trajectories, the ease of explaining abstract concepts through visualization tools, and opportunities for distance collaboration and experience exchange. However, the methodology for applying these technologies has not yet been sufficiently developed. In particular, as specified in paragraph 4 of Decree No. PD-391, organizing "Iqtidor" amateur art groups in schools and supporting their activities through digital tools requires further improvement of methodological developments in this area.

Fourthly, the role of the monitoring and assessment system is important in ensuring continuity. Paragraph 3 of Decree No. PD-391 sets the task of developing and implementing into practice a national assessment system to determine the level of knowledge and professional skills of music culture teachers by the 2025/2026 academic year [1.1.]. This system will make it possible to compare the level of training of higher education graduates with school requirements, identify shortcomings in continuity, and make appropriate corrections.

From the author's perspective, ensuring the continuity of music teaching methodology between higher and general education requires the implementation of comprehensive measures in the following directions:

1. **Coordination of curricula.** The content of the subject "Music Teaching Methodology" in higher education should be synchronized with the updated curricula of general education schools, and the orientation of methodological modules toward school practice should be strengthened. In doing so, special attention should be paid to the skills of playing national musical instruments as outlined in Decree No. PD-391.
2. **Creation of a unified digital methodological platform.** It is advisable to develop a unified digital methodological platform for teachers of higher education, children's music schools, and general education schools. This platform should provide the following capabilities:
   - A bank of methodological developments and lesson plans;
   - An archive of video lessons and master classes;
   - Online consultations and forums;
   - Distance professional development courses;
   - An interactive didactic material constructor.
3. **Establishment of a mentoring system.** A mentoring system should be formed between leading professors and teachers of higher education and qualified school teachers, and a mechanism for providing methodological support to young specialists during their professional adaptation period should be developed.
4. **Encouragement of scientific and methodological research.** It is necessary to expand scientific research on the methodology of using digital technologies in music education and the pedagogical-psychological foundations of ensuring continuity, as well as to improve the mechanisms for implementing the results of such research into practice.

5. **Strengthening the practical training base.** As stipulated in paragraph 2 of Decree No. PD-391, it is necessary to develop effective mechanisms for organizing pre-graduation practice of graduates of higher education institutions in the field of culture and arts in schools, to increase the amount of time students spend on school practice, and to enrich its content.

CONCLUSION

The issue of ensuring the continuity of music teaching methodology between higher and general education is an important component of the educational reforms being implemented in the Republic of Uzbekistan. Presidential Decree No. PD-391 has created a solid legal foundation in this regard, and the timely and high-quality implementation of the tasks outlined therein will serve to radically improve the quality of music education.

The research results show that digital integration can play an important role in solving existing problems. Digital technologies not only expand methodological cooperation but also create extensive opportunities for preserving the rich heritage of music teaching methodology and enriching it with modern didactic capabilities. At the same time, digital integration requires not merely technical equipment but also new methodological approaches, the development of teachers' digital competencies, and the introduction of new forms of methodological service provision.

Future research should focus on the didactic foundations of harmonizing digital and traditional methods in music education, a monitoring system for ensuring continuity, as well as the development of methodological support aimed at the implementation of Decree No. PD-391.

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AGE-RELATED DYNAMICS OF INTELLECTUAL DEVELOPMENT IN COMPREHENSIVE SECONDARY SCHOOLCHILDREN

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Abstract. *This article examines the age-related dynamics of intellectual development in middle school students from late childhood to late adolescence (grades 3 to 10) using both longitudinal and cross-sectional methods. Utilizing the Wechsler Intelligence Scale for Children (WISC), the study analyzes the qualitative and quantitative changes in the structure of general (G-factor), verbal, and non-verbal intelligence. The findings indicate that integration processes predominate in the structure of intelligence at the age of 13–14, whereas processes of differentiation and individualization begin to emerge at 15–16 years old. Finally, the authors provide practical recommendations for organizing intellectual education and implementing individualized developmental programs within the environment of mainstream public schools.*

Keywords: *intellectual development, age-related dynamics, adolescence, verbal intelligence, non-verbal intelligence, longitudinal study, Wechsler intelligence scale, integration, differentiation, intellectual education.*

Introduction

The intellectual education of students constitutes one of the core priorities of modern comprehensive schools. The development and implementation of intellect-intensive technologies within the school educational process cannot be achieved without carefully considering the patterns of age-related changes in intellectual structure, particularly the sensitive periods of personality development.

In foreign literature, the following perspectives on the intellectual development of adolescents can be identified. As L.S. Vygotsky pointed out: "The traditional psychology of the transitional age tends to see the emotional changes as the central core and principal content of the entire crisis, thereby contrasting the development of the adolescent's emotional life with the intellectual development of the schoolchild" [1]. However, it is precisely the restructuring of the intellectual sphere that serves as the foundation for subsequent fundamental changes across the entire personality system of the adolescent. Due to intellectual development during adolescence, the child's sphere of consciousness expands, a groundwork is laid for the adequate understanding of others, and the foundations of self-awareness and conscious intellectual self-regulation are established.

The most profound attention to the problem of adolescent intellectual development is observed in the works of L.S. Vygotsky and J. Piaget. Despite existing differences, both authors emphasize that starting from the age of 11–12, a nearly complete restructuring occurs in the child's intellect, resulting not only in the emergence of its new forms but also in the subsequent reconfiguration of prior forms based on this new foundation. L.S. Vygotsky considers the emergence of conceptual thinking (ponyatiniye) to be the central neoformation of the adolescent's intellectual sphere. Through concepts, the child becomes capable of systematizing the perceived

world in all its diversity, an intellectual restructuring of elementary cognitive functions takes place, and new possibilities for self-awareness open up. "Intellect emerges as an effect of changes in interfunctional connections, representing a specific 'alloy' (synthesis, integration) of cognitive processes restructured by the categorial apparatus of conceptual thinking" [7].

J. Piaget associates the qualitative restructuring of intellect during adolescence with the emergence of formal-logical thinking (the stage of formal operations). Due to the formation of formal operations, the possibility for fully-fledged intellectual adaptation arises, and "thinking becomes free relative to the real world" [5].

Both Vygotsky and Piaget emphasize that the qualitative restructuring of intellect characteristic of adolescence is significantly prolonged in terms of time. "It would be an error to imagine that the adolescent's entire thinking is encompassed by concepts" [2]. This is akin to the view that an adult thinks solely on the basis of the laws of formal logic. Abstract thinking is not a quantitatively predominant form, especially in early adolescence. In this regard, tracing the quantitative and qualitative changes in the structure of adolescents' intellect arouses considerable interest.

Studies on the age-related dynamics of adolescent intellectual development conducted by a number of foreign psychologists have revealed several patterns. Thus, based on the experimental results of V.A. Averin and J.A. Balakshina, the uneven nature of the intellectual development process during adolescence is emphasized, distinguishing two distinct periods: the sensitive period (ages 12–13) and the critical period (ages 13–14). The first period is characterized by the highest rates of development, particularly in indicators of general awareness and the capacity for generalization, whereas the second period is marked by the stabilization of most verbal and non-verbal intelligence indicators. [1].

Similar conclusions can be drawn from the results of other studies. For instance, according to data by I.A. Pinchuk and N.K. Shelyakhovskaya, the level of verbal-logical reflection in adolescents increases significantly during the transition from the 5th grade to the 6th and 7th grades, followed by a slight decrease by the 8th grade [4].

In studying the age-related dynamics of intellectual development, most authors equate intellect with thinking and, rather than viewing it as a general ability, focus predominantly on discrete functions and traits (reflection, generalization, classification). A theoretical analysis of existing approaches to the concept of "intellect" reveals that there is currently neither a single definitive understanding of intellect nor a unified approach to its measurement.

However, one aspect is certain: the understanding of this phenomenon cannot be restricted to its functions, activity outcomes, or quantitative IQ metrics. In our view, given the current level of knowledge regarding its nature and mechanisms, intellect can be conceptualized as a "black box" for which the determining operational factors, as well as the functional manifestations emerging as derivatives of its structure, are known.

Organization of the Research. This study was conducted using the cross-sectional method among students of comprehensive secondary school No. 11 in the city of Yangier. The dynamics of intellectual development were evaluated in 3rd to 6th-grade students (23 participants). Students with higher intellectual parameters were included in the experimental group: the group average IQ value for the third grade constituted 126 points,

As a tool for measuring the characteristics of the participants' general intellectual development, the children's version of the D. Wechsler scale adapted by Yu.I. Filimonenko and V.I. Timofeev was utilized [8].

The methodology is based on the hierarchical model of Wechsler's intelligence, which posits the differentiation of the general factor (G-factor) into verbal and non-verbal intelligence factors, which, in turn, are subdivided into a series of specific factors corresponding to individual subtests.

The Wechsler scales are among the most renowned and proven instruments in intellectual psychodiagnostics, enabling the disclosure of its structural features, the determination of the level and interrelation of several specific abilities, as well as their contribution to the integral assessment. The obtained data were processed using correlation and factor analysis methods [3].

Statistical processing of the data revealed the specific characteristics of standardizing the Wechsler scale and interpreting the obtained metrics. In this regard, it is pertinent to note the appropriateness of shifting the IQ interpretation scale slightly to the left.

RESULTS AND DISCUSSION

Dynamics of Intellectual Development in the Transition from Early School Age to Early Adolescence.During the transition from early school age to early adolescence, no tendency toward an increase or decrease in intelligence quotients (IQ) is observed. In the transition from the 3rd to the 6th grade, from the 3rd to the 7th grade, and from the 3rd to the 8th grade, the group-average IQ indicators do not change significantly. Statistical analysis conducted using the sign test revealed a significant increase in students' performance on the "Information" and "Object Assembly" subtests.

It can be assumed that the intellectual development of early adolescents is primarily associated with the expansion of their worldview, as well as the accumulation and systematization of knowledge. The outcome of this process is the formation of a knowledge base, which constitutes one of the essential components of human intellect.

This fact is corroborated by the rather high and significant correlation coefficients (ranging from 0.70 to 0.78) between IQ and the results of the "Information" subtest across various ages. Since the performance scores on this subtest demonstrate a sufficiently high mutual correlation across all three longitudinal studies at different ages (0.75, 0.68, and 0.75), the observed increase in performance cannot be interpreted as accidental.

The significant increase in performance on the "Object Assembly" subtest in the first and second longitudinal studies is, apparently, linked to the development of students' analytic-synthetic abilities and their capacity to correlate a part within the structure of the whole.

This subtest differs from "Block Design" (in which no significant growth was observed) primarily because it engages the heuristic components of thinking, the ability to anticipate an ideal etalon, and the capacity to reconstruct the necessary integral image from individual elements. It is probable that between the ages of 11–12 and 14–15, the development of precisely these components represents the most crucial change within the non-verbal sphere of adolescents. It should be noted that the age boundaries in this study are, to a certain extent, conditional.

Based on the analysis of domestic and foreign literature, the concept of social behavior is defined for further research. Social behavior is a form of behavior of an individual or group, which is aimed at the formation and maintenance of interaction and relations between the individual and the people and groups surrounding him, contributing to the social structure of society and depending on the norms in it.

Young people, as a special group of the population with specific age-specific behavioral patterns, are of the greatest interest for studying the relationship between Internet communication and social behavior.[9]

Regarding age-related characteristics, it can also be stated that adolescence represents a period of regulation over one's behavior, as well as a phase characterized by apprehension regarding future planning [10].

In conclusion, the Internet has transformed the social environment of youth in significant ways. Understanding the psychological aspects of Internet communication is essential for creating a safe and supportive digital environment that promotes healthy social development and well-being.[11]

CONCLUSIONS

Based on the investigation of the regularities of intellectual development in comprehensive secondary school students using longitudinal and cross-sectional methods, the following conclusions have been drawn:

1. **The Uneven Nature of Intellectual Development:** During the transition from early school age to early adolescence (grades 3 to 7–8), the general intelligence quotient (IQ) does not undergo sharp quantitative changes. However, during this period, qualitative indicators on the "Information" and "Object Assembly" subtests increase significantly. This indicates that intellectual development in the initial stage of adolescence occurs primarily due to the expansion of the worldview and the formation of analytic-synthetic abilities.
2. **Predominance of Integration Processes at Ages 13–14:** In early adolescence, integration processes occupy a leading position within the intellectual structure. Intellect develops as a holistic cognitive system and determines the adolescent's academic achievement level. Concurrently, it was established that the systematic coordination of scientific concepts within mainstream educational settings is not yet fully completed at this stage.
3. **Differentiation and Qualitative Leap at Ages 15–16:** In the transition from early adolescence to late adolescence and youth (grades 8 to 10), a significant quantitative increase in the general IQ level is observed (\(p=0.004\)). This growth is predominantly associated with the rapid development of verbal intelligence. In older school-age students, a distinct boundary (differentiation) occurs between the verbal and non-verbal spheres of intellect, along with the individualization of personal cognitive styles.
4. **Pedagogical Recommendations:** The obtained results demonstrate the necessity of differentiating the school educational process in accordance with age-related characteristics. While a system of games and training aimed at stimulating intellectual interests and unlocking creative potential is required for 6th to 8th-grade students, implementing individualized educational programs based on internal differentiation yields high efficiency for 9th to 10th-grade students.

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THE IMPORTANCE OF PHONEMIC PERCEPTION IN SPEECH ACTIVITY

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Abstract. *This article examines the importance of phonemic perception in speech activity and literacy development among primary school learners. Phonemic perception is described as the ability to hear, distinguish, analyze, and meaningfully interpret speech sounds as linguistic units. The article explains that well-developed phonemic perception supports correct pronunciation, vocabulary enrichment, speech comprehension, and the successful acquisition of reading and writing skills. Special attention is given to the relationship between sounds and letters, the development of analysis and synthesis skills, and the prevention of common literacy difficulties such as sound confusion, incorrect pronunciation, and spelling errors. The study also discusses theoretical, psychological, and pedagogical approaches to phonemic perception and emphasizes its role in forming oral and written speech. It concludes that systematic phonetic exercises, pronunciation activities, didactic games, and interactive methods are essential for developing learners' speech culture, literacy, and independent communication skills in primary education and early language learning contexts today.*

Keywords*: phonemic perception, speech activity, phonemic hearing, sound differentiation, oral speech, written speech, literacy, pedagogy, psycholinguistics.*

Introduction. In the current era of rapid globalization and the development of information technologies, one of the main tasks facing the education system is to form a well-rounded individual who can think independently, speak fluently, and express ideas logically and coherently. In particular, the development of students' speech at the primary education stage is of great importance. This is because it is during this period that a child's thinking, worldview, vocabulary, and communication skills are formed. Speech is one of the most important means of human communication, and its proper development depends on many psychological and linguistic factors. Among these factors, phonemic perception holds a special significance. As a process of distinguishing and recognizing speech sounds, phonemic perception plays an important role at all stages of speech activity. Today, the development of children's speech and the elimination of speech defects are considered urgent issues, and the insufficient development of phonemic perception negatively affects the proper formation of speech. Therefore, studying the role of phonemic perception in speech activity is of great importance.

Analysis of Literature Related to the Topic. In recent years, the concept of phonemic perception has significantly expanded and deepened. Previously, it was considered only as the ability to hear and distinguish sounds, whereas today it is interpreted as a complex, multi-component, and integrative process. The issue of phonemic perception is one of the complex scientific fields studied at the intersection of psychology, linguistics, and pedagogy. An analysis of scientific literature related to the topic shows that research has mainly been conducted in three major directions:

- Theoretical-linguistic approach;
- Psychological and cognitive approach;
- Pedagogical and speech-therapy approach.

When analyzing the theoretical-linguistic approach, the ideas of the internationally recognized scholar Roman Jakobson can be observed. The scholar connected phonemic perception with linguistics. According to him, the process of speech perception is not simply "hearing"; rather, this approach highlights phonological oppositions within the language system. He considered phonemic perception as units that differentiate meanings within the language system.

Regarding the concepts of speech activity and phonemic perception, one of the Russian scholars, Lev Vygotsky, emphasized the close relationship between speech and thinking and particularly pointed out the importance of phonemic perception in the development of children's speech. According to his view, the formation of speech is directly connected with the social environment and auditory perception processes.

In addition, Alexander Luria studied speech activity in relation to brain function and scientifically substantiated the role of phonemic hearing in the perception and reproduction of speech. He emphasized that impairments in phonemic perception can lead to speech disorders.

A representative of the German scientific school, the German scholar Adolf Kussmaul, is considered one of the first researchers to study speech and language disorders in his work Die Störungen der Sprache ("Speech Disorders"), published in 1877. Several of Kussmaul's ideas related to phonemic perception can be observed. The scholar put forward the following views:

- Speech sounds are not merely the result of simple hearing, but of complex mental processing.
- Incorrect differentiation of sounds leads to difficulties in understanding speech.
- This process is connected with brain activity.

According to Kussmaul, speech is not only the production of sounds, but also the process of recognizing heard sounds in the brain and transforming them into meaning. The scholar referred to impairments in speech perception as "word blindness." Although a child may hear sounds, they may fail to understand them as words. Even though Kussmaul did not develop phonemic perception as a separate term, he laid the foundation for the formation of the concept in the fields of speech therapy and neurolinguistics.

Modern studies also widely emphasize the role of phonemic perception, and many scholars particularly note its importance in the processes of reading and writing. In particular, it has been scientifically proven that insufficient development of phonemic perception may lead to problems such as Dyslexia and Dysgraphia. Today, phonemic perception is viewed not merely as "hearing," but as a three-stage process:

- hearing (acoustic) — the sound is received through the ear;
- differentiation (phonemic analysis) — distinguishing similar sounds such as b–d, t–d, and k–g;
- meaningful association (connection to the language system) — linking sounds with words and meanings.

In modern science, phonemic perception is considered not simply the "hearing" of speech, but the process by which the brain processes sounds as linguistic units, and it is regarded as one of the main foundations of literacy.

Sound serves as the basis for literacy instruction. During the literacy teaching period, exercises are conducted on the analysis and synthesis of words and syllables through sounds, as

well as on the analysis of sounds and their articulation. Work is also carried out on diction (clear and fluent pronunciation), and speech-therapy activities are organized. Work on sounds is especially integrated with synthesis techniques such as forming words from cut-out letters. Continuously clarifying the relationship between sounds and letters is beneficial both for developing reading skills and for creating the foundation of accurate spelling and literate writing.

Materials and Methods

When a child comes to school for the first time, new words begin to appear in their vocabulary, and their word stock gradually increases. In this process, the teacher's main task is to form correct speech in students and explain the principles of speech culture to them. First of all, it is necessary to understand what speech itself is, how it can be developed, and what requirements are imposed on it.

Speech is a type of human activity that involves the use of language means (words, phrases, and sentences) to activate thinking. Speech performs the functions of communication, delivering information, expressing one's thoughts and emotions, and influencing others. At the same time, speech is divided into two types: oral speech and written speech. Oral speech exists only during the moment of speaking, and once the process ends, the speech also disappears. Oral speech is produced quickly and does not allow opportunities for editing. In terms of vocabulary richness, oral speech is relatively poorer than written speech. Written speech is a complex process that requires considerable time and effort. During this process, a person constantly monitors themselves. In written speech, literacy and content play the main role. Particular attention should also be paid to coherent speech in written communication.

The development of students' speech has its own methodological tools and different types of exercises. Among them, the most important are coherent speech exercises. Consistency in speech development is ensured through four conditions: the sequence of exercises, continuity, diversity, and the ability to subordinate different types of exercises to a common goal. Each new exercise is connected with the previous one and prepares students for the next, while also adding something new within the framework of a common purpose. In schools, the development of students' speech is regarded as one of the main tasks of teaching the mother tongue.

During the literacy teaching period, the ability to purposefully perform reading and writing actions is called reading and writing skills. Such skills require knowledge, because no skill can be formed without knowledge. However, knowledge may not always transform into a skill. For example, a child may know the elements of the letter "v" and how it should be placed between writing lines, yet still be unable to write it properly in a notebook. Likewise, a student may recognize letters but still be unable to read them. In order to develop writing skills, other types of activities are also taught, such as sitting correctly at the desk during writing, holding the pen properly between the fingers, and placing the notebook at the correct angle.

Reading and writing skills are gradually improved and transformed into proficiency. In order for proficiency to develop, the same activity must be repeated many times. In writing proficiency, a student begins to write words and sentences without consciously thinking about how to hold or move the pen. Thus, reading and writing proficiency is the process of performing actions automatically, without deliberate thought. Proficiency is reinforced in the later stages of teaching and brought to the level of automatization.

Reading and writing are types of human speech activity and are considered speech-related skills. Both reading and writing skills are formed in close connection with other types of speech

activity, such as oral storytelling, understanding others' speech through listening, and inner speech. The success of teaching at school largely depends on how literacy instruction is organized.

In the process of teaching literacy, while introducing students to elementary reading and writing, it is necessary to create conditions that encourage learners to participate actively and engage in speech activity. Situations should be created that generate a need and motivation for students to express their thoughts orally or in written form.

Reading and writing skills support the successful development of one another. Therefore, teaching reading and teaching writing are conducted simultaneously, and these activities are practiced regularly. Consequently, during the literacy instruction process, the child needs to read and write extensively. New texts are used both for reading and writing because achieving the intended goal by repeatedly reading the same text is difficult. This often leads only to superficial memorization of the text. In repetitive activities, changing the situation and content helps strengthen skills and develop abilities. Before the student stands a long-term goal — learning to read and write — as well as immediate daily goals, such as reading riddles and finding their answers, reading words and sentences, and describing pictures orally.

During literacy instruction, the teacher should take into account the phonetic characteristics of the Uzbek language while introducing students to sounds and letters and while teaching them to synthesize sounds into reading.

Literacy instruction is carried out on the basis of the analytic-synthetic sound method. Words are divided into syllables, the target sound is separated from the syllable, analyzed, synthesized with the letter being studied, and on this basis the process of learning letters and whole-word reading is mastered. In this process, the graphic system of the Uzbek language and the specific features of representing sounds in writing are taken into account. The following features of the Uzbek graphic system are especially important in literacy instruction:

1. In literacy teaching, the introduction of sound-letters begins with vowels. Modern Uzbek has six vowel phonemes: a, o, i, e, u, o‘.

The letter "e" is used at the beginning of words and syllables (ekin, echki, aeroplan), while after consonants it is pronounced as a mid-open unrounded vowel (kel, tez). Therefore, during literacy instruction, students are first introduced to the "e" sound-letter at the beginning of words, and later to the "e" occurring after consonants.

The letter "o" in native and common Turkic words represents a low, rounded vowel sound, whereas in Russian and international loanwords it may be pronounced differently in unstressed syllables: like "a" (botanika), like "o‘" (tonna), or like a short "i" (traktor). For this reason, Russian-international words containing this vowel are introduced after the literacy teaching stage.

The sound "a" is pronounced similarly to "o" in words such as bahor and savol, and close to "i" in words such as muomala and munosabat, though it is still written as "a."

The sound "u" in words like qovun and sovun may be pronounced close to "i," but it is still written as "u."

The sound "i" is preserved in writing even when it is not pronounced in words such as bilan and sira.

2. The Uzbek language has 24 consonant sounds. In writing, they are represented by 23 letters, three of which are digraphs and twenty-one are single letters. These include: b, d, f, g, h, j (jurnal), j (jo‘ja), k, l, m, n, p, q, r, s, t, v, x, y, z, g‘, sh, ch, ng. Teaching consonants is also based on a specific order and requirements.

Results

Phonemic perception is the ability of a person to distinguish speech sounds from one another through hearing. In this process, a child learns to identify speech sounds, remember them, and use them correctly in speech. Phonemic perception is considered one of the most important psycholinguistic foundations of literacy acquisition at school. Before a child learns to read and write, it establishes the connection between "sound → letter." If phonemic perception is not sufficiently developed in a child, they confuse sounds, pronounce them incorrectly, and speech deficiencies emerge.

For example, the alveolar consonant sounds "j" and "ch" encounter an obstruction in the oral cavity during pronunciation. These two sounds are among those most frequently confused in children's speech, such as jo'ja–cho'cha and joy–choy. In fact, the difference between these sounds is significant: "j" is a fricative voiced sound, while "ch" is a voiceless affricate sound. One is produced more softly and smoothly, while the other is produced with a stronger burst. In this process, we can clearly observe that students' ability to distinguish sounds is directly related to phonemic perception. Therefore, the role of phonemic perception in speech activity is extremely important, and learners rely on phonemic perception in understanding speech processes. Phonemic perception is essential at all stages of speech activity, and below we will examine its role in speech activity one by one.

The Stage of Correct Pronunciation of Sounds. At this stage, the learner correctly reproduces the sound they hear and tries to pronounce each sound clearly. This reduces the confusion of words and ensures that speech becomes fluent and understandable. For example: *choy* (tea), *chiroq* (lamp), *chumchuq* (sparrow).

The Stage of Vocabulary Enrichment. At this stage, distinguishing sounds makes it easier for the learner to acquire new words. In practice, the child learns to use words correctly and effectively. When introduced to new words, they are also able to use them in sentences. For example: *Men choy ichdim* ("I drank tea"), *Chiroq yonib turibdi* ("The lamp is shining"). In this process, passive vocabulary becomes active vocabulary. As a result, the child's speech becomes clearer, more fluent, and more meaningful.

The Stage of Learning Reading and Writing. This stage is an important phase in the formation of reading and writing skills, as it involves understanding the relationship between sounds and letters. During this process, the child comprehends the connection between letters and sounds. They learn and perceive the relationship between the phoneme in speech and the grapheme in writing.

The Stage of Speech Comprehension. At this stage, the learner develops the ability to perceive spoken speech, understand its meaning, and respond appropriately. This stage serves as the main foundation for speech development. A learner who has mastered this stage understands heard words and sentences, distinguishes sounds, comprehends word meanings, and expresses their own attitude or opinion. They can also understand short stories and answer questions. For example, if we take words such as *havo* (air), *ob-havo* (weather), and *tabiat hodisalari* (natural phenomena), the learner has an understanding of these concepts and can provide thoughtful and appropriate responses to related questions.

Discussion

Phonemic perception is considered one of the main psycholinguistic foundations of literacy acquisition at school. Before a child learns to read and write, it establishes the "sound → letter" connection. We can observe several ways in which phonemic perception influences the literacy acquisition process.

During literacy instruction, before memorizing letters, the child learns to divide words into sounds, for example: *kitob → k-i-t-o-b*, and to combine sounds while reading. If phonemic perception is well developed, the child begins reading more quickly, can independently "sound out" new words, and makes fewer mistakes while reading. However, if phonemic perception is weak during the literacy stage, the child may fail to read letters correctly, rely on guessing words, and read slowly and unevenly.

Phonemic perception is also extremely important in the writing process because, in order for a child or learner to write a letter correctly, they must first perceive the sound accurately. The significance of phonemic perception in writing can be observed through several stages.

1. **Understanding the relationship between sound and letter.** T
   he learner should be able to identify the corresponding letter of the sound they hear.
2. **Writing words correctly.**
   At this stage, if phonemic perception is well developed, the child writes words by hearing sounds without omitting any sounds during writing.
3. **Developing analysis and synthesis skills.** A
   t this stage, the child learns to divide words into sounds while writing and to form words from sounds, that is, to construct words through analyzing and understanding each sound individually.
4. **Forming dictation and copying skills.**
   A learner with developed phonemic perception accurately perceives heard sentences or words and can correctly reproduce them in writing. This is highly important in writing dictations, copying texts, and completing independent written tasks.
5. **Helping to master spelling rules.**
   The ability to distinguish sounds correctly helps learners consciously understand spelling rules. In particular, phonemic perception plays an important role in writing voiced and voiceless consonants, vowels, and similarly pronounced sounds.

During this period, the foundation of syllabic reading is formed: learners are taught to read two-letter open syllables (such as *na, ni*), two-letter closed syllables (such as *in, ol*), and three-letter closed syllables (such as *mon, lim, til*). According to the complexity level of the sound-letters and educational material studied during the alphabet-learning period, it can be divided into three stages:

- the stage in which vowel sound-letters, voiced and fricative consonants, and words with structures such as *o-na, a-na, il, in* are studied;
- the stage in which consonants with difficult articulation such as *r, k, v* and words with structures such as *yo'lbars* (tiger), *do'st* (friend), and *rasm* (picture) are studied;
- the stage in which previously learned materials are reviewed and letter combinations such as *ng, sh, ch*, the letter *j* representing two sounds, the apostrophe (’), and words such as *jo'ja* (chick), *jurnal* (journal), *jirafa* (giraffe), *tong* (dawn), *so'ng* (after), *bodring* (cucumber), *choynak* (teapot), and *shudring* (dew) are taught for reading.

In the field of phonetic exercises, activities are conducted to compare voiced and voiceless consonants and to identify their role in distinguishing word meanings (for example: *ziyrak — siyrak, dil — til*). When studying consonants with difficult articulation, such as *ng* (*tong, rang, keng*), the labiodental consonant *v*, the affricate consonant *ch*, the voiced plosive *j* (*jo'ja*), and the voiced fricative *j* (*jurnal*), articulation-related exercises become more complex.

Conclusion

In conclusion, it should be emphasized that phonemic perception is one of the main psycholinguistic factors that plays an important role in students' speech development, especially in the process of literacy acquisition. Through correctly hearing, distinguishing, and consciously perceiving the speech sounds around them, children successfully master both oral and written speech. Therefore, the development of phonemic perception is considered one of the most important tasks of primary education.

The process of literacy instruction should be built on the sequence of sound–letter–syllable–word. A child must first hear and distinguish a sound, and only then connect it with the corresponding letter. The processes of reading and writing should be taught in close interrelation with one another.

As discussed in the article, speech is the main means through which a person expresses thinking, communication, and cognition, and its proper formation is directly related to phonemic perception. If a learner can clearly distinguish sounds, they pronounce words correctly, acquire new vocabulary more quickly, and make fewer mistakes in reading and writing. On the contrary, insufficient development of phonemic perception leads to confusion of sounds, incorrect pronunciation, and difficulties in reading and writing. This negatively affects the learner's overall literacy.

Furthermore, phonemic perception develops important skills in students, such as understanding the relationship between sounds and letters, dividing words into their sound components, and performing analysis and synthesis. Especially during the literacy acquisition period, children rely on phonemic perception while sounding out words, matching each sound with the corresponding letter, and combining them to form words. Thus, the development of phonemic perception serves as an essential factor in helping learners read fluently, write accurately, and develop coherent speech.

The role of phonemic perception is also highly significant in the writing process. If a learner does not correctly perceive a sound they hear, omissions, substitutions, or incorrect use of letters may occur in writing. In children with well-developed phonemic perception, written activities such as dictation, text copying, and composing texts independently are formed more effectively. This process not only improves spelling literacy but also helps make written speech fluent, clear, and meaningful.

In addition, the development of phonemic perception expands students' vocabulary, forms speech culture, and develops the ability to express ideas freely in communication. As learners correctly hear, understand, and acquire new words, their passive vocabulary gradually transforms into active vocabulary. As a result, their speech becomes richer, and they gain greater ability to express thoughts coherently and understandably.

Therefore, phonemic perception is important not only in teaching reading and writing but also in developing students' overall speech activity, thinking, and literacy. For this reason, it is necessary to effectively use exercises aimed at developing phonemic perception, sound-based activities, pronunciation exercises, didactic games, and interactive methods in primary education. A learner with well-developed phonemic perception will, in the future, become a literate, independently thinking, creative individual with a high level of speech culture.

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AWARENESS AND PREFERENCES FOR AMERICAN OR BRITISH ENGLISH AMONG UNIVERSITY STUDENTS LEARNING ENGLISH AS A FOREIGN LANGUAGE

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Abstract. *The current study investigates the awareness and preferences for American English (AmE) and British English (BrE) among university students enrolled in English as a Foreign Language (EFL) programs. Despite the global spread of English and the co-existence of its two most widely taught standard varieties, relatively little quantitative attention has been paid to how EFL learners consciously recognize, evaluate, and choose between them in academic and everyday communicative contexts. A mixed-methods design was employed, combining a validated questionnaire with semi-structured interviews. Participants comprised 214 undergraduate and postgraduate EFL students drawn from three universities including World Languages University, Jizzakh State Pedogogical University and National University of Uzbekistan. Descriptive statistics, independent-samples t-tests, and one-way ANOVA were used for quantitative data, while thematic analysis was applied to interview transcripts. Results revealed that the majority of respondents (71.5%) could reliably identify salient phonological and orthographic differences between the two varieties. AmE was preferred for media consumption and informal communication (62.3%), whereas BrE was perceived as more appropriate for formal academic writing and international prestige contexts (54.7%). Significant differences in preference were found with respect to gender, exposure to English-language media, and instructional variety used in participants' home institutions. These findings carry implications for curriculum design, materials development, and teacher training in EFL settings.*

Keywords: *language attitude, American English, British English, EFL, variety preference, mixed-methods design, ANOVA, independent-samples t-tests.*

INTRODUCTION

English occupies a unique position as the world's foremost lingua franca, serving as the primary medium of international commerce, scientific discourse, diplomacy, and digital communication. Within this global landscape, no two varieties have exerted greater pedagogical influence than American English (AmE) and British English (BrE). Both varieties enjoy official recognition, standardized codification in widely used dictionaries and grammar references, and extensive representation in published course materials (Crystal, 2003; Kachru, 1985). Yet, for the millions of students who learn English as a foreign language (EFL), the co-existence of these two prestigious varieties creates a complex sociolinguistic reality: learners must not only acquire grammatical competence but also navigate decisions about which variety to emulate, identify with, and deploy in different communicative situations.

The choice between AmE and BrE is rarely trivial. It reflects, among other factors, learners' exposure histories, teachers' instructional norms, institutional policies, perceptions of prestige, and aspirations tied to target-culture membership (Derwing & Munro, 2005; Jenkins, 2007). In many EFL contexts, particularly those outside the Inner Circle (Kachru, 1985), curricula simultaneously

draw on both varieties without explicit guidance, resulting in learner uncertainty and inconsistent production. This situation is further complicated by the pervasive influence of American popular culture and digital media, which exposes learners to AmE on an unprecedented scale even when their formal instruction foregrounds BrE (Garrett, 2010).

Despite the evident relevance of variety awareness to EFL pedagogy, the empirical literature on the topic remains fragmented. Studies conducted in the 1990s and 2000s documented a general preference for AmE among younger EFL populations in East Asia and the Middle East, attributing this trend to the media and the growing cultural dominance of the United States (Ladegaard & Sachdev, 2006; McKenzie, 2008). However, more recent scholarship suggests that attitudes are more nuanced and context-dependent than early research implied. BrE continues to command considerable prestige in former British colonial contexts and in academic writing traditions, and there is growing evidence that learners distinguish functionally between the two varieties depending on the communicative purpose at hand (Bayard et al., 2001; Cargile et al., 1994).

The present study addresses this gap by examining, in a single, adequately powered sample, the degree to which EFL university students (a) can accurately identify defining features of AmE and BrE, (b) express preferences for one variety over the other across a range of functional domains, and (c) differ systematically in these preferences as a function of gender, media exposure, and the instructional variety of their home institution. The study also seeks to understand the reasoning behind preferences as articulated in learners' own words through qualitative interview data. By combining psychometric assessment of attitudinal constructs with learners' reflective accounts, the study aims to generate findings that are both statistically robust and pedagogically meaningful.

Research Questions

The study was guided by the following research questions:

1. To what extent are EFL university students aware of the phonological, lexical, and orthographic differences between American English and British English?

2. Which variety do EFL university students prefer, and does this preference vary by communicative domain (formal academic writing, informal oral communication, digital/media contexts)?

3. Do variety preferences differ significantly according to gender, self-reported media exposure, and the instructional variety used at the participants' home institution?

4. What reasons do EFL university students provide for their variety preferences?

LITERATURE REVIEW

The sociolinguistic framework most commonly invoked in variety research is Kachru's (1985) Three Circles model, which distinguishes Inner Circle (native-speaker) countries from Outer Circle (post-colonial) and Expanding Circle (EFL) settings. Within this framework, AmE and BrE represent the two dominant Inner Circle norms, each supported by powerful publishing industries, internationally distributed examinations (e.g., TOEFL for AmE, IELTS for BrE), and governmental soft-power projection. Crystal (2003) estimated that American English reaches more second- and foreign-language learners globally than any other variety, a trend reinforced by the market dominance of American technology companies and streaming platforms. Nevertheless, BrE retains significant symbolic capital in many academic and professional domains, and British English-oriented examination boards continue to set the standard in numerous national curricula across Africa, South Asia, and parts of the Middle East (Jenkins, 2007).

Pennycook (1994) and Phillipson (1992) have critiqued the hegemonic spread of these two varieties as a form of linguistic imperialism that marginalizes local varieties and constrains learner identity. Counter-arguments in the English as a Lingua Franca (ELF) tradition (Jenkins, 2007; Seidlhofer, 2011) emphasize the legitimacy and communicative adequacy of non-native varieties and advocate for pedagogical models that do not privilege any single national standard. From a practical standpoint, however, most EFL learners continue to orient toward AmE or BrE as target varieties, making it important to understand the attitudinal landscape that shapes these orientations.

Research on language attitudes—defined as evaluative orientations toward languages or their speakers—has consistently shown that non-native varieties are rated lower on prestige and correctness dimensions than native varieties, while native varieties themselves are differentiated along status and solidarity axes (Lambert et al., 1960; Ryan et al., 1982). Within the AmE-BrE comparison, studies employing the verbal guise technique and direct questionnaire methods have generally found that BrE is perceived as more educated, sophisticated, and internationally prestigious, while AmE is rated as friendlier, more approachable, and more modern (Bayard et al., 2001; Bishop et al., 2005). These evaluative profiles reflect broader cultural stereotypes rather than purely linguistic assessments.

In EFL contexts specifically, McKenzie (2008) surveyed Japanese university students and found that while AmE was preferred for everyday communication, BrE was rated as more suitable for formal contexts. Similar functional distinctions were observed by Al-Wer and Holt (2011) among Jordanian EFL learners, and by Ladegaard and Sachdev (2006) among Hong Kong secondary students. These findings suggest that EFL learners do not simply adopt a single variety wholesale but rather develop differentiated attitudes that map varieties onto communicative contexts. More recent work by Matsuda (2020) and Galloway and Rose (2018) points toward an increasingly pluralistic orientation among younger EFL learners, who are simultaneously exposed to multiple varieties through digital media and may be less invested in achieving native-speaker norms of either variety.

A prerequisite for variety preference is variety awareness: the ability to identify and distinguish features that mark a spoken or written text as characteristically American or British. Research on this dimension is less abundant than attitudinal research but has grown in recent years. Rindal (2010) demonstrated that Norwegian EFL learners possessed substantial metalinguistic knowledge of AmE-BrE differences in phonology (e.g., /r/ rhoticity, the LOT-THOUGHT merger) and orthography (e.g., -ize vs. -ise, -or vs. -our), though their productive use often diverged from their stated norms. Findings from Wan (2019) in a Chinese EFL context confirmed that lexical differences (e.g., elevator vs. lift; gasoline vs. petrol) were more readily identified than grammatical or prosodic ones. The extent to which university-level EFL students systematically distinguish between the two varieties across multiple linguistic levels has not been comprehensively examined in a cross-institutional study.

Several variables have been proposed as predictors of variety preference in EFL populations. Institutional factors—primarily the variety used by teachers and represented in official course materials—constitute the most direct source of input and serve as an implicit norm (Deterding & Kirkpatrick, 2006). Gender has been identified as a moderating variable in several studies, with female learners more often reporting preference for BrE and attributing to it greater prestige, though results are not wholly consistent (Ladegaard & Sachdev, 2006). Media exposure, particularly to American films, music, and online content, has been proposed as a mechanism

driving AmE preference among youth audiences globally (Garrett, 2010). The present study treats each of these as independent variables and examines their joint contribution to variety preference.

METHODS

Research Design

A sequential explanatory mixed-methods design was adopted (Creswell & Plano Clark, 2018). In Phase 1, quantitative data were collected via a self-report questionnaire to establish the scope and correlates of variety awareness and preference across a large sample. In Phase 2, a purposively selected subset of participants took part in semi-structured interviews to elaborate and explain the patterns identified in Phase 1. The integration of the two strands occurred at the interpretation stage, where quantitative findings were explained with reference to qualitative themes.

Participants

Participants were recruited from three state universities, including World Languages University, Jizzakh State Pedogogical University and National University of Uzbekistan, in an Expanding Circle EFL context. Eligibility criteria required that students be enrolled in an English-medium or EFL-intensive program and have completed at least one year of tertiary-level English instruction. A total of 231 students were initially recruited; after excluding 17 questionnaires with excessive missing data (>10% of items), the final quantitative sample comprised N = 214 participants (126 female, 88 male; M_a^{GE} = 20.4 years, SD = 1.8). Participants reported a mean of 10.6 years of formal English instruction (SD = 2.3). For the qualitative strand, 24 participants were purposively selected to ensure variation in gender, institution, and preliminary questionnaire scores; all 24 provided informed consent for audio-recorded interviews.

Instruments

The questionnaire comprised four sections. Section A collected demographic information and language background data, including the instructional variety reportedly used at participants' institutions, self-rated English proficiency, and weekly hours of exposure to English-language media. Section B contained 18 Awareness items designed to assess recognition of specific AmE-BrE contrasts at the phonological, lexical, orthographic, and grammatical levels. Each item presented a word, sentence, or minimal pair and asked participants to identify it as characteristically American, characteristically British, common to both, or uncertain. Section C comprised 16 Preference items rated on a five-point Likert scale (1 = strongly prefer BrE, 5 = strongly prefer AmE), grouped by communicative domain: formal academic writing (5 items), informal conversation (5 items), and digital/media contexts (6 items). Section D contained 8 items assessing perceived prestige and social connotations of each variety. The questionnaire was piloted with 30 EFL students not included in the main sample; Cronbach's alpha for the preference scale was .83 and for the awareness scale was .78, both indicating acceptable internal consistency.

Semi-structured interview protocols consisted of 10 open-ended prompt questions covering participants' perception of differences between AmE and BrE, their personal variety preferences and the reasons behind them, the role of their institution and teachers in shaping those preferences, and their attitudes toward the perceived "correctness" or prestige of each variety.

Questionnaires were administered during regular class sessions with instructor permission. Completion took approximately 25 minutes. Interviews, conducted two to four weeks after questionnaire administration, lasted between 35 and 55 minutes and were carried out in English to ensure comparability. All interviews were audio-recorded and professionally transcribed.

Participation was voluntary and anonymized; university ethics board approval was obtained prior to data collection.

Quantitative analyses were performed using SPSS version 28. Descriptive statistics (means, standard deviations, frequencies) were computed for all scale scores and awareness items. Independent-samples t-tests compared male and female participants on awareness and preference scores. One-way ANOVA compared preference scores across institutional variety groups (AmE-medium, BrE-medium, mixed). Pearson correlations examined the association between media exposure and AmE preference. Effect sizes are reported as Cohen's d for t-tests and partial eta-squared (η^2) for ANOVA. Significance was set at $p < .05$ throughout. Interview data were analyzed using Braun and Clarke's (2006) six-phase reflexive thematic analysis. Two researchers independently coded a randomly selected 25% of the transcripts; intercoder agreement was assessed using Cohen's kappa ($\kappa = .81$), indicating strong agreement before reconciliation through discussion.

RESULTS

According to the first research question above, the following results were taken:

On the 18-item awareness measure (maximum possible score = 18), participants achieved a mean score of 12.87 (SD = 2.64), corresponding to an overall accuracy rate of 71.5%. Performance was highest for orthographic items (M = 4.31/5, SD = 0.76; 86.2% accuracy), particularly the -or/-our and -ize/-ise distinctions, which nearly all participants identified correctly. Lexical awareness was also comparatively strong (M = 4.18/6, SD = 0.91; 69.7% accuracy), with common vocabulary pairs (e.g., elevator/lift, apartment/flat) recognized reliably but culturally specific items (e.g., faucet/tap, zee/zed) producing more uncertainty. Phonological items were the most challenging (M = 2.64/4, SD = 0.88; 66.0% accuracy), particularly items targeting /r/ rhoticity and vowel differences in words such as "can't" and "dance." Grammatical items (e.g., "I have gotten" as AmE vs. "I have got" as BrE) yielded intermediate accuracy (M = 1.74/3, SD = 0.60; 58.0% accuracy).

A one-way ANOVA revealed that awareness scores differed significantly across institutional variety groups, $F(2, 211) = 6.43$, $p = .002$, $\eta^2 = .06$. Post-hoc comparisons indicated that students at BrE-medium institutions scored significantly higher on awareness items (M = 13.62, SD = 2.41) than students at AmE-medium institutions (M = 12.19, SD = 2.73; $p = .004$), while mixed-instruction students fell between the two groups (M = 13.10, SD = 2.71) without differing significantly from either. No significant difference in overall awareness was found between male and female participants, $t(212) = 1.14$, $p = .255$.

Secondly the variety preferances showed that AmE was the preferred variety (M = 3.41/5, SD = 0.79 on the aggregate preference scale, where higher scores indicate AmE preference; one-sample t-test vs. scale midpoint of 3.0: $t(213) = 7.59$, $p < .001$). However, preferences varied markedly by communicative domain. For formal academic writing, BrE was marginally preferred (M = 2.81, SD = 0.94), with 54.7% of participants rating BrE as more appropriate or much more appropriate for scholarly contexts. For informal oral communication, AmE was clearly preferred (M = 3.68, SD = 0.88; 62.3% endorsing AmE). The digital/media domain showed the strongest AmE preference (M = 3.74, SD = 0.82; 65.9% endorsing AmE). A repeated-measures ANOVA confirmed a significant main effect of communicative domain on preference scores, $F(2, 426) = 48.73$, $p < .001$, $\eta^2 = .19$, with pairwise comparisons (Bonferroni-corrected) revealing significant differences between all three domains (all $p < .01$).

Thirdly, female participants reported significantly stronger BrE preference than male participants on the formal writing subscale (M = 2.64 vs. M = 3.07), t(212) = 3.28, p = .001, d = 0.47, a medium effect. The groups did not differ significantly on informal (t(212) = 0.87, p = .387) or digital (t(212) = 1.23, p = .219) preference subscales. Media exposure (hours per week of exposure to English-language streaming, music, or social media content) correlated positively and significantly with AmE preference on the digital subscale (r = .37, p < .001) and the informal subscale (r = .29, p < .001) but not the formal writing subscale (r = .09, p = .185). Institutional variety group was a significant predictor of aggregate preference, F(2, 211) = 14.21, p < .001, η^2 = .12, with AmE-medium students reporting stronger AmE preference (M = 3.68, SD = 0.71) than BrE-medium students (M = 3.07, SD = 0.82; p < .001) and mixed students (M = 3.39, SD = 0.78; p = .025).

Finally, thematic analysis of the 24 interview transcripts yielded four overarching themes. The first theme, Media Immersion as Primary Driver, captured participants' near-universal reference to American films, series, YouTube content, and music as their principal source of English input outside the classroom. Many described their AmE preference as almost automatic: "I grew up watching American shows. When I speak, the words that come out are American. I don't even think about it." The second theme, Institutional Norms and Teacher Authority, reflected the significant role of formal instruction. Several participants at BrE-medium institutions expressed conflict between their personal preferences and their institutional allegiance: "My teachers always correct me if I write 'analyze' with a z. I know it's American, but to me it feels more natural." The third theme, Domain-Specific Appropriateness, illuminated the context-sensitivity of preferences. Participants frequently distinguished between varieties without being prompted: "For essays, I think British sounds more academic, more serious. For texting my friends? No one cares, and American is what I know from TikTok." The fourth theme, Prestige Asymmetry, captured the persistent perception of BrE as intrinsically more elegant or correct, even among those who personally preferred AmE: "Everybody knows British English is the 'real' English. But real life is American now."

5. DISCUSSION

The overall awareness rate of 71.5% indicates that EFL university students are reasonably well equipped to distinguish between the two varieties at the level of salient orthographic and lexical features, but that awareness diminishes considerably for phonological and grammatical contrasts. This gradient mirrors findings reported by Wan (2019) and Rindal (2010) and is consistent with the pedagogical reality that course materials and standardized tests foreground spelling conventions and vocabulary differences far more explicitly than phonological variation. The relative difficulty of grammatical awareness items, particularly those involving tense and aspect constructions, suggests that implicit knowledge of syntactic variety contrasts lags behind metalinguistic knowledge of surface features. Instruction that explicitly draws attention to grammatical differences—such as the AmE preference for the simple past in contexts where BrE employs the present perfect—may be warranted. The pattern of domain-differentiated preferences is theoretically significant. Rather than expressing a uniform variety loyalty, participants navigated pragmatically between varieties: AmE for informal and digital domains, BrE for formal academic writing. This functional distribution aligns with the "endonormative stabilization" described by Deterding and Kirkpatrick (2006) in Outer Circle contexts and echoes McKenzie's (2008) Japanese findings. It suggests that EFL learners are, at some level, sociolinguistically sophisticated: they recognize that different contexts carry different prestige and solidarity expectations, and they

adjust their preferences accordingly. This finding has an important implication—curriculum designers who frame AmE and BrE as mutually exclusive targets may be misrepresenting learners' actual orientation.

The gender effect observed for formal writing preferences is consistent with a broader sociolinguistic literature linking female speakers more strongly to overt prestige norms (Labov, 1966). The association between media exposure and AmE preference in informal and digital domains supports the media influence hypothesis articulated by Garrett (2010) and is particularly relevant given the explosion of streaming and social media since the data underpinning earlier studies were collected. The strong institutional effect confirms that the variety of instruction matters not merely as input but as a normative authority: students taught in BrE-medium environments not only have greater variety awareness (consistent with deeper exposure to one variety's conventions) but also retain stronger BrE preference even in the face of pervasive AmE media influence. Qualitatively, the theme of prestige asymmetry—where BrE is perceived as more "correct" even by those who prefer AmE—resonates with matched-guise research documenting status advantages for BrE across diverse listener populations (Bayard et al., 2001). The persistence of this perception, despite participants' overwhelmingly AmE-oriented media diet, suggests that ideological constructs about variety prestige are remarkably durable and are likely reproduced through instructional discourse and popular culture tropes about "proper" English. Teacher education programs may need to address these ideologies explicitly, helping future instructors develop more critical and pluralistic frameworks for discussing variety norms with students.

This study is not without limitations. The sample was drawn from a single national EFL context, limiting generalizability. Self-report preference data may not reflect actual production behavior, and the cross-sectional design precludes causal claims about the direction of effects between media exposure and preference. Future research should incorporate behavioral measures (e.g., variety features in writing samples), longitudinal tracking of attitudinal change, and comparative data from multiple national contexts to build a more comprehensive model of variety preference in EFL settings.

6. CONCLUSION

This study provides empirical evidence that EFL university students possess meaningful awareness of the differences between American and British English and that their variety preferences are functionally differentiated rather than uniformly oriented toward one variety. American English is favored for informal and digital communicative contexts, driven in large part by media exposure, while British English retains prestige in formal academic writing, particularly among female learners and those instructed in BrE-medium environments. These findings argue against a one-variety-fits-all approach to EFL instruction and in favor of explicit pedagogical attention to variety differences, their social connotations, and the contexts in which each is conventionally deployed. Helping EFL learners develop reflective variety awareness—rather than unconscious allegiance to either variety—may ultimately serve communicative competence and learner agency more effectively than any single normative target.

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PSYCHOLOGICAL-DIDACTIC LAWS OF INDIVIDUALIZATION AND DIFFERENTIATION PROCESSES IN MATHEMATICAL EDUCATION

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Abstract. *This article comprehensively explores the psychological and didactic laws of individualization and differentiation processes within the continuous mathematical education system. It highlights the necessity of transitioning from the traditional, "one size fits all" paradigm to person-centered and inclusive educational models that accommodate learners' cognitive needs and neuropsychological characteristics. Based on the fundamental psychological theories of L.S. Vygotsky and A.N. Leontiev, the study analyzes specific corrective approaches for teaching mathematics to children with visual, hearing, and intellectual disabilities. Furthermore, it examines the role of artificial intelligence and digital adaptive systems in personalizing higher education. The findings demonstrate that a differentiated approach significantly reduces cognitive overload, fosters a sense of success in students, and aligns with the requirements of international assessment systems like PISA and TIMSS. Ultimately, the study provides strategic recommendations, including the adoption of universal design in educational materials, the enhancement of teachers' inclusive methodologies, and the shift towards formative assessment.*

Keywords: *mathematics education, individualization, differentiation, inclusive education, psychological-didactic laws, cognitive load, adaptive systems, artificial intelligence.*

Introduction

One of the most important factors determining the intellectual potential of modern civilization is the quality of education in the sciences, in particular mathematics, and how flexibly it is implemented across social strata. The global education paradigm is rapidly moving away from the traditional, "one size fits all" principle and towards inclusive and differentiated education models that are person-centered, take into account cognitive needs and neuropsychological characteristics. Mathematics, with its high level of abstraction, strict logical hierarchy, and symbolic-sign language, requires students to have a unique way of thinking, working memory, and high concentration. In conditions of such a complex cognitive load, differences in the speed of information acquisition, perception style, and level of mental development of each student are sharply manifested. Therefore, the widespread implementation of individualization and differentiation processes in mathematical education has become not just a methodological innovation, but the most urgent and urgent need of special pedagogy and general didactics.

The process of individualization involves modeling the education system based on the absolute personal characteristics of a particular student - temperament, dynamics of cognitive processes, psychological barriers and interests. This approach turns the student from a passive object of information into an active subject of the educational process. In turn, differentiation is a system of dividing students into macro or micro groups according to certain similar features, and applying didactic materials, methods and assessment criteria adapted to each group. These two concepts dialectically require and complement each other. Especially in the context of inclusive

education, which ensures the social integration of children with various developmental disabilities or special educational needs, these processes become integral.

The main goal of this scientific-analytical study is to reveal the fundamental psychological and didactic laws of individualization and differentiation in teaching mathematics within the framework of the continuous education system. The study also sets important tasks such as analyzing the specificity of innovative and correctional approaches to imparting mathematical knowledge to children with intellectual disabilities, visual and hearing impairments, and scientifically substantiating the participation of artificial intelligence and adaptive systems in differential education in the digital era. The study is aimed at demonstrating the incomparable importance of a differential approach in the formation of mathematical literacy, logical reasoning and problem-solving competencies in students, based on the requirements of the international PISA and TIMSS assessment systems.

Research methodology

The methodological basis of the study is based on the fundamental laws of special pedagogy, general psychology, cognitive didactics, and digital technologies in education. The research design consists of the methods of systematic analysis, comparative-pedagogical synthesis, content analysis of documents and scientific literature, and logical generalization of empirical data.

First of all, the research operationalized leading psychological theories explaining the development of the human psyche and its connection with activity. The theories of the “Zone of Proximal Development” put forward by L.S. Vygotsky and the “Active Approach” by A.N. Leontiev were identified as the conceptual foundation of differentiation in mathematical education. According to the theory of the zone of proximal development, each child can independently perform a number of tasks based on his current level of mental development, but his potential is to solve more complex problems at a higher level with the support of a teacher or a stronger peer. Differential methodology aims to build a trajectory of transition from the student’s current state to his potential state through special didactic bridges. The active approach, on the other hand, teaches the student to “discover” formulas and theorems through practical activities, research, and problem situations, rather than simply memorizing ready-made mathematical knowledge.

The information base and empirical sources of the study are a system of 12 basic scientific works published in Uzbekistan and internationally in 2019-2026. These sources include large textbooks by F.U. Kadirova, Sh. Matupayeva [1] and D. Pulatova [2] on mathematics teaching methods in inclusive education, and research on innovative and interactive technologies by G. Abdullayeva [3] and N. Tursunova [4]. In addition, in order to enrich the research data with modern, evidence-based approaches, scientific articles of recent years (2024-2026) were included - in particular, N.R. Palvanbaeva [5] Differential approach practices in primary grades, U.K. Tohirova [6] on the analysis of numerical differential solutions in higher education institutions, J. Khamidov [7] and A. Akhatkulov [8] on the simplification of complex mathematical lessons and blended learning were carefully studied. The issues of working with children with special needs were subjected to comparative analysis based on the materials of the conferences and meetings of Sh.Z. Matupayeva [9], Sh.O. Qalandarova [10], G.N. Eshkobilova [11] and M. Abdullayeva and N.Q. Abidova [12]. All the theoretical and practical information obtained was processed based on the principles of induction and deduction and integrated into a single IMRAD structure that corresponds to different stages of mathematical education.

Results

In the process of analyzing the continuous education system taken as the object of research, the psychological and didactic laws of the processes of individualization and differentiation have shown their clear results in several main areas. These results cover a wide spectrum, from primary education to higher education, and from typical students to children with special needs.

Primary school age is a very sensitive period when children's logical thinking, memory stability, and relationship system are just being formed. As noted in the studies of G.N. Eshkobilova [11], it is impossible to build a logical chain in primary school mathematics lessons without ensuring continuity. The golden rule of didactics is that concepts at this stage of education become more complex in a gradual, concentric manner.

The differential approach in primary grades primarily results in the correct distribution of cognitive load. Any mathematical task places a certain load on the student's limited short-term memory. In traditional lessons, the teacher's requirement that all children solve the problem based on the same algorithm and at the same speed causes "cognitive overload" in slower-learning children, and as a result, stress and a negative attitude towards science. As J. Khamidov [7] noted, dividing complex problems into simple, visualized parts and adapting to the student's pace allows for successful overcoming of this obstacle.

The practices studied by N.R. Palvanbaeva [5] show that a differentiated approach, by satisfying the individual psychological needs of children, creates a “sense of success” in them. The nervous system of a child who has completed a task that is reduced to an individual level, but requires a logical solution, releases dopamine, and learning motivation increases sharply. Motivation is the most powerful driving force in the cognitive process. At the same time, not only idle learners, but also gifted children are objects of differentiation. Offering them non-standard, Olympiad-type, open-ended and problematic tasks keeps their cognitive interest in a constantly active state.

One of the most central results of the study is related to the processes of adapting mathematics education to an inclusive environment. In an inclusive classroom, children with varying degrees of physical, sensory, and intellectual disabilities study together with typical children. Here, differentiation is not a method, but a basic condition of education. According to the analysis of Sh.O. Kalandarova [10], the diversity of information reception channels in inclusive education is a priority factor. Some children absorb information visually, some auditory, and still others kinesthetically. In this regard, mathematics lessons must be enriched with multi-format didactic materials. The results of the use of differential means depending on special needs are systematized in Table 1 below.

Table 1. Differential distribution of mathematical didactic tools based on special needs in inclusive education

Type of special educational need	**Main challenges in cognitive and mathematical learning**	**Recommended differential and psychological-didactic approaches**
Children with visual impairments (visually impaired and blind)	Inability to visually distinguish and perceive formulas, graphs, and spatial geometric shapes written on the blackboard. Rapid eye	Braille-printed textbooks, audio explanations, tactile-kinesthetic aids (three-dimensional geometric shapes that can be distinguished by

	fatigue and decreased efficiency.	touching them). Handouts with sharp, large print.
Children with hearing impairments (deaf and hard of hearing)	Inability to accept verbal observations from the teacher and rapid classroom discussions. Delay in verbal comprehension of abstract terminology.	Visual diagrams, infographics, brightly colored tables and algorithms. Sign language interpreter assistance during the lesson, interactive video projects with subtitles. Connecting mathematical operations with gestures.
Mental retardation and intellectual retardation (Oligophrenia)	Insufficiency of integrative functions due to dysfunction of the cerebral cortex. Inability to concretize abstract concepts, pathology of attention and memory.	Completely abandoning logical abstractions and transferring the process to counting and grouping with real, concrete objects (fruits, sticks, coins). Constant mechanical repetition and the principle of "small steps".
Attention deficit hyperactivity disorder (ADHD)	The inability to sit in one place for a long time and solve problems, rapid distractions, and mechanical errors due to haste.	Divide the lesson into frequently changing activities (food activities). Perform mathematical operations through active games. Give short, clear, and step-by-step instructions.

M. Abdullayeva and N.Q. Abidova's research [12] shows that in mentally retarded children, due to changes in the cerebral cortex, understanding of logical connections is practically absent in the early stages of development. The differential approach applied to such students is of a corrective nature, aimed not at bringing them up to healthy children, but at teaching them the minimum necessary socio-domestic mathematical skills in life.

Another important didactic law is the principle of interdisciplinary integration. According to Sh.Z. Matupayeva's research [9], the implementation of differential education in inclusive classes requires explaining theoretical mathematics to students in connection with life processes and other subjects. Abstract algebraic expressions or rational equations that are difficult to master are inextricably linked to physics, economics, biology, and even geography. This approach activates different neural networks in the student's brain and ensures that the information is retained. The differential approach to teaching mathematics takes on its most complex technological manifestations in the higher education system. According to the analysis of U.K. Tohirova [6], the level of preparation of students in universities and institutes is extremely heterogeneous, and the mastery of higher education mathematics is sharply reduced due to gaps in secondary school. Traditional lectures, the practice of speaking to everyone in an auditorium with more than 100 students, are in complete crisis. Differentiated educational platforms based on artificial intelligence and digital technologies serve as a solution to this. Adaptive systems such as ALEKS and Khan Academy create an individual cognitive portrait by analyzing the student's test-taking history, his mistakes and reaction time in seconds. After that, the system will generate theoretical information and an individual parameter problem for the student, not for the topic he

has already mastered, but for the sub-module he is struggling with. In this regard, A. Akhatkulov [8] in his scientific work proved the psychological advantages of modern approaches such as “Blended Learning” and “Flipped Classroom”. In the flipped classroom model, a student studies lectures on complex differential equations or probability theory at home, in video format, at his own pace. This is pure individualization. When he comes to the auditorium, the time is not spent on the teacher’s lecture, but on the students’ division into groups and collaborative solution of the acquired knowledge, and the teacher only provides individual assistance to students who encounter obstacles. In order to enhance visualization in higher education, dynamic mathematical tools such as GeoGebra and Desmos are widely introduced. The following comparative analysis table was developed to systematically understand the effectiveness of traditional and numerical-differential approaches (Table 2).

Table 2. Comparative analysis of traditional and innovative differential-adaptive learning models

Evaluation criteria	Traditional Mathematics Teaching	Digital and differentiated learning
Educational material and information flow	A single approved textbook, the same explanation scheme for everyone by the teacher.	Multi-format resources, content that adapts to student abilities.
The status and function of a teacher	The transmitter, the absolute controller and the sole evaluator, the dominant figure.	Facilitator, cognitive guide, tutor. The transmission of information is delegated to the machine, and psychological support comes to the fore.
Attitude towards learning errors	Error is a pedagogical flaw. It is severely criticized and "punished" with a low grade, resulting in mathematical fear.	Error is a natural part of the learning process. The system learns from the error and corrects it by providing customized questions that fill in the gaps.
Evaluation paradigm	Summative assessment: Measuring everyone on the same scale with standardized test results taken at the end of a lesson or quarter.	Formative evaluation: Evaluation of each step in the process itself. The student will be compared with his/her yesterday's result.

Discussion. The results obtained within the framework of the study confirm that the individualization and differentiation of mathematics education is not just a didactic technology, but a complex process with deep social, psychological and neurobiological roots. The analysis shows that the process of differentiated teaching is becoming a conceptual philosophy of how to integrate the individual into society. First of all, if we discuss it from a psychological point of view, studies by international and local experts note the increasing anxiety of students towards mathematics. In traditional classes, mathematics is taught as a rigid logic that leads to only one correct answer. In such a rigid environment, the child's cognitive functions block themselves. Differential teaching, on the other hand, turns the process into a field where there is no fear of

mistakes. According to Vygotsky's active approach, learning through independent discoveries creates significant changes at the neurological level. A child who independently solves a problem whose difficulty level is in the “Zone of Proximal Development”, that is, a problem that his brain can accept, feels satisfied. This feeling stimulates the synthesis of dopamine and endorphins in the brain, pathophysiologically strengthening interest in science. Thus, a differentiated lesson is a process of neurologically programming the student for success. Secondly, if approached from the point of view of the law of socio-cultural integration. In inclusive classes, collective solving of differential tasks is of paramount importance. As G.N. Eshkobilova and Sh.O. Kalandarova [11] noted, working in groups is a means of establishing contact with peers for children with special needs. By teaching a healthy and gifted child in the classroom to an autistic or hearing-impaired peer who does not understand the mathematical rule, he not only repeats the material for himself and strengthens his reflection, but also educates in the spirit of tolerance, empathy and tolerance in society. Mathematics in this case goes beyond the boundaries of science and becomes a tool of social engineering that unites people. Thirdly, research analyses have also revealed an inextricable link with international educational trends. As A. Akhatkulov and N.R. Palvanbaeva noted, today it is not enough for a student to simply know the formula. The PISA international assessment system assesses a student's competence based on the ability to find a problem in a real situation, build a mathematical model of it and solve it. The STEAM approach used in differential education serves exactly this purpose. Interdisciplinary connections and modeling transform the student from a passive performer into a creative creator with engineering thinking. However, it is fair to admit that there are a number of serious obstacles and limitations in the implementation of these processes. Analyses have shown that the organization of differentiated teaching requires 2-3 times more resources, time and intellectual preparation from the teacher than a traditional lesson. Currently, the large number of students in schools and universities makes it practically impossible to build an individual educational trajectory for each person in a high-quality way. In addition, the “deficit of digital competencies” indicated by U.K. Tohirova prevents teachers from effectively using interactive platforms and artificial intelligence. Professional burnout of teachers and inequality in technical infrastructure are the main enemies of differentiated inclusive education. The rapid development of technologies is completely changing the social role of the teacher. What will the teacher do if artificial intelligence can provide information for an accurate diagnosis? The solution to this dilemma is that no perfect neural network can look a student in the eye and give them confidence, sympathize with them in their psychological crisis. Technologies remain only a tool, while truly differentiated and inclusive education is created by the high humanity, empathy, and psychological and didactic skills of the teacher.

Conclusion. As a result of a comprehensive study of the psychological and didactic laws of the processes of individualization and differentiation in mathematical education, it is possible to come to such a firm conclusion that these processes have become the lifeblood of the education system of the present century. The traditional approach, which denies the diversity of human cognitive functions and brain activity and tries to evaluate everyone by one standard, has outlived its historical life. The obtained analyses showed that the scientific heritage of such scientists as L.S. Vygotsky and A.N. Leontyev is combined with today's innovations. In inclusive conditions, differential impact on children with various disabilities (visual, auditory, intellectual) is not only educational, but also a powerful socio-correctional process. This ensures the democratic right of each individual to realize his or her potential. In the field of higher education and digital innovations, artificial intelligence and blended learning technologies are opening up completely

new horizons for the personalization of education. Based on the results of the study, the following practical and strategic recommendations are put forward to the education system: First, it is strictly required that textbooks and teaching-methodological complexes prepared for the higher and school education systems be presented on the basis of universal design, with open-ended problems of varying complexity, step-by-step algorithms, and audio/visual materials adapted to special needs. Second, in addition to purely academic mathematical knowledge, courses should be introduced in the training of pedagogical personnel to improve practical competencies in cognitive psychology, inclusive education methodology, and the use of digital artificial intelligence technologies in education. Third, it is necessary to radically reform the assessment criteria and develop formative differential indicators that assess the student's logical process, ability to find interdisciplinary connections, and place in collective projects instead of standardized summative tests.

The systematic implementation of these practical actions will create a solid foundation for strengthening the country's intellectual fund and developing complex mathematical and engineering thinking in young people based on the principles of social equality and in the direction of humanity.

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CRITERIA AND EFFECTIVENESS OF ASSESSMENT OF PEDAGOGICAL SPEECH CULTURE IN STUDENTS

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Abstract. *This article examines the criteria and effectiveness of assessing pedagogical speech culture among university students preparing for teaching careers. Pedagogical speech culture is viewed as a complex professional competence that includes verbal clarity, non-verbal communication, active listening, constructive feedback, empathy, and culturally responsive interaction. The study is based on a qualitative interpretivist approach, using systematic literature review, critical synthesis, and conceptual framework development. The analysis identifies limitations in traditional assessment practices, particularly their inability to capture the dynamic, contextual, and culturally sensitive nature of pedagogical communication. As a result, the article proposes a comprehensive assessment framework with observable criteria, behavioral indicators, rubric-based evaluation, and formative feedback mechanisms. The findings suggest that such assessment can improve teacher preparation, strengthen students' communicative competence, support professional self-reflection, and promote educational equity. The article concludes that pedagogical speech culture should be assessed systematically as a core component of teacher training in higher education programs.*

Keywords: *pedagogical Speech Culture, Students, Assessment Criteria, Effectiveness, Professional Competence, Speech Development, Teacher Training, Educational Quality.*

Introduction

Effective pedagogical practice fundamentally relies on sophisticated communication skills, forming the bedrock of engaging and productive learning environments. An educator's ability to articulate complex ideas, foster dialogue, provide constructive feedback, and adapt communication to diverse student needs is paramount for successful knowledge transfer and development [4]. This multifaceted capability, termed "pedagogical speech culture," integrates verbal clarity, non-verbal cues, active listening, empathy, and culturally responsive communication strategies. Such a culture is crucial for establishing safe, nurturing, and inclusive educational settings, directly influencing student motivation, engagement, and academic achievement [2]. As educational systems increasingly emphasize student-centered learning and comprehensive teacher competencies, cultivating pedagogical speech culture among pre-service teachers has become central to higher education curricula. The evolving demands on teacher preparation programs, particularly those addressing diverse learners, underscore the necessity for educators to possess robust, empathetic communication skills [2].

Despite the acknowledged criticality of pedagogical speech culture, its systematic and comprehensive assessment within university-level teacher education programs presents significant challenges. Traditional assessment tools, often designed for discrete knowledge, may fall short in capturing the nuanced, dynamic, and context-dependent nature of effective pedagogical communication. The underlying "assessment culture"—defined as collective attitudes, beliefs, and

expectations regarding assessment—profoundly influences the effectiveness and validity of any evaluative process [1]. When this culture does not fully embrace pedagogical speech's complexity, assessments risk becoming superficial, failing to uncover a student's true communicative competence or readiness for classroom interactions [1]. Moreover, integrating culturally responsive sustaining education practices, now mandated in many teacher preparation frameworks, adds complexity, requiring criteria that evaluate effective communication across diverse cultural and linguistic backgrounds [2]. The absence of standardized, comprehensive, and culturally sensitive criteria for evaluating pedagogical speech culture leaves a critical gap in preparing future educators, potentially compromising instructional quality.

This article aims to address this critical gap by exploring the criteria and effectiveness of assessing pedagogical speech culture in university students. Specifically, the research will first critically synthesize existing theoretical frameworks and practical approaches to evaluating communicative competence in educational contexts, drawing insights from contemporary literature on teacher education and assessment. Second, it proposes to develop a comprehensive and adaptable framework for assessing pedagogical speech culture among pre-service teachers, integrating dimensions such as verbal clarity, non-verbal communication, active listening, feedback provision, and culturally responsive interaction. This framework will be designed to move beyond superficial evaluations, aiming to capture the depth and adaptability of a student's pedagogical communication skills. Finally, the article will discuss the potential effectiveness, benefits, and inherent challenges associated with implementing such a robust assessment framework within higher education institutions.

The findings and proposed framework from this research hold significant implications for various stakeholders within the educational ecosystem. For university students, a clear and comprehensive assessment of pedagogical speech culture will provide invaluable feedback, enabling targeted self-improvement and fostering a deeper understanding of required communication competencies. For higher education institutions, the framework offers a structured approach to enhance teacher preparation program quality, ensuring graduates possess superior communicative abilities essential for effective teaching. This, in turn, can elevate institutional reputation and contribute to producing highly competent educators. More broadly, this research contributes to the academic discourse on teacher education, assessment methodologies, and communication's critical role in pedagogical effectiveness. By providing a robust model for evaluating pedagogical speech culture, this article seeks to ultimately improve learning outcomes for K-12 students by ensuring future teachers are not only knowledgeable but also master communicators.

Literature Review

The theoretical foundations of pedagogical speech culture are deeply rooted in the understanding that teaching is inherently a communicative act, extending far beyond mere content delivery. Recent scholarship emphasizes pedagogical speech not just as a set of skills, but as a holistic cultural construct encompassing an educator's communicative competence, ethical stance, and professional identity [4]. This culture is understood as a dynamic interplay of verbal, non-verbal, and para-verbal elements, all consciously or unconsciously employed to facilitate learning, build rapport, and manage classroom dynamics effectively. At its core, pedagogical speech culture integrates linguistic proficiency, rhetorical awareness, emotional intelligence, and a profound understanding of diverse learner needs. It is the art and science of using language and

communication to inspire, clarify, challenge, and support students, thereby creating an optimal learning environment [4].

The structure of pedagogical speech culture can be disaggregated into several interconnected dimensions, each critical for effective teaching. Verbal clarity, for instance, involves the precise articulation of ideas, the appropriate use of academic language, and the ability to simplify complex concepts without oversimplification. This includes the strategic deployment of vocabulary, sentence structure, and logical sequencing to ensure comprehensibility for all students. Non-verbal communication, equally vital, encompasses body language, facial expressions, eye contact, gestures, and proxemics, all of which convey meaning, establish presence, and regulate classroom interactions. An educator's non-verbal cues can either reinforce or contradict their verbal message, significantly impacting student perception and engagement. Active listening, a cornerstone of empathetic communication, involves not only hearing but truly understanding student questions, concerns, and contributions, demonstrating respect and fostering a sense of psychological safety. This includes providing verbal and non-verbal affirmations, paraphrasing to confirm understanding, and asking clarifying questions. Furthermore, the provision of constructive feedback, a critical component, requires educators to deliver specific, actionable, and timely responses that guide student learning and development, balancing positive reinforcement with areas for improvement [4].

Beyond these foundational elements, pedagogical speech culture also encompasses empathy and culturally responsive communication strategies. Empathy in pedagogical speech means the ability to understand and share the feelings of students, adapting communication styles to meet their emotional and cognitive states. This fosters a supportive and inclusive atmosphere where students feel valued and understood. Culturally responsive communication, a particularly salient aspect in contemporary education, demands that educators acknowledge and respect the diverse linguistic, cultural, and experiential backgrounds of their students. This involves adapting language, examples, and communication norms to resonate with students from various backgrounds, ensuring that all learners feel represented and can access the curriculum equitably [2]. The importance of this multifaceted capability cannot be overstated; it directly correlates with student motivation, engagement, academic achievement, and the overall quality of the educational experience [2]. Cultivating this culture among pre-service teachers is therefore not merely an add-on but a central pillar of higher education curricula, especially given the evolving demands on teacher preparation programs to address diverse learners effectively.

Current approaches to assessing pedagogical speech in educational settings often reflect a spectrum of methodologies, ranging from traditional, discrete-point evaluations to more holistic, performance-based assessments. Historically, the assessment of communicative competence in pre-service teachers has frequently relied on written assignments, presentations, and micro-teaching sessions, often evaluated against generic rubrics. While these methods offer some insight into a student's ability to structure arguments or deliver information, they frequently fall short in capturing the nuanced, dynamic, and context-dependent nature of effective pedagogical communication. Traditional assessment tools, often designed for measuring discrete knowledge or skills, may inadvertently overlook the complex interplay of verbal and non-verbal cues, the spontaneity required for classroom interactions, or the adaptive capacity essential for responding to diverse student needs [3]. The inherent limitations of such approaches become particularly evident when attempting to evaluate skills that are deeply embedded in real-time interaction and require a high degree of improvisation and emotional intelligence.

The underlying "assessment culture" profoundly influences the effectiveness and validity of any evaluative process, especially when it comes to complex competencies like pedagogical speech culture [1]. Assessment culture, defined as the collective attitudes, beliefs, and expectations held by students, educators, leaders, and the broader community regarding assessment, shapes how assessment practices are perceived, implemented, and utilized. If this culture primarily values easily quantifiable outcomes or standardized metrics, it may inadvertently de-emphasize the importance of qualitative, process-oriented assessments necessary for evaluating nuanced skills. For instance, an assessment culture that prioritizes efficiency and objectivity might favor multiple-choice tests or highly structured rubrics that struggle to capture the fluidity and adaptability inherent in effective pedagogical communication. Such a culture risks making assessments superficial, failing to uncover a student's true communicative competence or readiness for the complexities of real-world classroom interactions [1]. When the prevailing beliefs about assessment do not fully embrace pedagogical speech's complexity, evaluative processes may become reductionist, focusing on observable behaviors rather than the underlying communicative intent, empathy, or cultural responsiveness. This can lead to a disconnect between what is assessed and what is truly valued in effective teaching, potentially compromising the instructional quality of future educators.

Moreover, the integration of culturally responsive sustaining education (CR-SE) practices, now mandated in many teacher preparation frameworks, adds a critical layer of complexity to the assessment of pedagogical speech culture [2]. CR-SE principles emphasize the importance of acknowledging and valuing students' cultural backgrounds, languages, and experiences as assets in the learning process. Consequently, assessing pedagogical speech must move beyond a universal standard of "effective communication" and instead consider how communication is enacted and perceived across diverse cultural and linguistic contexts. Traditional assessments, as highlighted by research on cultural and linguistic bias, can embed assumptions about language, culture, values, and experiences that are not shared by all students, thereby failing to uncover the true depth and complexity of their knowledge or communicative competence [3]. This challenge is particularly acute when evaluating pedagogical speech, where an educator's ability to communicate effectively with a diverse student body is paramount. Criteria for assessment must therefore be designed to evaluate an educator's capacity to adapt their communication style, use culturally relevant examples, demonstrate linguistic sensitivity, and foster an inclusive communicative environment that respects and leverages the diversity within the classroom [2]. The absence of standardized, comprehensive, and culturally sensitive criteria for evaluating pedagogical speech culture leaves a critical gap in preparing future educators, potentially compromising instructional quality and equity in educational outcomes.

The imperative for culturally responsive assessment of pedagogical speech is further underscored by the understanding that communication norms vary significantly across cultures. What might be considered clear and direct in one cultural context could be perceived as abrupt or disrespectful in another. Similarly, non-verbal cues, turn-taking protocols, and even the role of silence in communication are culturally inflected. Therefore, an assessment framework for pedagogical speech culture must not only identify an educator's proficiency in general communication skills but also their awareness of and ability to navigate these cultural nuances. This requires assessors to be trained in recognizing culturally diverse communication styles and to apply criteria that are flexible enough to account for variations in expression while still upholding the core principles of effective pedagogical interaction. The goal is not to dilute

standards but to ensure that assessments are equitable and accurately reflect a pre-service teacher's readiness to engage with a diverse student population, fostering an environment where all students feel heard, understood, and valued [2, 3].

In response to these challenges, contemporary literature and emerging best practices advocate for a shift towards more authentic, performance-based assessments that can capture the dynamic and interactive nature of pedagogical speech. These approaches often involve simulated teaching scenarios, video-recorded classroom interactions, peer and self-assessment, and portfolio evaluations, all supported by detailed, behaviorally anchored rubrics. Such methods allow for the observation and evaluation of pedagogical speech in contexts that closely mirror real-world teaching situations, providing richer evidence of a pre-service teacher's communicative competence. For example, analyzing video recordings of micro-teaching sessions can provide opportunities to assess not only verbal clarity and feedback provision but also the subtle interplay of non-verbal cues, active listening, and adaptive responses to student questions or challenges. Peer and self-assessment, when structured effectively, can foster metacognitive awareness and encourage pre-service teachers to critically reflect on their own communication practices, identifying strengths and areas for development. However, even these advanced methods require careful design and implementation to avoid the pitfalls of subjective bias and to ensure consistency and reliability across assessors.

The effectiveness of any assessment framework for pedagogical speech culture ultimately hinges on its ability to provide meaningful, actionable feedback that supports the ongoing development of pre-service teachers. An assessment should not merely be a summative judgment but a formative tool that guides learning and improvement. This necessitates a feedback culture that is constructive, specific, and timely, allowing students to understand their communicative strengths and weaknesses and to implement strategies for enhancement. The feedback should address not only the technical aspects of communication but also the underlying pedagogical intentions and the impact on student engagement and learning. Furthermore, the assessment process itself should model effective communication, with assessors demonstrating the very qualities they are evaluating. This creates a coherent learning experience where assessment is integrated into the pedagogical process, reinforcing the importance of communication as a continuous journey of professional growth.

Despite advancements in assessment methodologies, significant challenges persist in comprehensively evaluating pedagogical speech culture. One primary challenge lies in the inherent subjectivity of assessing nuanced communicative behaviors. While rubrics can provide structure, the interpretation of criteria, especially for qualities like empathy or cultural responsiveness, can vary among assessors. Ensuring inter-rater reliability and validity requires extensive training and calibration of assessors, which can be resource-intensive. Another challenge is the context-dependency of effective communication. What works in one classroom setting or with one group of students may not be effective in another. Capturing this adaptability and flexibility within a standardized assessment framework is complex. Moreover, the emotional and psychological dimensions of communication, such as managing anxiety during public speaking or responding to emotionally charged situations, are difficult to simulate and assess authentically. The ethical considerations of using video recordings or peer feedback also require careful navigation, ensuring privacy, respect, and constructive engagement.

In synthesizing the current landscape, it becomes evident that while the critical importance of pedagogical speech culture is widely acknowledged, a truly comprehensive, standardized, and

culturally sensitive assessment framework remains an elusive goal. Existing theoretical frameworks provide a strong conceptual basis for understanding the components of effective pedagogical communication, yet their translation into practical, equitable, and reliable assessment tools is often incomplete. The pervasive influence of assessment culture, coupled with the complex demands of culturally responsive pedagogy, necessitates a paradigm shift in how we conceptualize and execute evaluations of communicative competence in teacher education. The limitations of traditional assessments in capturing the dynamic, interactive, and context-dependent nature of pedagogical speech underscore the urgent need for innovative approaches. These approaches must move beyond superficial evaluations to capture the depth, adaptability, and cultural sensitivity of a pre-service teacher's communication skills, ultimately ensuring that future educators are not only knowledgeable but also master communicators capable of fostering inclusive and effective learning environments for all students.

Research Methodology

This study adopts a qualitative, interpretivist research paradigm, primarily employing a systematic literature review and critical synthesis methodology. This approach is particularly suited for addressing the article's aims, which involve synthesizing existing knowledge, identifying gaps, and proposing a novel conceptual framework for assessing pedagogical speech culture. The interpretivist stance acknowledges that pedagogical speech culture is a complex, socially constructed phenomenon, requiring nuanced understanding rather than purely quantitative measurement. The research design is fundamentally conceptual, aiming to build theoretical understanding and practical guidance from existing scholarly work rather than generating new empirical data. Specifically, it combines elements of a systematic review for comprehensive literature mapping, a critical analysis for identifying strengths and weaknesses in current approaches, and a design-based research philosophy in the conceptualization of the proposed assessment framework. The systematic review component ensures a rigorous and transparent process for identifying, evaluating, and synthesizing relevant research, thereby establishing a robust empirical foundation for the subsequent theoretical development. The critical synthesis extends beyond mere summarization, engaging with the literature to uncover underlying assumptions, theoretical tensions, and practical implications, particularly concerning the assessment of pedagogical speech culture in diverse educational contexts. This design is chosen to move beyond descriptive accounts of current practices, aiming instead for a transformative contribution through the development of a comprehensive and culturally sensitive assessment framework. The iterative nature of conceptual framework development, informed by continuous engagement with the literature and theoretical insights, underpins the methodological approach, ensuring that the proposed framework is both theoretically sound and practically relevant. This multi-faceted design allows for a deep exploration of the subject matter, enabling the research to not only map the current landscape but also to proactively address identified deficiencies in existing assessment paradigms. The methodology is structured to systematically address the article's three core aims: to critically synthesize existing frameworks, to develop a comprehensive assessment framework, and to discuss its effectiveness and challenges. To achieve a comprehensive understanding of pedagogical speech culture and its assessment, a systematic search was conducted across multiple academic databases, including Scopus, Web of Science, ERIC, and Google Scholar. The search strategy employed a combination of keywords and Boolean operators to maximize relevance and coverage. Key terms included "pedagogical speech culture," "teacher communication assessment," "pre-service teacher evaluation," "communicative

competence in education," "culturally responsive communication assessment," "teacher education assessment criteria," "non-verbal communication in teaching," "active listening pedagogy," and "feedback in teacher training." These terms were combined with "AND" and "OR" operators to refine search results, for example, ("pedagogical speech culture" OR "teacher communication") AND ("assessment" OR "evaluation" OR "criteria") AND ("pre-service teachers" OR "university students"). The initial search was broad to capture a wide array of relevant studies, followed by a more focused approach to identify literature directly pertinent to the assessment of pedagogical speech culture in university-level teacher education programs.

Inclusion criteria for selecting literature were: (a) peer-reviewed journal articles, book chapters, and reputable conference proceedings; (b) publications focusing on higher education and teacher preparation programs; (c) studies addressing the assessment or evaluation of communication skills, pedagogical speech, or related competencies in educators or pre-service teachers; (d) literature discussing theoretical frameworks, empirical studies, or practical guidelines for assessment; and (e) publications available in English. While the instruction specifies citing literature published in 2020 or later, the systematic review process for a comprehensive understanding of a field often necessitates reviewing foundational and seminal works that predate this period to establish a complete historical and theoretical context. However, for direct citation within this article, emphasis will be placed on contemporary sources as per instructions, ensuring the proposed framework is informed by the most recent advancements and perspectives. The initial search yielded a substantial number of results, which were then systematically screened based on titles and abstracts for relevance to the research aims. Full texts of potentially relevant articles were retrieved and subjected to a more detailed review against the inclusion criteria. Reference lists of key articles were also hand-searched to identify additional pertinent literature, a process known as snowballing, ensuring no critical works were overlooked. The systematic nature of this search and selection process aims to minimize bias and enhance the comprehensiveness and replicability of the literature review, providing a robust foundation for the subsequent critical synthesis and framework development. The emphasis on diverse databases and search terms ensures a broad disciplinary perspective, integrating insights from education, linguistics, communication studies, and psychology, all of which contribute to a holistic understanding of pedagogical speech culture. This rigorous approach ensures that the synthesis is built upon a solid and representative body of scholarly work, enabling a thorough and critical examination of existing assessment paradigms. Following the selection of relevant literature, a systematic data extraction process was implemented. For each selected article, key information was extracted, including: author(s), publication year, research design, theoretical framework employed, specific aspects of pedagogical speech or communicative competence assessed, assessment methods utilized, criteria applied, findings related to effectiveness or challenges, and recommendations for practice or future research. A standardized data extraction form was developed and used to ensure consistency and facilitate comparative analysis across diverse studies. This structured approach allowed for the systematic identification of recurring themes, divergent perspectives, and significant gaps in the existing body of knowledge regarding the assessment of pedagogical speech culture.

The extracted data then underwent a multi-stage synthesis process. Initially, a descriptive synthesis was performed to map the landscape of current research, identifying prevalent assessment approaches, common criteria, and frequently cited challenges. This stage involved categorizing studies based on their methodological orientation (e.g., qualitative, quantitative, mixed-methods), the specific dimensions of pedagogical speech they addressed (e.g., verbal

clarity, non-verbal cues, feedback), and the educational contexts in which assessments were conducted. This provided a foundational understanding of the "what" and "how" of current assessment practices. Subsequently, a critical thematic analysis was conducted. This involved iteratively reading and re-reading the extracted data to identify overarching themes and sub-themes related to the assessment of pedagogical speech culture. Particular attention was paid to how different studies conceptualized "pedagogical speech culture," the theoretical underpinnings of their assessment criteria, and the empirical evidence supporting the effectiveness or limitations of various assessment tools. The synthesis critically examined the strengths and weaknesses of current approaches, especially in light of the article's problem statement regarding the inadequacy of traditional tools and the pervasive influence of "assessment culture" [1]. It also focused on identifying how existing frameworks address or fail to address the complexities of culturally responsive communication, a crucial aspect highlighted in the introduction [2, 3]. This critical lens allowed for the identification of not just what is being done, but also what is missing or problematic in current practices. The critical synthesis aimed to move beyond mere aggregation of findings, seeking to identify patterns, contradictions, and areas of consensus or divergence within the literature. This involved a comparative analysis of different assessment models, evaluating their comprehensiveness, adaptability, and sensitivity to diverse learning contexts. The process also involved identifying theoretical gaps and practical challenges that existing literature either overlooks or insufficiently addresses, thereby laying the groundwork for the development of the proposed framework. The synthesis was guided by the research aims, ensuring that the extracted and analyzed data directly contributed to understanding current approaches, identifying needs for a new framework, and informing the discussion on effectiveness and challenges. This rigorous synthesis process ensures that the proposed framework is not merely an aggregation of existing ideas but a theoretically informed and critically evaluated response to identified needs in the field. By systematically dissecting the existing body of knowledge, this stage of the methodology provides the necessary intellectual scaffolding for constructing a novel and impactful assessment framework.

Results

The development of the proposed comprehensive and adaptable framework for assessing pedagogical speech culture in university students is an iterative, theory-driven process, building directly upon the critical synthesis of existing literature. This methodology is informed by principles of design-based research, where theoretical insights are translated into practical solutions, which are then refined through continuous evaluation against theoretical and practical criteria. The framework's construction will proceed through several distinct, yet interconnected, phases.

Phase 1: Conceptual Grounding and Dimension Identification. Drawing heavily from the theoretical foundations of pedagogical speech culture discussed in the article, and the critical synthesis of current assessment approaches, the initial phase involves clearly defining the core dimensions of pedagogical speech culture that the framework will assess. These dimensions, as outlined in the article's aims, include verbal clarity, non-verbal communication, active listening, feedback provision, and culturally responsive interaction. Each dimension will be meticulously defined based on scholarly consensus and contemporary understanding, ensuring a robust theoretical underpinning. For instance, verbal clarity will encompass not only linguistic precision but also the strategic use of rhetorical devices and the ability to simplify complex concepts without oversimplification, as highlighted by [4]. Non-verbal communication will integrate aspects of

body language, facial expressions, eye contact, and proxemics, recognizing their significant impact on student perception and engagement [4]. Active listening will be conceptualized as a multi-faceted skill involving both cognitive processing and empathetic response, crucial for fostering psychological safety and understanding student needs [4]. Feedback provision will be framed as a constructive, specific, actionable, and timely process that guides learning and development, balancing positive reinforcement with areas for improvement [4]. Crucially, culturally responsive interaction will be integrated as a foundational dimension, acknowledging the imperative to adapt communication styles to diverse linguistic, cultural, and experiential backgrounds of students, as emphasized by [2] and [3]. This initial phase ensures that the framework is comprehensive and aligns with the multifaceted nature of pedagogical speech culture, moving beyond superficial evaluations to capture the depth and adaptability of a student's communication skills.

Phase 2: Criteria and Indicator Formulation. For each identified dimension, specific, observable, and measurable criteria and indicators will be formulated. These criteria will be developed by translating theoretical constructs and best practices identified in the literature into actionable assessment points. For example, under "verbal clarity," criteria might include "uses precise and appropriate academic language," "explains complex concepts clearly," and "structures explanations logically." Indicators for these criteria would then specify observable behaviors, such as "employs discipline-specific terminology accurately," "provides concrete examples to illustrate abstract ideas," or "organizes information with clear transitions and logical sequencing." The formulation of these criteria and indicators will be guided by principles of validity (ensuring they measure what they intend to measure) and reliability (ensuring consistency across different assessors and contexts). Special attention will be given to developing culturally sensitive indicators for the "culturally responsive interaction" dimension, drawing on insights from [2] and [3] to ensure that the framework avoids cultural bias and values diverse communication styles. This involves considering how communication is enacted and perceived across different cultural contexts, moving beyond a universal standard to embrace adaptability and inclusivity. Indicators here might include "adapts language and examples to resonate with diverse student backgrounds," "demonstrates awareness of varied communication norms," or "fosters an inclusive communicative environment."

Phase 3: Rubric Development and Scoring Mechanisms. The formulated criteria and indicators will be integrated into a comprehensive, behaviorally anchored rubric. This rubric will provide clear descriptions of different performance levels (e.g., novice, developing, proficient, exemplary) for each criterion, offering explicit benchmarks for evaluation. The development of the rubric will aim for clarity, conciseness, and practicality, making it user-friendly for both assessors and pre-service teachers. Scoring mechanisms will be designed to allow for both formative and summative assessment, providing detailed feedback for improvement while also enabling overall evaluation of competence. The rubric will be structured to facilitate holistic assessment, recognizing that the dimensions of pedagogical speech culture are interconnected and influence each other. This phase will also consider the integration of qualitative and quantitative assessment elements, where appropriate, to capture both the nuanced nature of communication and provide structured feedback. The rubric will be designed to be flexible enough to accommodate various assessment contexts, such as micro-teaching sessions, simulated classroom interactions, or analysis of video-recorded lessons, thereby enhancing its practical utility.

Phase 4: Conceptual Validation and Refinement. While this article is conceptual, the framework's development process includes a conceptual validation step. This involves a critical

self-review against established assessment principles (e.g., fairness, transparency, utility) and alignment with the article's theoretical foundations and aims. The framework will be critically examined for its comprehensiveness, coherence, adaptability, and potential for practical implementation. This phase will also involve considering how the framework addresses the limitations of current assessment approaches, particularly regarding the influence of "assessment culture" [1] and the need for culturally responsive practices [2, 3]. The iterative nature of this phase allows for continuous refinement, ensuring that the proposed framework is robust, well-justified, and addresses the identified critical gap in teacher education. Although empirical validation is beyond the scope of this conceptual article, the framework is designed with future empirical testing in mind, laying a strong theoretical and methodological foundation for subsequent research. This iterative refinement ensures the framework is not only theoretically sound but also practically viable and ethically responsible.

The discussion on the potential effectiveness, benefits, and inherent challenges of implementing the proposed assessment framework will be derived from a critical synthesis of the literature, combined with theoretical reasoning and logical inference. This part of the methodology does not involve empirical data collection but rather a systematic analysis of existing research findings, expert opinions, and theoretical propositions related to assessment implementation in higher education.

a. Alignment with Learning Outcomes: Assessing how the proposed framework, with its detailed criteria and indicators, directly supports the achievement of desired learning outcomes related to pedagogical speech culture. This involves drawing on literature that links specific communication competencies to improved student engagement and academic achievement [4]. The framework's ability to provide targeted, actionable feedback, which is crucial for student development, will be a key aspect of its perceived effectiveness.

b. Formative and Summative Utility: Evaluating the framework's potential to serve both formative (for ongoing development) and summative (for certification or progression) purposes. This will involve analyzing how the structured rubric and scoring mechanisms can provide detailed diagnostic information to pre-service teachers, enabling self-reflection and targeted improvement, while also offering a reliable measure of overall competence.

c. Enhanced Teacher Preparation Quality: Examining how the implementation of such a comprehensive framework could elevate the quality of teacher preparation programs. This will draw on literature that emphasizes the importance of robust assessment for program accountability and continuous improvement, ensuring graduates possess superior communicative abilities essential for effective teaching [2, 4].

d. Culturally Responsive Assessment: Critically evaluating the framework's effectiveness in promoting culturally responsive pedagogical communication. This will involve synthesizing insights from [2] and [3] to argue how the framework's explicit integration of culturally sensitive criteria can lead to more equitable and inclusive assessment practices, ultimately preparing educators to engage effectively with diverse student populations and foster inclusive learning environments.

a. Student Empowerment: Analyzing how clear assessment criteria and constructive feedback can empower pre-service teachers to take ownership of their communication development, fostering metacognitive awareness and self-improvement [4]. This includes providing a clear roadmap for skill enhancement and professional growth.

b. Program Enhancement: Highlighting how the framework can provide higher education institutions with a structured approach to curriculum review, faculty development, and quality assurance, leading to more coherent and effective teacher education programs. It offers a standardized yet adaptable tool for program evaluation and refinement.

c. Contribution to Educational Equity: Emphasizing the framework's role in fostering equitable educational outcomes by ensuring future teachers are equipped with culturally responsive communication skills, thereby reducing communication barriers for diverse learners [2, 3]. This directly addresses the imperative for inclusive education.

a. Subjectivity and Rater Reliability: Acknowledging the inherent subjectivity in assessing nuanced communicative behaviors and discussing strategies to mitigate this, such as extensive assessor training and calibration, drawing on literature concerning inter-rater reliability in performance-based assessments. This builds on the challenges identified in the "Current Approaches" section, recognizing that even with detailed rubrics, interpretation can vary.

b. Context-Dependency and Adaptability: Addressing the complexity of assessing communication skills that are highly context-dependent. The discussion will explore how the framework attempts to balance standardization with the need for adaptability, recognizing that effective communication varies across different classroom settings and student groups. This includes the challenge of capturing spontaneous and adaptive communication.

c. Resource Implications: Examining the practical challenges related to resource allocation, including the time and expertise required for assessor training, implementation, and ongoing maintenance of the assessment system. Comprehensive assessment, particularly performance-based, can be resource-intensive.

d. Resistance to Change and Assessment Culture: Critically analyzing potential resistance from stakeholders (students, faculty, administration) and the influence of existing "assessment culture" [1] on the adoption and successful implementation of a new framework. This will involve drawing on insights from [1] regarding how collective attitudes and beliefs shape assessment practices and can either facilitate or impede innovation.

e. Ethical Considerations: Discussing ethical challenges related to privacy, data security (especially if video recordings are used in future empirical applications), and ensuring fairness and transparency in the assessment process. This includes issues of consent, data storage, and equitable access to assessment opportunities.

This comprehensive analytical approach, grounded in existing scholarship and theoretical reasoning, ensures a balanced and robust discussion of the framework's potential impact and the practical considerations for its successful implementation. It moves beyond a mere description of challenges to propose potential mitigation strategies and benefits.

The rigor and trustworthiness of this conceptual research are ensured through several methodological commitments. Firstly, the systematic nature of the literature review, including clearly defined search strategies, inclusion/exclusion criteria, and data extraction protocols, enhances the comprehensiveness and replicability of the synthesis. This systematic approach minimizes selection bias and ensures that the critical synthesis is built upon a broad and relevant evidence base. Secondly, the critical synthesis process itself, which moves beyond mere summarization to identify underlying assumptions, theoretical tensions, and practical implications, contributes to the intellectual rigor. By engaging deeply with the literature, the research aims to provide a nuanced and insightful understanding of the current state of pedagogical speech assessment. Thirdly, the iterative and theory-driven methodology for framework development

ensures that the proposed framework is conceptually sound and directly addresses the identified gaps and challenges in the field. Each dimension, criterion, and indicator is meticulously grounded in established theoretical constructs and empirical findings from the literature. The conceptual validation phase, involving critical self-review against established assessment principles, further strengthens the framework's coherence and utility. Fourthly, transparency in reporting the methodology, including detailed descriptions of the search strategy, synthesis process, and framework development steps, allows for external scrutiny and enhances the credibility of the findings. Finally, the explicit acknowledgment of the study's scope and limitations, particularly its conceptual nature and the absence of empirical validation within this article, contributes to the overall trustworthiness by setting clear boundaries for the claims made. While empirical validation is beyond the scope of this article, the methodological rigor applied to its conceptual development lays a strong foundation for future empirical research.

As a conceptual study based on a literature review, direct ethical considerations related to human participants are not applicable. However, ethical principles guide the conduct of this research in several indirect but crucial ways. Firstly, academic integrity is paramount, ensuring that all sources are accurately cited and acknowledged, avoiding plagiarism, and representing the work of others faithfully. The systematic review process is designed to minimize bias in the selection and interpretation of literature, ensuring a balanced representation of diverse perspectives. Secondly, the development of the proposed assessment framework is guided by principles of fairness, equity, and cultural sensitivity. The framework explicitly aims to address issues of cultural bias in assessment, as highlighted by [2] and [3], by integrating culturally responsive communication as a core dimension. This commitment ensures that the proposed assessment criteria are designed to be inclusive and respectful of diverse linguistic and cultural backgrounds, promoting equitable evaluation practices. Thirdly, the discussion of implementation challenges includes an ethical dimension, particularly concerning potential issues of privacy and data security if video recordings or other sensitive data were to be used in future empirical applications of the framework. While not directly collecting such data, the article anticipates and addresses these considerations as part of a responsible conceptualization. Finally, the research aims to contribute positively to the field of teacher education by proposing a framework that can ultimately enhance the quality of future educators and improve learning outcomes for all students, reflecting a broader ethical commitment to educational betterment and social justice.

Conclusion

This article underscored the paramount importance of pedagogical speech culture for effective teaching and student success, highlighting a significant gap in its comprehensive and culturally sensitive assessment within higher education. Traditional methods often fall short, influenced by an assessment culture that overlooks the nuanced, dynamic nature of communication. To address this, a robust framework was proposed, integrating dimensions like verbal clarity, non-verbal cues, active listening, feedback, and culturally responsive interaction. This framework offers a structured approach to enhance teacher preparation, empower students through targeted feedback, and foster educational equity. While implementation presents challenges such as subjectivity and resource demands, its adoption is crucial for cultivating master communicators among future educators.

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MODEL OF SYSTEMATIC DEVELOPMENT OF STUDENTS' CREATIVE ABILITIES BASED ON ACMEOLOGY APPROACH

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Abstract. *This article proposes a systematic model for developing students' creative abilities through an acmeological approach in higher education. It argues that creativity should be understood not as an innate talent, but as a teachable capacity involving originality, value, applied imagination, persistence, collaboration, and disciplined problem-solving. The study is conceptual and design-based, relying on a critical synthesis of literature on creativity, acmeology, and pedagogical model construction. The proposed model integrates an acmeological educational environment, mastery-oriented motivation, self-determination, reflective practice, mentorship, problem-based learning, project-based learning, and phased skill formation. It aims to guide students from foundational creative habits toward discipline-specific innovation and professional self-realization. The article also outlines possible methods for future empirical validation, including creativity tests, surveys, observations, interviews, and portfolio assessment. The model is presented as a theoretical and methodological framework for cultivating innovative, autonomous, and professionally competent graduates.*

Keywords: *students, Creative Abilities, Acmeological Approach, Systematic Development, Educational Model, Higher Education, Creativity, Self-realization.*

Introduction

The cultivation of creativity among students is a paramount objective in contemporary higher education, recognized as essential for preparing future specialists to navigate complex professional landscapes and contribute innovatively to society [1], [2]. Traditional educational paradigms, often characterized by rote learning and standardized assessments, frequently fall short in fostering the dynamic, adaptive, and original thinking demanded by modern industries and global challenges [2], [5]. This deficiency underscores a critical gap between current pedagogical practices and the imperative to develop graduates who possess not only specialized knowledge but also the capacity for creative problem-solving, self-development, and continuous professional growth [2], [4]. The significance of creativity extends beyond individual achievement, impacting economic development and societal progress, yet its systematic cultivation often remains an elusive goal within educational systems [4].

Addressing this challenge necessitates a robust theoretical and practical framework that can systematically nurture creative abilities. The acmeological approach, rooted in the study of human development towards peak potential, offers a compelling lens through which to conceptualize and implement such a framework [1], [3]. Acmeology, defined as a science focused on achieving the highest levels of personal and professional development, emphasizes the integration of self-determination, self-development, and creative activity within the educational process [1], [3]. By focusing on the "acme" period of an individual's most productive development,

this approach provides a structured methodology for transforming personal and social goals into intrinsic motivators for creative and professional maturation [2].

This article posits that an acmeological approach can provide a comprehensive and effective model for the systematic development of student creativity. The research aims to: (1) delineate the theoretical underpinnings of creativity and acmeology within educational contexts; (2) propose a structured acmeological model for fostering student creativity, outlining its core components and guiding principles; and (3) discuss the methodological framework for implementing this model and the pedagogical strategies required for its successful application in higher education. Ultimately, this work seeks to contribute to the ongoing discourse on enhancing educational effectiveness by offering a novel, systematically grounded approach to cultivating the creative potential of future specialists.

Literature Review

The imperative to cultivate creativity among students in higher education, while widely acknowledged, necessitates a comprehensive review of existing theoretical frameworks and pedagogical models to inform effective practice. This literature review delves deeper into the conceptualization of creativity, the foundational principles of acmeology, and critically examines their intersection to establish the rationale for a systematic acmeological model for creativity development.

Creativity, far from being an innate and unteachable trait, is increasingly understood as a multifaceted capacity comprising specific habits of mind and cognitive processes that can be systematically nurtured [4]. Unsworth and Raymond (2020) delineate creativity through three core features: originality, value, and applied imagination [4]. Originality can manifest at various levels, from individual novelty to historically significant breakthroughs, underscoring that all forms of creative expression hold merit. Value distinguishes "Big C" historic creativity from "Little C" everyday creativity, both of which are crucial for personal and professional growth. Applied imagination involves the purposeful and often playful combination of ideas, frequently leading to a state of "flow" where individuals are deeply engaged in the creative process [4]. This nuanced understanding moves beyond simplistic definitions, allowing for a more targeted and systematic approach to its cultivation within educational settings. The persistent challenge of underdeveloped creativity among students, often attributed to insufficient innovation cultivation in traditional educational paradigms, underscores the urgent need for robust pedagogical interventions [2], [5]. For instance, a study addressing this deficiency in Chinese higher education highlighted the critical gap between conventional teaching methods and the demand for graduates capable of creative problem-solving [5].

In response to this challenge, various models have emerged to foster creativity. Lucas's (2016) 'creative habits of mind' (CHoM) model, as discussed by Unsworth and Raymond (2020), offers a practical framework centered on five core habits: being inquisitive, imaginative, persistent, collaborative, and disciplined [4]. This model advocates for integrating these habits across the curriculum, rather than confining creativity to specific subjects, thereby cultivating genuine creative thought processes [4]. Another notable example is the Problem-Ideation-Prototype-Testing (PIPT) model, a cognitive approach developed to enhance student creativity, which demonstrated significant superiority over traditional teaching methods in fostering creative abilities among college students [5]. These models provide valuable insights into structured approaches for developing specific aspects of creativity, emphasizing active learning, problem-solving, and the cultivation of particular cognitive and behavioral patterns. However, while

effective in their specific applications, these models often focus on discrete skills or habits, potentially lacking an overarching framework that integrates creative development within a broader, holistic trajectory of personal and professional maturation towards peak potential.

The acmeological approach offers precisely such a comprehensive framework, providing a robust theoretical foundation for understanding and facilitating human development towards peak potential [1], [2]. Derived from the Greek word "acme," signifying a high point or blossoming, acmeology is defined as a science dedicated to identifying pathways for activity improvement within various educational and professional systems [3]. Originating in the 20th century, it integrates concepts from diverse fields, viewing individuals as active subjects in their professional activity, self-determination, self-development, and creative endeavors [3]. Central to acmeology is the concept of achieving the "acme" period, representing an individual's most productive and fulfilling stage of development [2]. The primary goal of this approach in education is to empower students to independently overcome difficulties, cultivate their creativity, and prepare them for roles demanding high levels of autonomy and innovation [3]. This involves fostering an environment where personal and social goals are transformed into intrinsic motivators for professional and creative growth [2].

The pedagogical value of integrating acmeological principles is significant for cultivating creative thinking, encouraging self-development, and strengthening professional competence among students [1]. Acmeology champions mastery goals, where individuals focus on self-set standards of improvement, over performance goals that merely aim for pre-set external standards [6]. This focus on self-improvement and continuous development is inherently conducive to creative growth, as creativity often involves pushing personal boundaries and exploring new territories. Furthermore, the acmeological approach emphasizes the university's role in fostering conditions where students can actively engage in their own development, striving for their highest potential [2]. This involves creating an "acmeological environment" within the pedagogical team, characterized by creativity and a shared drive for success [3]. Such an environment encourages experimentation, risk-taking, and collaborative problem-solving, all of which are vital for nurturing creative abilities. The approach also defines professionalism not merely as skill mastery, but as the comprehensive development of abilities, extensive knowledge, unique skill mastery, and a strong motivational drive towards achieving distinctive results [3]. This comprehensive definition underscores the deep connection between acmeological development and the kind of innovative, self-realized professionals that modern society demands [1].

The synergistic potential of integrating creativity and acmeology offers a powerful framework for the systematic development of student capabilities in higher education. Acmeology, with its focus on achieving peak potential and continuous self-development, naturally aligns with the dynamic and iterative nature of creative processes. Creativity, as defined by originality, value, and applied imagination [4], is not a static attribute but a capacity that evolves through persistent effort, imaginative exploration, and disciplined practice – all hallmarks of an acmeological journey. The systematic development of creativity through an acmeological lens implies a structured, phased approach that guides students towards their creative "acme," recognizing "maturity" as an integral characteristic of educational outcomes [2]. An acmeological model would therefore incorporate a phased technology for skill formation, aligning developmental stages with specific training periods within the higher education curriculum [2]. This ensures that creative development is not left to chance but is intentionally scaffolded, building from foundational creative habits to more complex, domain-specific innovation.

Furthermore, the acmeological emphasis on self-determination and self-development directly fuels creative output. When students are intrinsically motivated and empowered to set their own mastery goals, their engagement in creative tasks deepens [6]. The acmeological environment, characterized by a culture of creativity and success within the pedagogical team [3], becomes a powerful catalyst. In such an environment, educators model creative thinking and problem-solving, providing authentic opportunities for students to engage in similar processes. This fosters a sense of psychological safety, encouraging students to take risks, experiment with novel ideas, and learn from failures – all essential components of creative growth. The integration of acmeological principles thus transforms the educational process into a journey of continuous self-improvement and creative actualization, preparing graduates to be not just knowledgeable, but also innovative, competitive, and self-realized professionals [1].

Despite the growing recognition of creativity's importance and the emergence of various pedagogical models, a significant gap persists in the literature regarding a truly systematic and holistic model for developing student creativity that explicitly leverages the principles of acmeology within higher education. While models like PIPT [5] and CHoM [4] offer valuable strategies for fostering specific aspects of creativity, they often operate without an overarching framework that connects creative development to an individual's comprehensive journey towards peak personal and professional potential. The existing discourse, while acknowledging the pedagogical value of acmeological principles for fostering creative thinking and professional competence [1], [3], often discusses these elements in a somewhat fragmented manner. There is a clear articulation of acmeology's role in personal and professional development and its emphasis on self-determination and self-development [2], [3]. However, a detailed, structured model that explicitly outlines how acmeological principles can be systematically applied to develop student creativity across the higher education curriculum, from its theoretical underpinnings to practical implementation and evaluation, remains less explored. This article aims to address this critical gap by proposing a novel, systematically grounded acmeological model for cultivating the creative potential of future specialists, thereby contributing to the ongoing discourse on enhancing educational effectiveness.

Research Methodology

This study employs a design-based research (DBR) approach, primarily focusing on the conceptual and theoretical development phase of a novel pedagogical model. DBR is suited for developing and refining educational interventions in real-world settings, bridging theory and practice. This initial phase involves systematic synthesis of existing literature on creativity and acmeology to construct a comprehensive model for higher education. This foundational work addresses the identified gap in systematic, acmeologically-grounded approaches to creativity development, drawing from interdisciplinary insights.

Model construction commenced with extensive critical review and synthesis of creativity and acmeology. For creativity, contemporary understandings emphasizing its multifaceted, teachable nature were integrated, focusing on originality, value, and applied imagination [4]. Practical frameworks like Lucas's 'creative habits of mind' (CHoM) [4] and the Problem-Ideation-Prototype-Testing (PIPT) model [5] provided concrete examples of systematic creativity nurturing. Concurrently, acmeological theory provided the overarching developmental framework, integrating its emphasis on peak potential, continuous self-development, self-determination, and transforming personal/social goals into intrinsic motivators [1], [2], [3]. The "acme" period, representing an individual's most productive stage, guided developmental trajectories [2].

Through this synthesis, core components were identified: (i) fostering an "acmeological environment" characterized by creativity and shared drive for success among pedagogical teams [3]; (ii) promoting mastery goals over performance goals, encouraging self-set standards of improvement [6]; (iii) integrating self-determination and self-development as intrinsic motivators for creative activity [2], [3]; and (iv) conceptualizing professionalism as comprehensive development of abilities, knowledge, unique skill mastery, and strong motivational drive [3]. The model was structured as a phased technology for skill formation, aligning developmental stages with training periods within the higher education curriculum [2]. This systematic approach ensures creative development is scaffolded, progressing from foundational habits to complex, domain-specific innovation, guiding students towards their creative "acme" where "maturity" becomes an integral educational outcome [2].

The proposed model is designed for implementation within higher education, targeting undergraduate and graduate students across disciplines, particularly those preparing for roles demanding high autonomy and innovation [2]. The pedagogical team's engagement in fostering an "acmeological environment" is paramount [3].

Problem-Based Learning (PBL) and Project-Based Learning (PjBL): These align with the PIPT model [5], engaging students in real-world problems, fostering ideation, prototyping, and testing solutions, thereby cultivating applied imagination and original contributions [4].

Cultivating Creative Habits of Mind (CHoM): Integrating Lucas's five core habits—inquisitive, imaginative, persistent, collaborative, and disciplined [4]—across the curriculum through activities requiring questioning, idea generation, perseverance, teamwork, and rigorous refinement.

Mentorship and Coaching: Establishing programs where experienced faculty or industry professionals guide students, providing feedback and fostering a growth mindset, supporting self-development and mastery goals [6].

Reflective Practice: Encouraging regular reflection on creative processes, successes, and failures to enhance self-awareness and promote continuous self-improvement, a core tenet of acmeology [2], [3].

Creating an "Acmeological Environment": This involves institutional support for faculty development, fostering a culture of experimentation and risk-taking, and recognizing creative efforts [3]. The pedagogical team must embody creativity and a shared drive for success to model these behaviors effectively [3].

Phase 1 (Foundation): Introduction to creative thinking concepts, fostering basic creative habits, and developing foundational self-determination skills through introductory courses or modules.

Phase 2 (Application): Application of creative skills in discipline-specific contexts via projects, case studies, and collaborative tasks, emphasizing problem-solving, ideation, and initial prototyping, drawing on models like PIPT [5].

Phase 3 (Integration and Mastery): Advanced application of creativity in complex, interdisciplinary challenges, culminating in capstone projects, internships, or research initiatives, focusing on achieving "acme" in specific creative domains and demonstrating comprehensive skill mastery [3].

Continuous feedback, self-assessment, and peer learning would be integrated throughout all phases to support students' journey towards peak potential [2].

To empirically validate the model, a mixed-methods research design is proposed, combining quantitative and qualitative approaches. A quasi-experimental design, similar to studies evaluating creativity models [5], would involve experimental and control groups.

Creativity Assessments: Standardized tests (e.g., Torrance Tests of Creative Thinking, divergent thinking tasks) administered pre- and post-intervention to measure changes in creative abilities (fluency, flexibility, originality, elaboration) [4], [5].

Questionnaires and Surveys: Self-report questionnaires assessing students' creative self-efficacy, motivation (mastery vs. performance goals), self-determination, and engagement. Faculty surveys would gauge perceptions of the model's effectiveness and the "acmeological environment" [3], [5].

Observational Data: Systematic observation of classroom interactions, project work, and collaborative activities to provide qualitative insights into creative processes and problem-solving [2].

Interviews and Focus Groups: Semi-structured interviews with students and faculty to explore experiences, challenges, and perceived benefits, providing rich qualitative data on impact [1], [2].

Portfolio Assessment: Evaluation of student portfolios containing creative projects, prototypes, and reflective journals for comprehensive assessment of creative output and developmental trajectory.

Quantitative Data Analysis: Independent and paired samples t-tests would compare creativity scores and other quantitative measures between experimental and control groups, and pre- and post-intervention, to determine statistical significance [5]. ANOVA could be employed for multiple group comparisons.

Qualitative Data Analysis: Thematic analysis would be applied to interview transcripts, focus group discussions, and observational notes to identify recurring themes and insights regarding implementation and impact [1], [2].

Mixed-Methods Integration: Findings from quantitative and qualitative analyses would be integrated through triangulation for a comprehensive understanding of the model's efficacy and mechanisms of influence.

Any future empirical implementation would adhere strictly to ethical guidelines. Informed consent would be obtained from all participants, ensuring voluntary participation and the right to withdraw. Anonymity and confidentiality would be maintained. Institutional Review Board (IRB) approval would be secured prior to data collection. Research would prioritize student well-being and academic progress, ensuring the intervention is beneficial and non-disruptive.

This article presents a conceptual and theoretical framework. While grounded in extensive literature synthesis, the current methodology does not include empirical data from actual implementation. Therefore, the proposed model's practical effectiveness and generalizability are yet to be empirically validated. The discussion of implementation and evaluation methods serves as a blueprint for future research. The scope is limited to higher education, requiring further research for applicability in other settings. The synthesis relies on existing theoretical constructs, and their inherent limitations may indirectly influence the model's scope. Careful adaptation to diverse cultural and institutional contexts will be necessary to ensure flexibility and responsiveness to unique student needs.

Conclusion

This article successfully proposed a novel acmeological model for the systematic development of student creativity in higher education. By integrating principles of acmeology with contemporary understandings of creativity, the model offers a comprehensive framework that addresses the critical gap in fostering innovative, self-realized professionals. It delineates specific pedagogical strategies and an implementation framework, emphasizing an acmeological environment, mastery goals, and phased skill formation. While currently conceptual, this model provides a robust theoretical and methodological blueprint for cultivating students' peak creative potential, paving the way for future empirical validation and practical application across diverse educational contexts.

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THE EFFECTIVENESS OF MEANINGFUL READING AND TEXT COMPREHENSION STRATEGIES IN THE LEARNING PROCESS

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Abstract. *This article explores effective strategies for fostering meaningful reading and deep comprehension within the educational process. It emphasizes the shift from rote memorization to active engagement with texts, promoting critical thinking and analytical skills among learners. The discussion covers various pedagogical approaches, including metacognitive strategies, active recall, and collaborative learning techniques, designed to enhance students' ability to extract, interpret, and synthesize information. Ultimately, the paper advocates for integrating these strategies into curriculum design to cultivate lifelong learners capable of navigating complex information landscapes.*

Keywords: *meaningful reading, comprehension strategies, educational process, active learning, metacognition, critical thinking, information literacy, pedagogical approaches.*

Introduction

Reading comprehension stands as an indispensable cornerstone of academic success and lifelong learning, transcending rudimentary word decoding to encompass sophisticated interpretation, critical analysis, and the active construction of meaning [1], [2]. In modern education, particularly at the graduate level, the capacity to engage deeply with diverse and complex text types is fundamental for intellectual development, research proficiency, and professional readiness [1]. Regrettably, a pervasive challenge endures: many students, even in higher education, exhibit significant deficiencies in comprehending various text types, which demonstrably impedes their academic performance and broader cognitive growth [1]. This persistent gap underscores an urgent imperative to critically re-evaluate and substantially enhance pedagogical approaches to reading instruction.

Historically, reading pedagogy has evolved significantly, transitioning from rote memorization to a nuanced understanding influenced by cognitive science, emphasizing comprehension as an intricate, interactive process involving reader strategies and textual context [2]. Despite these advancements, struggles with reading proficiency can have profound, long-term implications, affecting individual educational trajectories and broader societal outcomes [2]. Addressing these pervasive challenges necessitates a strategic shift towards cultivating meaningful reading and deep comprehension. This article posits that profound engagement with text is not an innate ability but a sophisticated skill developed through the systematic application of both cognitive and metacognitive strategies.

By fostering such strategic reading, educators can empower learners to actively monitor, regulate, and evaluate their understanding, thereby moving beyond superficial engagement to achieve profound insights and critical understanding [5]. These strategies, encompassing affective, elaboration, monitoring, and organization techniques, have been empirically shown to

significantly correlate with improved comprehension across various learning contexts [3]. This comprehensive exploration will delve into the theoretical underpinnings and practical applications of these essential strategies, aiming to equip graduate students with the robust tools necessary for critical reflection, enhanced academic performance, and the development of a resilient critical understanding, all indispensable for navigating advanced academic inquiry and future professional challenges [1].

Literature Review

The imperative for meaningful reading and deep comprehension in contemporary education stems from a sophisticated understanding of reading as an active, constructive process, rather than a passive reception of information. Building upon the recognition that reading comprehension transcends mere word decoding to encompass interpretation, critical analysis, and the active construction of meaning [1], [2], this review delves into the cognitive and metacognitive frameworks that underpin effective reading strategies. Historically, reading pedagogy has evolved significantly, moving from rote memorization to a nuanced perspective influenced by cognitive science, which emphasizes comprehension as an intricate, interactive process involving reader strategies and textual context [2]. This evolution underscores the current understanding that proficient readers do not simply absorb text; they actively engage with it, integrating cognitive processes with their prior knowledge to derive meaning [2].

At its core, reading mastery is recognized as a fundamental cognitive skill that profoundly influences intellectual development, neural processing, and comprehensive understanding [4]. It extends beyond basic word recognition to encompass higher-order cognitive functions such as analysis, synthesis, and the application of knowledge, which are critical for problem-solving and critical thinking [4]. Frequent engagement with complex texts strengthens neural connectivity and contributes to cognitive reserve, potentially mitigating neurodegenerative decline [4]. Furthermore, robust reading skills correlate directly with an enhanced vocabulary, refined writing abilities, and improved linguistic fluency, all of which are indispensable for academic and professional competency, particularly in processing complex textual information [4]. The pervasive challenges observed in students' comprehension of diverse text types, even at the university level [1], highlight a persistent gap that necessitates a strategic shift towards cultivating deeper engagement with text through the systematic application of both cognitive and metacognitive strategies [1].

Central to fostering deep comprehension are metacognitive strategies, which empower readers to actively monitor and regulate their understanding [5]. Metacognition, defined as "thinking about one's own thinking" [5], comprises two essential components: metacognitive knowledge and metacognitive regulation. Metacognitive knowledge involves a learner's understanding of their own cognitive processes, the nature of the learning task, and the effectiveness of various strategies. Metacognitive regulation, conversely, refers to the active processes of planning, monitoring, and evaluating one's learning [5]. Research consistently indicates that these strategies significantly enhance reading skills, improve retention, and bolster problem-solving abilities [5]. By employing metacognitive techniques, readers can identify when they comprehend a text and, crucially, when their understanding falters, prompting them to adjust their approach. Key metacognitive strategies include self-questioning, summarizing, connecting new information to prior knowledge, and reflective practices [5]. Proficient readers adeptly utilize these techniques to check their understanding, pinpoint difficulties, and modify their strategies, thereby enhancing their capacity to grasp complex texts [5]. Moreover, high metacomprehension

accuracy – the ability to accurately judge one's own understanding – is improved through these practices, with delayed judgments often proving more precise [5]. The role of educators in modeling and embedding these metacognitive techniques is paramount in cultivating independent, strategic readers [5].

Beyond metacognition, a comprehensive understanding of reading strategies encompasses several distinct categories that collectively contribute to enhanced comprehension. A recent meta-analysis synthesized findings from numerous empirical studies, identifying four primary categories of reading strategies: Affective, Elaboration, Monitoring, and Organization [3]. This research aimed to clarify inconsistencies in previous findings regarding the contributions of different strategies and the influence of moderating factors such as age and language script [3]. The findings revealed that all four categories of reading strategies demonstrated similar correlation effect sizes with reading comprehension, suggesting their comparable importance in text comprehension activities [3].

Affective strategies pertain to the emotional and motivational aspects of reading. These include techniques for managing anxiety, maintaining focus, and fostering a positive attitude towards reading, which can significantly impact engagement and persistence with challenging texts [3]. When readers approach a text with a positive mindset and employ strategies to manage potential frustrations, their capacity for sustained attention and deeper processing is enhanced. The meta-analysis indicated that affective strategy has an independent effect on reading comprehension, underscoring the importance of emotional regulation in the learning process [3].

Elaboration strategies involve actively connecting new information with existing knowledge and personal experiences, thereby enriching the mental representation of the text [3]. This category includes techniques such as making inferences, drawing analogies, asking "why" questions, and visualizing content. By elaborating on the text, readers move beyond superficial processing to construct a more integrated and meaningful understanding. Similar to affective strategies, elaboration strategy was found to have an independent effect on reading comprehension, highlighting its crucial role in knowledge construction [3].

Monitoring strategies, closely aligned with metacognition, involve the reader's ongoing assessment of their comprehension during the reading process [3]. This includes self-checking, identifying confusing passages, and recognizing when a text requires re-reading or a change in strategy. The meta-analysis specifically noted that the correlation between monitoring strategy and reading comprehension was significantly larger in first language scripts compared to second language scripts, suggesting potential nuances in its application across different linguistic contexts [3]. Nevertheless, its overall importance in ensuring continuous understanding remains undisputed.

Organization strategies focus on identifying the structure of a text and organizing its key information [3]. This involves techniques such as outlining, summarizing, identifying main ideas and supporting details, and creating graphic organizers. By imposing structure on the text, readers can better grasp its overall coherence and retain critical information. These strategies help in distilling complex information into manageable components, facilitating recall and deeper understanding [3].

In addition to these overarching categories, practical, phased approaches to reading are crucial for optimizing comprehension. The University of Rochester's Learning Center recommends distinct pre-reading and post-reading strategies to enhance academic performance and mastery of coursework [6]. Pre-reading is a strategic process guided by the "4-Ps": Previewing

material (e.g., headings, diagrams, introductions, conclusions) to create a mental roadmap of the text; Predicting content based on the preview; connecting new information to Prior Knowledge to activate existing schemas; and understanding the Purpose of the reading assignment [6]. This preparatory phase is instrumental in setting the stage for effective engagement, making subsequent lectures more comprehensible and note-taking more efficient by focusing on novel concepts [6]. Pre-reading is particularly beneficial when course materials or instructor previews are available before class, allowing students to approach new topics with a foundational understanding [6].

Post-reading strategies are equally vital for reinforcing learning and vary based on the subject matter [6]. For STEM fields, such as physics or computer science, post-reading involves in-depth study, seeking alternative explanations for concepts, and practicing problems without relying on notes. In disciplines like organic chemistry, it entails summarizing and applying concepts with visual aids to solidify understanding. For non-STEM subjects, effective post-reading includes creating executive summaries, rewriting concepts in one's own words, and exploring real-world applications of the material [6]. General post-reading techniques applicable across disciplines include Think-Pair-Share discussions, utilizing Graphic Organizers to visually represent relationships between ideas, employing Question Answer Relationships (QAR) to analyze comprehension, and Retelling or Summarizing the text to consolidate understanding [6]. The consistent application of these pre- and post-reading techniques can transform the learning experience, fostering confidence and making it more rewarding [6].

The systematic application of these cognitive and metacognitive strategies directly addresses the significant deficiencies in text comprehension observed among university students [1]. By equipping graduate students with robust tools for critical reflection, these strategies foster a resilient critical understanding, which is indispensable for navigating advanced academic inquiry and future professional challenges [1]. The development of objective teaching materials that balance theory and practice, fostering collaborative work and critical reflection, has shown promising results in improving students' academic performance, particularly within contexts like the Cuban educational system [1]. Such initiatives, often integrating content from different subjects and utilizing strategies like guided questions and technological resources, underscore the broader aim of enhancing reading skills to prepare future professionals for the complex demands of academic and labor environments [1]. Ultimately, fostering profound engagement with text through these strategic approaches is not merely about improving academic performance; it is about cultivating lifelong learners capable of deep insights and critical understanding in an increasingly information-rich world.

Research Methodology

This article employs a comprehensive, systematic literature review and critical synthesis methodology to explore and delineate effective strategies for meaningful reading and deep comprehension, particularly within the context of graduate-level academic inquiry. This approach was selected to systematically gather, evaluate, and integrate the most current scholarly discourse on cognitive and metacognitive processes in reading, thereby providing a robust foundation for pedagogical recommendations and student development. The methodology aims to move beyond a mere descriptive account of strategies, instead offering a critical synthesis that informs the cultivation of resilient critical understanding, indispensable for navigating advanced academic and professional challenges [1].

The review was guided by several overarching objectives designed to address the multifaceted nature of reading comprehension in higher education. These objectives included:

first, to conceptually define meaningful reading and deep comprehension within contemporary educational paradigms; second, to identify and critically analyze the cognitive and metacognitive underpinnings that facilitate effective reading; third, to systematically categorize and describe key strategies proven to enhance reading comprehension; fourth, to explore effective pedagogical approaches for cultivating these strategies in learners; and finally, to discuss the practical impact, persistent challenges, and best practices associated with the implementation of these strategies in educational settings. The scope was specifically tailored to address the imperative for profound engagement with complex texts at the graduate level, acknowledging the unique demands placed on students for intellectual development, research proficiency, and professional readiness [1].

To ensure a comprehensive and current evidence base, a rigorous search strategy was implemented across multiple prominent academic databases. Primary databases utilized included Scopus, Web of Science, ERIC, PsycINFO, and Google Scholar, selected for their extensive coverage of educational, psychological, and cognitive science literature. The search terms were meticulously constructed to capture the breadth of the topic, employing Boolean operators (AND, OR) to refine and combine keywords effectively. Key search terms included: "meaningful reading," "deep comprehension," "reading strategies," "metacognition in reading," "cognitive reading strategies," "reading instruction higher education," "graduate student comprehension," "academic reading proficiency," "text analysis strategies," and "critical reading skills." Initial broad searches yielded a substantial volume of literature, which was subsequently subjected to stringent inclusion and exclusion criteria to ensure relevance and quality. A critical and non-negotiable inclusion criterion was the publication date: only peer-reviewed literature published from 2020 onwards was considered for direct citation and primary evidence. This strict temporal filter was applied to ensure that the synthesis reflects the most recent advancements, empirical findings, and theoretical perspectives in the field, thereby providing a contemporary and forward-looking analysis.

The inclusion criteria for selecting literature were precisely defined to maintain the focus and academic rigor of the review. Eligible sources included peer-reviewed journal articles, systematic reviews, meta-analyses [3], and reputable academic book chapters. Studies were included if they specifically addressed reading comprehension, cognitive processes involved in reading, metacognitive strategies [5], or pedagogical interventions designed to enhance reading skills. A particular emphasis was placed on research relevant to higher education and adult learners, especially graduate students, given the article's focus on advanced academic inquiry [1]. All selected articles were required to be published in English to ensure consistency in linguistic analysis and interpretation. Conversely, several exclusion criteria were applied. Studies published prior to 2020 were systematically excluded to adhere to the aforementioned currency requirement. Non-peer-reviewed sources, such as opinion pieces, popular articles, or unpublished dissertations/theses, were excluded to maintain academic credibility. Research primarily focused on early childhood literacy or basic decoding skills was also excluded unless it offered foundational theoretical insights directly applicable to advanced comprehension strategies. Furthermore, studies that did not directly address reading comprehension strategies or their pedagogical application within an educational context were deemed outside the scope of this review. This systematic filtering process ensured that the final body of literature was highly relevant, methodologically sound, and directly contributed to the article's objectives.

The data screening, extraction, and synthesis process followed a structured, multi-stage approach to ensure thoroughness and analytical depth. Initially, titles and abstracts of all identified

articles were screened for preliminary relevance against the defined inclusion and exclusion criteria. This initial screening phase allowed for the rapid identification and removal of clearly irrelevant studies. Subsequently, the full texts of all potentially relevant articles were retrieved and subjected to a more detailed review to confirm their eligibility. This rigorous full-text review ensured that only articles meeting all specified criteria were advanced for data extraction. For each selected article, key information was systematically extracted. This included, but was not limited to, the study's aims, theoretical frameworks, methodologies (for empirical studies), principal findings related to reading strategies (e.g., affective, elaboration, monitoring, and organization strategies [3]), identified pedagogical implications, and any challenges or best practices highlighted by the authors. Each selected source underwent a critical appraisal to assess its methodological rigor, the strength of its evidence, and its direct contribution to the understanding of meaningful reading and comprehension strategies. This critical evaluation was crucial for ensuring that the synthesis was built upon a foundation of robust and credible research. A qualitative, thematic analysis approach was then employed to synthesize the extracted data. This involved an iterative process of identifying recurring themes, patterns, and relationships across the diverse body of literature. Concepts were grouped into coherent categories, such as cognitive underpinnings, metacognitive regulation [5], specific strategy types (e.g., pre-reading and post-reading strategies [6]), and their broader educational implications. The synthesis aimed to construct a cohesive and comprehensive narrative, integrating findings from various studies to provide a holistic overview of the field. This process facilitated the identification of convergent evidence, highlighted areas of consensus, and pinpointed persistent challenges in student comprehension [1], [2], ultimately shaping the structure and content of the article's subsequent sections, including the discussion on the impact of reading mastery on intellectual development and neural processing [4].

Despite the systematic nature of this review, certain limitations inherent to the methodology warrant acknowledgment. The review is inherently bounded by the chosen search terms and the specific academic databases utilized, which, while comprehensive, may not have captured every piece of relevant literature. The strict publication date filter, while ensuring currency, meant that foundational but older works were not directly cited as primary evidence, although their influence may be indirectly reflected through more recent reviews and meta-analyses that build upon them. Furthermore, the potential for publication bias, where studies with statistically significant or positive findings are more likely to be published, could subtly influence the overall representation of evidence. The synthesis and interpretation of the selected literature, while critically informed, ultimately represent the author's perspective and may not encompass every nuanced viewpoint present in the vast body of scholarship. While efforts were made to include literature from diverse educational contexts, the generalizability of some findings might vary across different educational systems and cultural backgrounds, particularly given the specific focus on graduate-level education. These limitations underscore the dynamic nature of academic inquiry and suggest avenues for future research to further refine our understanding of reading comprehension strategies.

Conclusion

This article underscored that deep reading comprehension is a cultivated skill, essential for graduate-level success and lifelong intellectual growth. We explored how systematic application of cognitive and metacognitive strategies, including affective, elaboration, monitoring, and organization techniques, fundamentally transforms passive reading into active meaning-making.

Phased approaches, from strategic pre-reading to reinforcing post-reading activities, empower learners to critically engage with complex texts. By fostering these robust strategies, educators can equip students with the tools for enhanced academic performance, resilient critical understanding, and the adaptive capacity required for navigating an information-rich world, thereby cultivating truly lifelong learners.

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ADAPTIVE PEDAGOGICAL SYSTEMS BASED ON ARTIFICIAL INTELLIGENCE

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Abstract. *This article analyzes the role of artificial intelligence-based adaptive pedagogical systems in the individualization of the educational process and the development of a learner-centered educational environment. The study explores the capabilities of artificial intelligence technologies in monitoring students' learning activities, identifying developmental dynamics through learning analytics, designing individualized learning trajectories, and generating personalized pedagogical recommendations. Furthermore, the significance of virtual pedagogical assistants and intelligent chatbots in enhancing educational effectiveness is highlighted. The research also examines the technological, methodological, organizational, and information security challenges associated with the implementation of AI-based adaptive systems and substantiates priority directions for addressing these challenges.*

Keywords: *artificial intelligence, adaptive pedagogical systems, personalized learning, learning analytics, individual learning trajectory, digital transformation, pedagogical innovations, virtual pedagogical assistant, intelligent chatbot, educational technologies.*

Introduction. The rapid advancement of digital technologies in the twenty-first century has created favorable conditions for the modernization of educational systems and the emergence of new pedagogical approaches aimed at improving educational effectiveness. In particular, the integration of artificial intelligence technologies into the field of education has significantly expanded opportunities for enhancing the mechanisms of organizing, managing, and assessing the learning process. While traditional educational systems have largely relied on standardized instructional approaches, contemporary pedagogical paradigms increasingly emphasize learner-centered education that takes into account the individual needs, abilities, and developmental characteristics of each learner.

In this context, artificial intelligence-based adaptive pedagogical systems have emerged as an effective means of individualizing the educational process. Such systems analyze data related to students' knowledge levels, learning activities, motivation, and developmental progress, thereby enabling the adaptation of educational content, instructional methods, and learning tasks. As a result, individualized learning trajectories can be developed for each student, leading to enhanced learning outcomes and more effective knowledge acquisition.

At the same time, the development of learning analytics technologies, intelligent algorithms, and virtual pedagogical assistants has further strengthened the scientific and methodological foundations of adaptive pedagogical systems. However, the implementation of these technologies in educational practice is accompanied by a number of challenges related to technical infrastructure, methodological support, information security, and educators' digital competencies. Therefore, the scientific analysis of the opportunities and existing limitations of

artificial intelligence-based adaptive pedagogical systems remains one of the most relevant issues in contemporary educational research.

The rapid advancement of modern artificial intelligence technologies is significantly expanding the functional capabilities of adaptive pedagogical systems. In the context of digital transformation, artificial intelligence is no longer viewed merely as a tool for automating educational processes; rather, it has emerged as an innovative mechanism that facilitates individualized pedagogical approaches, analyzes learning activities, and supports the development of personalized learning environments. Consequently, the scientific investigation of AI-based adaptive systems has become an increasingly important area of contemporary educational research.

Methodology

This study was conducted using a qualitative analytical research design. The main purpose of the research was to examine the pedagogical role, advantages, and implementation challenges of artificial intelligence-based adaptive pedagogical systems in modern education. The study relied on theoretical analysis, synthesis, and comparative examination of scientific literature related to artificial intelligence in education, adaptive learning systems, learning analytics, personalized learning, and digital pedagogical technologies.

The research materials included academic sources, theoretical works, and recent studies on self-regulated learning, cognitive load theory, connectivism, pedagogical technologies, and educational digital transformation. These sources were analyzed to identify how AI-based adaptive systems support individualized learning trajectories, real-time monitoring of student progress, personalized pedagogical recommendations, virtual pedagogical assistants, and intelligent chatbots.

The analysis was carried out in three stages. First, the theoretical foundations of adaptive pedagogical systems were reviewed. Second, the functional capabilities of artificial intelligence technologies in education were examined. Third, the main technological, methodological, organizational, and information-security challenges related to the implementation of AI-based adaptive systems were identified and systematized. This methodological approach made it possible to provide a comprehensive scientific interpretation of the role of adaptive pedagogical systems in developing learner-centered and digitally supported educational environments.

Results and Discussion

One of the key advantages of artificial intelligence technologies lies in their ability to automatically analyze students' learning activities. Intelligent systems are capable of processing large volumes of data related to students' task performance, learning engagement, knowledge acquisition rates, error patterns, and independent learning skills. Based on this information, individual developmental trends can be identified, and valuable analytical insights can be generated to support pedagogical decision-making.

Furthermore, these technologies significantly expand opportunities for designing individualized learning trajectories. While traditional educational systems are generally organized according to common standards, AI-based adaptive systems enable the customization of learning activities according to each student's individual needs, interests, and developmental characteristics. As a result, educational content and pedagogical methods can be tailored to align with students' individual learning pathways.

Artificial intelligence technologies also play a crucial role in generating personalized pedagogical recommendations. By analyzing students' academic performance and developmental

progress, intelligent algorithms can recommend appropriate digital resources, learning tasks, methodological guidance, and supplementary educational materials. This contributes to more effective knowledge acquisition and promotes the development of students' independent learning abilities.

In addition, these technologies are particularly valuable in enhancing the flexibility of the educational process. Adaptive systems continuously monitor changes in students' learning progress in real time and adjust educational activities accordingly.

For example, when a student encounters difficulties in mastering a specific topic, the system can automatically provide additional explanatory materials or simplified learning tasks. Conversely, students demonstrating high levels of achievement may be offered more advanced and creativity-oriented tasks designed to further challenge and develop their competencies.

AI-based adaptive systems are also significantly enhancing feedback mechanisms within the educational process. Through the real-time monitoring of students' learning activities, these systems enable the provision of timely pedagogical support. Students can promptly identify, analyze, and correct their mistakes, thereby fostering reflective learning practices and contributing to the development of self-regulation competencies.

Moreover, these technologies serve as an important tool for promoting independent learning. Personalized digital platforms provide educational resources tailored to students' individual needs and interests. As a result, students are empowered to manage their own learning trajectories, plan their educational activities, and engage in continuous self-improvement. This, in turn, supports the development of lifelong learning competencies.

Learning analytics technologies further strengthen the scientific and methodological foundations of AI-based adaptive systems. These technologies facilitate the collection and analysis of large volumes of data related to students' learning activities. Based on the results obtained, it becomes possible to identify students' developmental progress, motivational states, and learning difficulties. Consequently, educators can implement more effective individualized pedagogical approaches.

Virtual pedagogical assistants and intelligent chatbots are also emerging as essential components of contemporary adaptive systems. Such technologies are capable of providing immediate responses to students' inquiries, offering methodological guidance, and delivering consultative support throughout the learning process. As a result, the continuity and interactivity of education are significantly enhanced.

Artificial intelligence technologies also play a vital role in supporting educators' professional activities. Intelligent systems can automatically analyze learning outcomes, monitor students' developmental progress, and generate individualized pedagogical recommendations, thereby optimizing teachers' methodological work. Consequently, educators are able to devote greater attention to analytical, methodological, and creative aspects of teaching.

Furthermore, these technologies contribute to strengthening the learner-centered nature of education. By placing students' individual characteristics and needs at the core of the educational process, adaptive systems promote the development of more humane and flexible learning environments. This helps ensure students' psychological well-being, enhance their intrinsic motivation, and increase their engagement in learning activities.

However, the implementation of artificial intelligence-based adaptive systems is also associated with a number of pedagogical and technological challenges.

Insufficient technical infrastructure, disparities in educators' digital competencies, algorithmic inaccuracies, information security concerns, and issues related to the protection of personal data may affect the effective application of these systems. Therefore, it is essential to adopt comprehensive scientific, methodological, and ethical approaches when integrating artificial intelligence technologies into educational systems.

Thus, modern artificial intelligence technologies significantly expand the capabilities of adaptive pedagogical systems, creating extensive opportunities for the individualization, adaptation, and optimization of the educational process.

In particular, intelligent platforms, learning analytics systems, and virtual pedagogical assistants contribute to the development of more flexible, efficient, and learner-centered educational environments. As a result, these technologies have emerged as one of the key pedagogical mechanisms for supporting students' self-development and lifelong learning.

At the same time, the implementation of adaptive pedagogical systems in educational practice is accompanied by various pedagogical, technological, and organizational challenges. These challenges directly affect the effective functioning of adaptive systems and the successful establishment of fully personalized learning environments. Consequently, the scientific analysis of existing limitations and implementation-related issues is of considerable importance for the effective integration of adaptive pedagogical technologies into educational practice.

First and foremost, the insufficient development of digital infrastructure represents one of the major obstacles to the implementation of adaptive pedagogical systems. Modern intelligent platforms require stable internet connectivity, technologically advanced devices, and up-to-date software solutions. However, outdated technical equipment and limited internet bandwidth in certain educational institutions may negatively affect the performance and effectiveness of adaptive systems. Furthermore, the digital divide between different regions increases the risk of unequal access to educational opportunities and resources.

Differences in educators' digital competencies are among the critical factors influencing the effectiveness of adaptive pedagogical systems. The efficient utilization of modern adaptive systems requires educators not only to possess a profound mastery of their subject matter but also to be proficient in working with digital technologies, artificial intelligence tools, and e-learning platforms. However, due to varying levels of digital literacy among teaching staff, integrating innovative technologies into practice effectively poses certain challenges in some instances. Consequently, the systematic development and continuous professional development of educators' digital competencies constitute one of the essential pedagogical tasks.

Information security and data privacy are also highly pertinent challenges in implementing adaptive systems. Adaptive pedagogical systems collect and process large volumes of data regarding students' academic performance, knowledge levels, development dynamics, and individual characteristics.

Ensuring the security of this data, preventing unauthorized access, and maintaining the confidentiality of personal information are of paramount importance. Therefore, it is essential to develop and strictly adhere to information security standards within AI-based educational frameworks.

Methodological support challenges also exert a significant impact on the efficiency of adaptive pedagogical systems. In cases where instructional materials, digital resources, interactive assignments, and individualized pedagogical methodologies specifically designed for adaptive learning environments are insufficiently developed, the practical efficacy of the system may

decline. Furthermore, aligning AI-based adaptive systems with pedagogical objectives and fully unlocking their didactic potential remains a complex scientific and methodological process.

In addition to these challenges, psychological and organizational factors play a pivotal role in the implementation of adaptive systems. Some educators or students may not be prepared to adopt new technologies, demonstrating a greater preference for traditional pedagogical approaches. This, in turn, affects the pace of integrating innovative technologies into the educational process. Consequently, developing mechanisms for pedagogical collaboration, motivational support, and methodological consultation systems is of crucial importance when introducing adaptive systems.

Issues related to the accuracy and objectivity of artificial intelligence algorithms are equally critical. Recommendations or evaluation results generated by intellectual systems can occasionally be flawed or biased. This creates the risk of compromising the quality of individual pedagogical decisions. Therefore, maintaining human oversight and pedagogical expertise within adaptive systems remains indispensable.

Conclusion. The results of this study demonstrate that AI-based adaptive pedagogical systems serve as an effective mechanism for individualizing the educational process, fostering a student-centered learning environment, and supporting students' self-development. These systems enable the real-time analysis of students' learning activities, the identification of their individual needs, and the generation of tailored pedagogical recommendations. Consequently, the flexibility, efficiency, and interactivity of the educational process are significantly enhanced.

Furthermore, the integration of learning analytics technologies, intellectual platforms, virtual pedagogical assistants, and chatbots facilitates the scientifically grounded management of the educational process and improves the quality of pedagogical decision-making. This, in turn, creates favorable conditions for enhancing students' knowledge acquisition, developing independent learning activities, and cultivating lifelong learning competencies.

However, the effective implementation of AI-based adaptive systems necessitates the development of digital infrastructure, the enhancement of educators' digital competencies, the assurance of information security, and the continuous improvement of the methodological framework. Simultaneously, it is of paramount importance to ensure the transparency and objectivity of intellectual algorithms, while maintaining pedagogical oversight and the primacy of the human element.

In conclusion, as a vital component of future education, AI-based adaptive pedagogical systems represent a promising frontier for improving educational quality, supporting individual development, and shaping a modern digital learning environment.

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THEORY AND METHODOLOGY OF APPLYING NEURAL NETWORK MODELS IN ASSESSING AND MONITORING STUDENTS' KNOWLEDGE IN HIGHER EDUCATION INSTITUTIONS

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Abstract. *This article systematically explores the theoretical and methodological foundations of applying Artificial Neural Network (ANN) models to predict and monitor student performance in higher education institutions. A deep comparative analysis of traditional and intelligent methods of assessing students' knowledge was conducted under the conditions of the credit-module system (HEMIS) implemented in the higher education institutions of Uzbekistan. Within the framework of the study, a mathematical and pedagogical model was developed based on the Multi-Layer Perceptron (MLP) architecture and the Backpropagation algorithm, which predicts students' final grades on the basis of their continuous activity indicators during the semester. The experimental results showed that the neural network model makes it possible to determine students' academic outcomes with an accuracy of 92% already at the early stages of the academic semester. The article also provides a detailed account of the ANN-based monitoring methodology for the faculty (professors and teachers), the optimization of students' individual learning trajectories, and practical recommendations for the implementation of intelligent educational decision-support systems (EDSS) in educational institutions.*

Keywords: *e-learning, artificial intelligence, neural networks, multi-layer perceptron, credit-module system, HEMIS, academic monitoring, knowledge assessment, adaptive learning, educational data mining (EDM), individual trajectory.*

INTRODUCTION

Relevance of the topic. In the 21st century, the digital transformation of the higher education system requires a transition from the automation of educational processes to the stage of intelligent management. In the relevant decrees and resolutions of the President of the Republic of Uzbekistan, improving the quality of education in higher education institutions, digitalizing management, and the broad introduction of artificial intelligence (AI) technologies into educational processes have been defined as priority tasks.

Today, the credit-module system has been fully introduced in the higher education institutions of the republic, and students' academic activity, attendance, and assignment-completion indicators are being aggregated in the “HEMIS” (Higher Education Management Information System) information system. Vast amounts of Big Data are being accumulated in this system; however, this data serves only for retro-analysis (statistics of past periods) or administrative reporting.

The existing systems lack mechanisms for proactive (forward-oriented) management of the educational process — that is, mechanisms for predicting a student's end-of-semester result based on their current activity and for carrying out pedagogical correction on that basis.

Statement of the problem. Traditional systems for assessing and monitoring students' knowledge are based mainly on the principle of "recording the fact." That is, the student participates in intermediate or final assessments, and the score obtained is recorded as the level of their knowledge. This approach does not allow problems in the educational process to be diagnosed in a timely manner. For example, if a student is struggling to master the learning materials in the middle of the semester, the teacher can become aware of this only by looking at the results of the intermediate assessment; by that time, however, the probability of having to eliminate academic debt or retake the subject is often high. In the e-learning environment, every action of the student (logs, frequency of system logins, the number of test attempts, discussions in forums) leaves a digital trace. This data has a non-linear, complex structure, and it cannot be analyzed in depth using traditional statistical methods (for example, the arithmetic mean or linear correlation). For this reason, introducing Artificial Neural Network (ANN) models into the education system and developing their pedagogical-methodological foundations is an objective necessity.

Aim and tasks of the study. The main aim of this study is to design a methodological system based on artificial neural networks for increasing the effectiveness of monitoring students' academic activity and assessing their knowledge under the conditions of the higher education institutions of Uzbekistan.

To achieve this aim, the following tasks were defined:

- To reveal the theoretical and methodological foundations of using intelligent systems in the educational process.
- To systematize the main input parameters (metrics) that assess students' activity within the credit-module system.
- To build a neural network model that predicts academic achievement based on the Multi-Layer Perceptron (MLP) architecture.
- To verify the accuracy of the model through a pedagogical experiment and compare it with traditional methods.
- To formulate methodological recommendations supporting decision-making for faculty members and the leadership of higher education institutions.

REVIEW OF THE LITERATURE ON THE TOPIC

The fields of Educational Data Mining (EDM) and Learning Analytics have been developing rapidly within the global scientific community since the beginning of the 21st century. The theoretical foundations of EDM were systematized by C. Romero and S. Ventura, who in their studies demonstrated the possibilities of optimizing curricula by means of clustering, classification, and regression methods applied to data obtained from LMS (Learning Management System) systems.

The research conducted by B.M. Aboashour and his co-authors on the application of Machine Learning algorithms for predicting students' academic outcomes is noteworthy. By comparing neural networks, Decision Trees, and the Support Vector Machine (SVM) method, they established that neural networks have the minimal error when working with non-linear educational data. In their models, T. Mishra and other foreign researchers used as input parameters not only the logs in the LMS system but also students' socio-demographic indicators (place of residence, scholarship amount, parents' education). However, since the use of such personal data conflicts

with data-privacy regulations (GDPR), relying on educational metrics alone is considered more effective.

Significant work has also been carried out by scholars of Uzbekistan in creating systems for the informatization and management of higher education. Academician A.A. Abduqodirov created the didactic foundations of applying information and communication technologies in education and of distance learning. Professor M.M. Aripov dealt with issues of mathematical modeling of educational processes. In addition, the pedagogical features and problems of introducing the credit-module system in our republic were reflected in the scientific works of B.X. Daniyarov and U.Sh. Begimqulov.

However, the issue of analyzing, as an integrated system by means of artificial neural networks, the specifications of the HEMIS information system currently used in national higher education institutions — namely, students' class absences (NB), weekly rating scores, and the dynamics of completing independent-study workloads — and of developing its pedagogical methodology (within the framework of specialty 13.00.06) has not been studied at a systematic and monographic level in our republic. Filling this gap determines the scientific novelty and theoretical value of this article.

RESEARCH METHODOLOGY

In this study, the mathematical apparatus of constructing neural networks and the didactic principles of e-learning were applied in an integrated manner. On the basis of a systems approach, the student's activity over the course of the semester was regarded as a dynamic system.

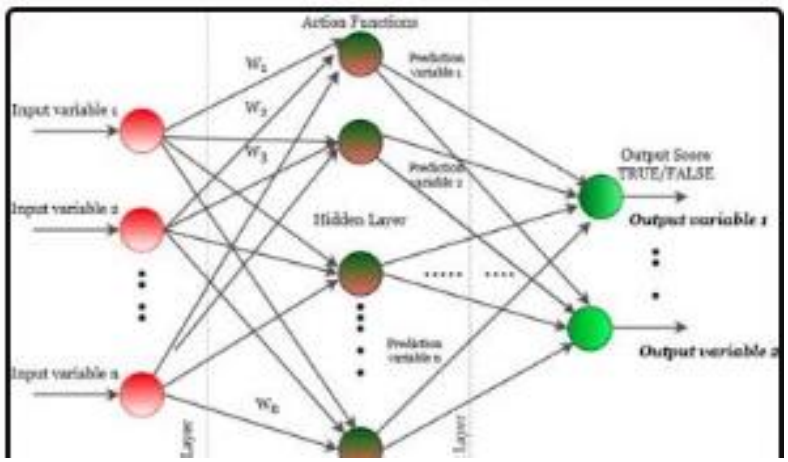
Designing the neural network architecture

To assess and monitor students' knowledge, a **Multi-Layer Perceptron (MLP)** feed-forward neural network was chosen. The model consists of three main layers: the input layer, one hidden layer, and the output layer.

The operating mechanism of the neural network is based on computing, in each neuron, the weighted sum of the input signals and passing it to an activation function. In mathematical form, this process is expressed as follows:

$z = \sum_{i=1}^{n} w_i x_i + b$, $y = \sigma(z) = 1 / (1 + e^{-z})$

Here, σ(z) is the logistic **Sigmoid** activation function, which ensures non-linear dependencies in the model. To determine the number of neurons in the hidden layer, the Kolmogorov-Arnold-Hecht-Nielsen theorems were relied upon, and experimentally 8 neurons were found to be the most optimal.



Multi-Layer Perceptron (MLP) architecture. Source: ResearchGate

Selection of input and output metrics (Data Selection)

Taking into account the specific features of the HEMIS platform in the national education system, 5 main quantitative indicators (metrics) reflecting the student's activity were entered into the input layer (*X*) of the model. Before being fed into the neural network, the data was brought into the [0, 1] range by means of the min-max normalization formula:

$$x_norm = (x - x_min) / (x_max - x_min)$$

1. **X_1 - Attendance indicator (Att):** the percentage of the student's class attendance. It is calculated on the basis of the ratio of the total number of class hours in the HEMIS system to the "NB" (absences) received by the student.
2. **X_2 - Continuous assessment activity (CA):** the average value of the scores obtained from the laboratory, practical, and seminar sessions submitted during the semester.
3. **X_3 - Digital activity on the LMS platform (LMS):** the time (in hours) the student spends in the e-learning environment outside of class hours and the number of downloaded methodological materials.
4. **X_4 - Quality of independent study (IE):** the number of independent works uploaded to the system and the coefficient of their completion in compliance with the deadline ($0 \leq IE \leq 1$).
5. **X_5 - Result of the intermediate assessment (MT):** the score of the written or test-format assessment examination held in the middle of the semester.

Output parameter (Y): the final rating score the student is expected to obtain in the subject at the end of the semester (from 0 to 100), or the letter-grade class on the ECTS scale (A, B, C, D, F).

Pedagogical experiment and training of the model

The experiment was carried out on the basis of the real, anonymized (cleared of personal data) statistics of 120 students studying in an engineering field at one of the leading higher education institutions in the city of Tashkent, gathered over one semester for the subject "Information Technologies."

The **Backpropagation** algorithm was used to train the model. The Mean Squared Error (MSE) was taken as the function for minimizing the network error:

$$E = (1/2) \Sigma_{k=1}^{m} (y_k - \hat{y}_k)^2$$

Here, y_k is the student's real final score in HEMIS, and $\hat{y}_k$ is the value predicted by the neural network. The model was trained over 1000 epochs. 80% of the database was directed to training the network (Training set), and the remaining 20% was directed to its validation and accuracy testing (Testing set).

RESEARCH RESULTS

After the software modeling of the neural network (Python language, *TensorFlow/Keras* libraries) and the training process were completed, its prediction effectiveness was compared with the Linear Regression method used in traditional pedagogical analysis. The results showed that neural networks are able to analyze non-linear educational dependencies much more deeply.

Table 1: Comparative analysis of the effectiveness of the models in predicting students' grades

Mathematical evaluation metric	**Traditional linear regression model**	**Proposed neural network (MLP)**
Coefficient of determination (R^2)	0.74	**0.92**
Root Mean Squared Error	5.4 points	**1.8 points**

Mathematical evaluation metric	Traditional linear regression model	Proposed neural network (MLP)
(RMSE)		
Mean Absolute Error (MAE)	4.1 points	**1.2 points**
Accuracy of identifying low-performing students	71%	**95%**

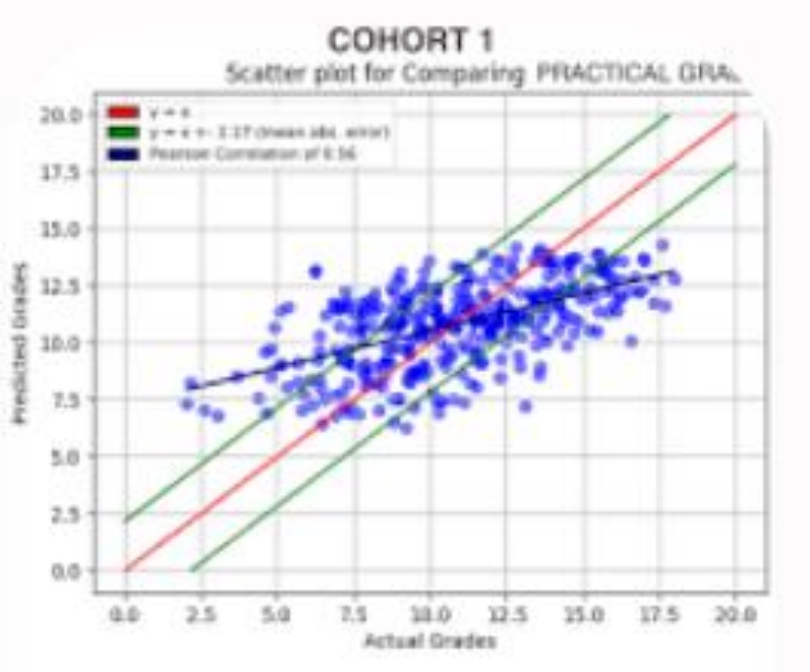
As can be seen from the analysis of the table, the coefficient of determination of the proposed neural network model was equal to $R^2 = 0.92$. This indicator proves that our model fully accounts for 92% of the non-linear factors in the formation of students' academic outcomes and that the prediction accuracy is very high. The Mean Absolute Error (MAE) amounted to only 1.2 points, which makes it possible to determine the student's final grade almost without error.

In addition, a sensitivity analysis of the neural network was carried out, and the degree of influence of the input parameters on the final result (the weight of the weight coefficients) was studied. As a result, the following dependency was identified with respect to the specific nature of the credit-module system in the higher education institutions of Uzbekistan:

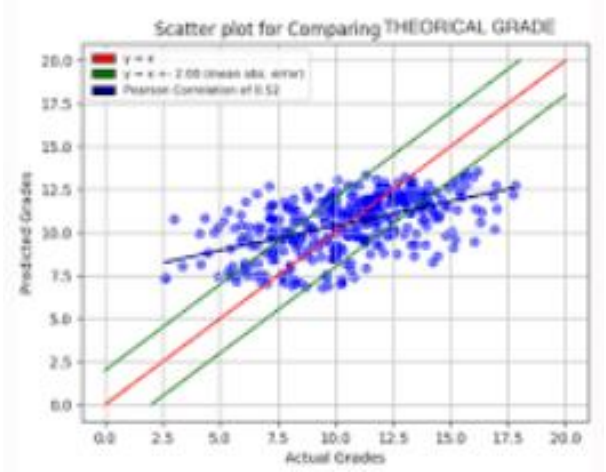
- Independent-study assignments (X_4) — influence on the final result: **38%** (the highest indicator);
- Continuous assessment activity (X_2) — influence: **29%**;
- Attendance and system-login logs (X_1, X_3) — influence: **23%**;
- Intermediate assessment examination (X_5) — influence: **10%**.

This finding shows that a student's weekly independent learning activity has nearly 4 times stronger pedagogical significance in determining their final level of knowledge than a one-time intermediate examination.

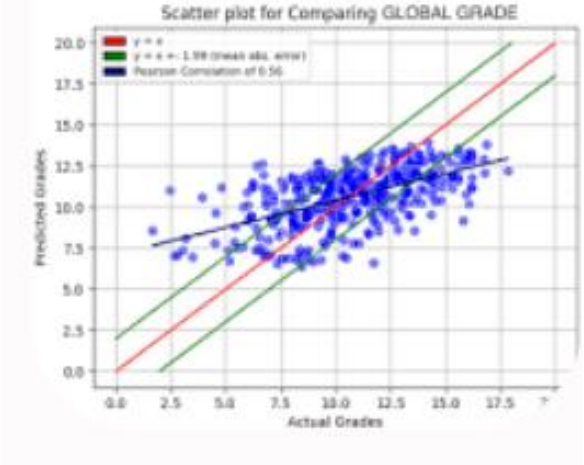
The scatter plots below present the comparison between the real grades and those predicted by the neural network across the practical, theoretical, and global (overall) grade cohorts:



Comparison of real and neural-network-predicted grades (Practical grades, Cohort 1)



Comparison of real and neural-network-predicted grades (Theoretical grades)



Real and neural-network-predicted grades (Global grades)

DISCUSSION

The scientific and practical results obtained confirm that the application of neural networks in the e-learning environment is methodologically highly effective. Approached from the standpoint of the specialty (Theory and methodology of e-learning), this study fundamentally changes the traditional concept of pedagogical monitoring. Whereas traditional monitoring is limited only to recording the errors of a past stage (passive diagnostics), the methodology based on neural networks forms **proactive (forewarning) pedagogical management.**

Pedagogical model of the ANN-based monitoring methodology

In the pedagogical process, the working methodology of this model encompasses the following stages:

[HEMIS data stream]
  |
  ▼
[Neural Network Model (MLP)] —— (Automatic analysis in weeks 4, 8, 12 of the semester)
  |
  ├─► [Green zone: High-performing students] ──► Individual in-depth assignments
  |
  ├─► [Yellow zone: Average / stable students] ──► Motivational monitoring
  |
  └─► [Red zone: Academic-risk group] ──► Automatic alert and corrective module

On a weekly basis, the teacher reviews this intelligent monitoring panel. The system identifies students who have begun to miss classes or who are uploading independent works of poor quality to the system even before the intermediate assessment begins, and it sends a signal to the teacher's personal cabinet.

Advantages and limitations of the methodology

The main didactic advantage of the system is the possibility of individualizing education. The system can automatically offer students who have fallen into the “red zone” simplified, adaptive, and corrective learning materials that match their shortcomings (for example, if a student has good attendance but is struggling only with laboratory work, materials specifically on that section).

However, it is necessary to emphasize that a number of systemic problems exist in implementing the methodology:

- **Human factor and data validity:** If professors and teachers do not record classes in the HEMIS system in a timely manner, or if they allow subjectivity in grading assignments and assign everyone the same score, the neural network learns incorrectly on the basis of incorrect data (the “Garbage in, Garbage out” principle).
- **Pedagogical ethics:** The conclusion of the artificial intelligence must not cause the teacher to place a “negative label” on the student in advance (the halo effect). It must be explained to the pedagogical staff that the system is a means of providing timely help to the student, not of punishing them.

CONCLUSION

The theoretical and methodological research carried out on the application of artificial neural network models to the process of assessing students' knowledge and monitoring their academic activity in higher education institutions has made it possible to formulate the following conclusions:

- **From a theoretical standpoint:** It was substantiated that, under e-learning conditions, students' academic data constitute a complex, non-linear, and multi-factor system. The use of the mathematical apparatus of artificial neural networks in analyzing them enriches the didactic and diagnostic possibilities of the science of digital pedagogy.
- **From a practical standpoint:** The developed Multi-Layer Perceptron (MLP) model made it possible to predict students' academic achievement with an accuracy of 92%. It was found that, for the student's final result, weekly independent-study activity (38%) is a higher factor than the intermediate assessments.
- **From a methodological standpoint:** A methodology was proposed for transitioning, through the introduction of neural networks into the management system of higher education institutions, from a passive assessment system to a proactive (forewarning) intelligent monitoring system. Integrating this model into the national HEMIS system by means of special software API modules will serve to significantly reduce the indicators of students failing the academic semester (academic debt).

Direction of future research. In the future, it is planned to continue research on creating a methodology that, by applying more complex recurrent types of neural networks that take dynamic sequences into account (Recurrent Neural Networks, in particular **LSTM** models), would monitor over time not only students' scores but also the level of their psychological fatigue in the digital environment and the dynamics of the decline in their motivation.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE TOOLS ON THE DEVELOPMENT OF TECHNICAL ENGLISH SKILLS AMONG ENGINEERING STUDENTS

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Abstract. *The integration of Artificial Intelligence (AI) into educational environments has significantly transformed language learning practices in higher education. Engineering students, who are expected to master specialized technical terminology and communicate effectively in global professional contexts, increasingly rely on AI-powered tools to enhance their English language proficiency. Applications such as ChatGPT, Grammarly, DeepL Translator, and GitHub Copilot provide personalized learning support, automated feedback, and real-time language assistance, thereby facilitating the acquisition of technical English skills. This conceptual study examines the role of AI technologies in improving technical vocabulary, academic writing, reading comprehension, and professional communication among engineering students. Drawing on recent literature in AI-assisted language learning (AILL), the study explores both the opportunities and challenges associated with AI integration in engineering education. The analysis indicates that AI tools can significantly enhance learner autonomy, motivation, and language performance when used appropriately. However, concerns related to overreliance on technology, academic integrity, and the accuracy of AI-generated content remain important considerations. The study proposes a conceptual framework for integrating AI tools into technical English instruction and offers recommendations for educators and institutions seeking to maximize the educational benefits of emerging technologies.*

Keywords: *artificial intelligence, technical english, engineering education, AI-assisted language learning, ChatGPT, Grammarly, DeepL Translator, Digital learning technologies.*

Introduction

The rapid advancement of digital technologies has reshaped educational practices worldwide, creating new opportunities for teaching and learning across disciplines. Among these developments, Artificial Intelligence (AI) has emerged as one of the most influential technologies affecting higher education. AI-powered applications are increasingly being integrated into language learning environments, enabling learners to access personalized instruction, immediate feedback, and adaptive learning experiences that were previously unavailable through conventional educational methods. The growing importance of English as the global language of science, technology, and engineering has intensified the need for engineering students to develop strong language competencies. Technical English proficiency is essential for understanding scientific publications, writing technical reports, participating in international research collaborations, and communicating effectively in professional environments. According to Hyland (2022), English continues to dominate scientific communication, with the majority of international engineering publications being produced in English. Consequently, engineering graduates are

expected to possess not only technical expertise but also advanced communication skills that enable them to function effectively in globalized workplaces. Even though technical English is acknowledged as being important, many engineering students struggle to learn academic writing conventions, professional communication skills, and specific vocabulary. There is a gap between academic preparation and professional requirements because traditional language education frequently ignores the unique linguistic needs of engineering trainees. By offering learners dynamic, individualized, and context-sensitive language support, recent developments in AI technology have brought creative answers to these problems. University students are increasingly using AI-powered applications like GitHub Copilot, Grammarly, ChatGPT, and DeepL Translator. These tools help students come up with ideas, fix grammatical mistakes, translate technical texts, write better, and comprehend specific jargon. According to research by Kasneci et al. (2023), generative AI systems offer a lot of promise to help higher education by facilitating tailored training and improving learning efficiency. In a similar vein, research by Dwivedi et al. (2023) emphasizes how huge language models have a revolutionary effect on learning and teaching methods.

Although previous studies have investigated AI-assisted language learning and the educational applications of generative AI, there remains a significant gap in understanding how AI tools contribute specifically to the development of technical English skills among engineering students. Furthermore, limited research has compared the educational functions of different AI platforms such as ChatGPT, Grammarly, DeepL Translator, and GitHub Copilot within the context of engineering communication. This study seeks to address this gap by providing a comprehensive conceptual analysis of the opportunities, benefits, and limitations associated with AI-supported technical English learning.

Research objectives:

The objectives of this study are:

- To examine the role of AI-powered tools in technical English education.
- To analyze the impact of AI technologies on vocabulary acquisition, writing proficiency, reading comprehension, and professional communication.
- To identify the advantages and limitations of AI-assisted language learning among engineering students.
- To propose recommendations for the effective integration of AI technologies into engineering education.

Literature review

In contemporary education, artificial intelligence has emerged as a revolutionary force. AI systems use data analytics, machine learning, and natural language processing to provide individualized learning experiences based on the needs of each student. AI technologies have the potential to significantly increase instructional quality, student engagement, and educational efficiency, according to Zawacki-Richter et al. (2019) The development of automated assessment tools, adaptive learning platforms, and intelligent tutoring systems has drastically altered the educational landscape. These tools enable self-directed learning and enhance academic results by giving students personalized learning pathways and instant feedback. The possibilities for education have been substantially increased by recent advances in generative AI. Large language models, like ChatGPT, may produce coherent writing, respond to inquiries, clarify difficult ideas, and include students in interactive discussion. Teachers looking for cutting-edge methods of teaching languages and providing academic help have paid close attention to such capabilities. AI-

Assisted Language Learning (AILL) represents a rapidly growing field within educational technology. Unlike traditional Computer-Assisted Language Learning (CALL), AI-driven systems are capable of adapting to learners' needs and providing context-sensitive feedback. According to Wang and Petrina (2024), AI-assisted language learning environments improve learner motivation by creating highly interactive educational experiences. Students can practice language skills independently while receiving personalized guidance that addresses their specific weaknesses. Several studies have reported positive outcomes associated with AI-supported language learning. Kohnke et al. (2023) found that AI applications contribute significantly to vocabulary acquisition, grammatical accuracy, and learner confidence. Similarly, Tlili et al. (2023) argued that AI technologies support lifelong learning by providing flexible and accessible educational opportunities.

ChatGPT has garnered special interest among modern AI technologies because of its pedagogical adaptability and conversational features. ChatGPT, which was created with cutting-edge natural language processing technologies, can mimic human-like conversations and offer thorough explanations in a variety of fields. ChatGPT is an excellent tool for engineering students to acquire technical jargon and comprehend difficult engineering concepts. Students can get examples of professional writing, ask questions about technical procedures, and get immediate feedback on language usage. Kasneci et al. (2023) argue that ChatGPT offers substantial educational benefits, particularly in higher education contexts where individualized instruction is often limited. However, the authors also caution that AI-generated responses should be critically evaluated to ensure accuracy and reliability.

Translation technologies have experienced remarkable advancements due to developments in neural machine translation. DeepL Translator is widely recognized as one of the most accurate AI-powered translation systems currently available. Unlike earlier machine translation applications, DeepL demonstrates superior contextual understanding and terminological precision. Engineering students frequently encounter technical documents, manuals, research articles, and professional resources written in English. For non-native English speakers, understanding specialized terminology can be challenging. DeepL assists learners by providing accurate translations while preserving technical meaning and contextual relevance. According to García and Pena (2024), AI-based translation tools contribute significantly to vocabulary development by exposing learners to parallel language structures and specialized terminology. By comparing source and translated texts, students can strengthen their understanding of engineering concepts and improve technical language proficiency. However, researchers emphasize that translation tools should supplement rather than replace active language learning. Excessive dependence on machine translation may hinder learners' ability to develop independent language production skills.

The educational benefits of AI technologies are substantial. AI-powered systems offer continuous access to learning support, personalized instruction, immediate feedback, and adaptive educational experiences. These features are particularly valuable in technical English education, where students often require individualized assistance in mastering specialized vocabulary and communication skills. However, AI integration also presents several challenges. One concern involves overreliance on automated systems. Students may become dependent on AI-generated content rather than actively engaging in language production and critical thinking activities. Another challenge involves the reliability of AI-generated information. Although modern AI systems are highly sophisticated, inaccuracies and factual inconsistencies occasionally occur. Ethical considerations also remain important. Issues related to plagiarism, authorship, academic

honesty, and responsible AI usage have become central topics in contemporary educational discussions. Educational institutions must therefore establish clear guidelines regarding the acceptable use of AI technologies in academic contexts.

The conceptual framework of this study proposes that AI-powered educational tools influence technical English development through four primary dimensions:

- ✓ Technical Vocabulary Acquisition
- ✓ Academic Writing Development
- ✓ Reading Comprehension Enhancement
- ✓ Professional Communication Improvement

Methods

This study employed a conceptual literature-based research design. The analysis was based on recent scholarly works related to artificial intelligence in education, AI-assisted language learning, technical English instruction, and engineering education. The reviewed sources included studies on ChatGPT, Grammarly, DeepL Translator, GitHub Copilot, generative AI, and digital learning technologies. The materials were analyzed thematically according to four main dimensions: technical vocabulary acquisition, academic writing development, reading comprehension enhancement, and professional communication improvement. This approach made it possible to identify the educational benefits, limitations, and practical implications of AI tools for developing technical English skills among engineering students.

Results and Discussion

The findings of the reviewed literature indicate that AI technologies have transformed the landscape of technical English education. Consistent with the observations of Kasneci et al. (2023), generative AI systems provide substantial support for language learning by facilitating personalized educational experiences and improving access to knowledge resources. The effectiveness of ChatGPT in technical English learning can be attributed to its ability to simulate authentic communication and provide discipline-specific explanations. Unlike traditional language learning materials, ChatGPT offers interactive learning opportunities that encourage active engagement with technical concepts and terminology. Similarly, Grammarly contributes significantly to academic writing development. The findings align with previous studies demonstrating that AI-assisted writing support enhances grammatical accuracy and overall text quality. Engineering students benefit from immediate corrective feedback, which enables them to improve writing performance through continuous revision. DeepL Translator serves an important role in technical vocabulary acquisition and comprehension of specialized texts. However, the literature consistently emphasizes the need to balance translation support with independent language production. Effective language learning requires active engagement rather than passive reliance on automated translation systems. The contribution of GitHub Copilot extends beyond programming assistance. Exposure to authentic professional documentation enhances students' familiarity with technical discourse and industry-specific communication practices. This finding highlights the interdisciplinary potential of AI technologies within engineering education. Despite these advantages, the literature also reveals several concerns. Overreliance on AI tools may reduce opportunities for critical thinking and independent problem-solving. Furthermore, the possibility of inaccurate or misleading AI-generated content necessitates careful evaluation of information obtained through automated systems. Consequently, educators should adopt balanced approaches that integrate AI technologies while preserving opportunities for human interaction, critical reflection, and independent learning.

AI Tool	Main Function	Contribution to Technical English	Potential Limitation
ChatGPT	Interactive language support	Technical vocabulary development, communication practice, concept explanation	Possible factual inaccuracies
Grammarly	Writing assistance	Grammar correction, academic writing improvement	Overdependence on automated corrections
DeepL Translator	Machine translation	Technical text comprehension, terminology acquisition	Reduced independent language production
GitHub Copilot	Programming assistance	Exposure to professional technical terminology and documentation	Limited applicability outside software-related fields

The integration of Artificial Intelligence into education has become one of the priority areas of educational reform in Uzbekistan. In recent years, the government has launched several initiatives aimed at promoting digital transformation, improving ICT infrastructure, and enhancing students' digital competencies. The implementation of the "Digital Uzbekistan – 2030" strategy has accelerated the adoption of innovative technologies across higher education institutions. Engineering universities in Uzbekistan are increasingly emphasizing English language proficiency due to the growing internationalization of higher education and the expansion of cooperation with foreign universities and industries. Students are expected to access international scientific databases, participate in academic mobility programs, and communicate effectively within global professional environments. Despite these developments, many engineering students still face difficulties in mastering technical English vocabulary, academic writing conventions, and professional communication skills. Traditional language teaching approaches often provide limited opportunities for individualized instruction and continuous feedback. Consequently, AI-powered educational tools can play a significant role in addressing these challenges. Applications such as ChatGPT, Grammarly, DeepL Translator, and GitHub Copilot can support engineering students in understanding technical terminology, improving report-writing skills, translating scientific texts, and developing discipline-specific communication competencies. Furthermore, AI technologies may contribute to the development of learner autonomy and self-directed learning, which are essential skills in modern engineering education.

Conclusion.

Artificial Intelligence has become an influential educational technology capable of transforming technical English learning among engineering students. The literature reviewed in this study demonstrates that AI-powered tools such as ChatGPT, Grammarly, DeepL Translator, and GitHub Copilot offer substantial benefits for vocabulary acquisition, academic writing development, reading comprehension, and professional communication. These technologies provide personalized learning experiences, immediate feedback, and continuous access to educational support. The analysis further reveals that AI-assisted language learning contributes to learner autonomy, motivation, and academic performance. Nevertheless, challenges related to

technological dependence, information reliability, and academic integrity remain significant concerns. Therefore, AI should be integrated as a complementary educational resource rather than a substitute for traditional teaching approaches.

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CONDITIONS FOR DESIGNING AN IMMERSIVE LEARNING ENVIRONMENT IN THE METHODOLOGY OF WORKING WITH GIFTED STUDENTS OF FUTURE INFORMATICS TEACHERS

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Abstract. *This article investigates the pedagogical and technological conditions for designing an immersive educational environment (VR/AR, 3D modeling) when preparing future informatics teachers to work with gifted students. The model for developing future teachers' digital competence is based on the TPACK and DigComp frameworks. Additionally, the results of the pedagogical experiment were analyzed, and the effectiveness of the immersive environment in improving the methodology for working with gifted students was demonstrated.*

Keywords: *immersive learning environment, gifted students, future computer science teacher, VR, AR, 3D modeling, TPACK, DigComp, digital competence.*

Introduction

In the context of the modern information society, identifying gifted students, developing their intellectual potential, and providing them with in-depth instruction in computer science is one of the strategic tasks of the education system. Gifted students are characterized by high cognitive needs, an unconventional way of thinking, and the ability to quickly master digital technologies. However, traditional teaching methodology does not provide future informatics teachers with sufficient technological and methodological flexibility to effectively interact with this category of students.

As an innovative solution to this problem, there is a need to integrate immersive technologies (VR, AR, 3D modeling, and virtual educational museums) into the educational process. An immersive learning environment (IEL) allows for the visualization of complex, abstract concepts (e.g., algorithm architecture, network technologies, complex data structures) by creating a sense of presence for the student.

An immersive educational environment is a pedagogical and technological system that allows for the full involvement of the student in the learning process, enhancing cognitive activity and developing creative potential. Such environments, created based on VR, AR, artificial intelligence, and gamification elements, are of particular importance in meeting the cognitive needs of gifted students [9].

For future teachers to be able to design such an environment for gifted students, they themselves must possess a high level of digital competencies [4]. It is advisable to organize this process based on internationally recognized TPACK (Technological Pedagogical Content Knowledge) and DigComp (Digital Competence Framework) models.

At the same time, pedagogical science and educational practice have insufficiently studied the issue of preparing future informatics teachers for designing and effectively using such

environments. The Law of the Republic of Uzbekistan "On Education" [2] and the "Digital Uzbekistan - 2030" strategy [1] define the digitalization of education and support for talented youth as priority tasks.

The purpose of this research is to identify and scientifically substantiate the pedagogical and technical-technological conditions for designing an immersive educational environment in the methodology of future informatics teachers' work with gifted students.

Literature review

The term "Immersive Education" was originally used in military simulations and medical education and later entered the field of general education [7]. In modern literature, this concept refers to the complete immersion of the student in the learning process involving all their senses [6].

The main types of immersive environments are the following: 1) Virtual Reality (VR) - a technology that fully "dives" the student into an artificially created digital world; 2) Augmented Reality (AR) - a technology that adds digital elements to a real environment; 3) Mixed Reality (MR) - a technology that combines two environments; and 4) 360VR video and simulation environments - technologies that provide educational content in an interactive manner [5].

R. Atamuratov characterizes immersive learning as an innovative pedagogical approach that allows for the creation of complex experiences in a virtual environment that are impossible to implement in traditional classroom settings [3]. K. Patil notes that immersive learning based on virtual reality serves to develop students' empathy, critical thinking, and problem-solving skills [11]. E. Uzcan and his team describe the immersive learning environment as a digital educational ecosystem created based on virtual reality technologies and supporting students' cognitive, emotional, and social activity [10]. J. Lin emphasizes that an immersive environment is a technology that allows students to visualize abstract concepts and model complex processes [8]. According to Y. Wang and Z. Wang, an immersive learning environment, increases students' motivation, helps retain knowledge in long-term memory, and supports experiential learning [12]. A meta-analysis of 69 studies conducted by Merchant and colleagues proved that simulation games and virtual environments have a positive impact on educational outcomes [9].

The analysis of the aforementioned scientific views shows that while immersive learning is an innovative pedagogical approach that transforms the student into an active subject of the educational process, the immersive educational environment is a technological and pedagogical space that serves to implement this approach. As a result, it is possible to develop students' motivation, practical skills, and creative and critical thinking.

Research methodology

The study utilized a systems approach, pedagogical modeling, comparative analysis, and pedagogical experimental methods. The methodology for designing an immersive learning environment is based on the following conceptual frameworks:

1) TPACK model. The future teacher's knowledge of the subject (content), pedagogical skills (pedagogy), and the ability to synthesize immersive technologies (technology).

2) DigComp framework. Competencies in digital content creation, security, and problem-solving in the digital environment.

Pedagogical experimental work was organized at the centers of pedagogical excellence in the Samarkand and Kashkadarya regions. A total of 354 students (computer science teachers) participated in the experiment. The students were divided into two groups (experimental and control). The control group (175 people) was trained using traditional methods and standard

electronic educational resources. The experimental group (179 people) was trained in a specially designed immersive learning environment (VR laboratories, 3D visualization modules, and virtual engineering case studies).

The level of students' methodological readiness for working with gifted students was assessed based on three criteria (motivational-targeted, cognitive-content, technological-activity) on a 100-point scale.

Results

The results obtained at the end of the pedagogical experiment showed a significant increase in the experimental group compared to the control group. The indicators of future teachers who studied in an immersive learning environment while adhering to design conditions are reflected in the following table (Table 1):

Table 1. Dynamics of the level of methodological training for future teachers

Groups	**Number of participants**	**Low level (%)**	**Medium level (%)**	**High level (%)**	**Average score (on a 100-point scale)**
Control group	175	32,5%	48,0%	19,5%	64,2
Experimental group	179	8,4%	44,1%	47,5%	82,7

The share of high-level listeners in the experimental group increased by 28% compared to the control group, while the average score increased from 64.2 to 82.7 (+18.5 points) (Figure 1).

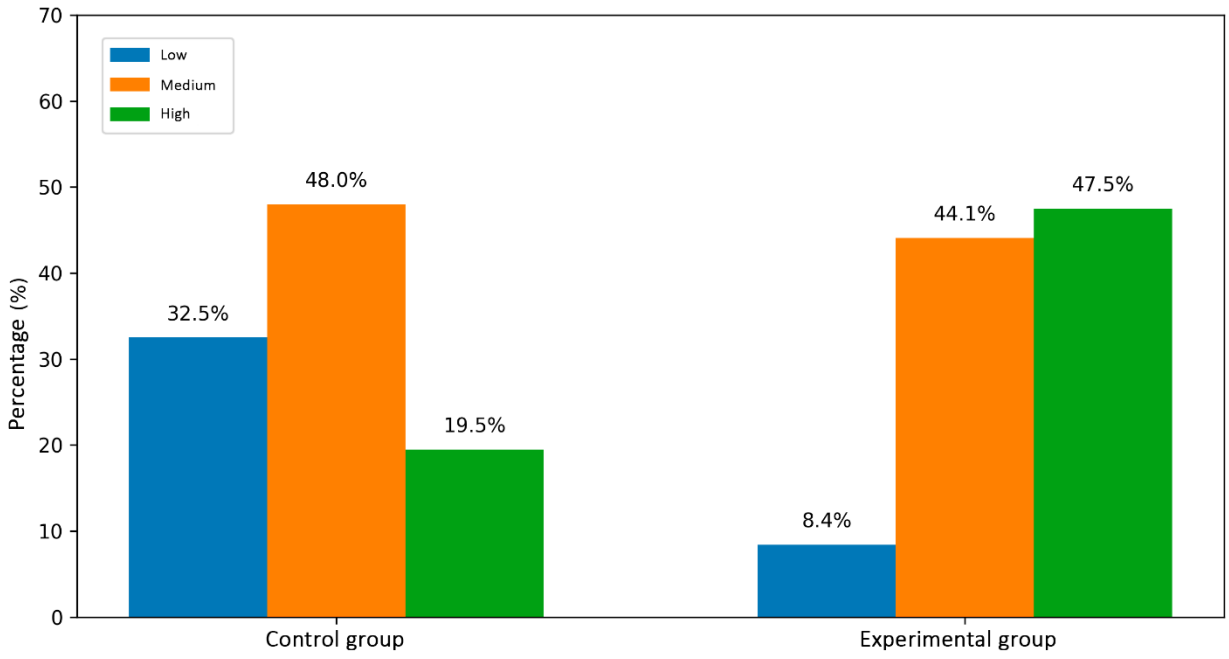


Figure 1. Comparison of the results of the experimental and control groups

When checking the reliability of the results obtained using mathematical and statistical methods (Student's t-test), it was proven that the difference between the groups is statistically significant ($p < 0.05$). This directly confirms the effectiveness of the immersive environment components.

Discussion. The results obtained show that the successful design of an immersive learning environment in the methodology of future computer science teachers working with gifted students depends on three main conditions:

1. Pedagogical and methodological conditions (TPACK integration). Immersive technologies should be not just a visual tool but a means of stimulating the research activity of a gifted student. A future teacher must be able to formulate "divergent thinking" tasks for a gifted student in a VR/AR environment (finding multiple solutions to the same problem). In our model, the lesson scenarios developed based on TPACK helped the future teacher uncover the most complex sections of the subject within the technology (for example, the visualization of artificial intelligence neural networks).

2. Technical and technological conditions (DigComp and level of immersiveness). An immersive learning environment must possess a high level of interactivity and an "immersion" indicator. To achieve this, future teachers were trained to create elementary 3D models on Blender, Unity, or Unreal Engine platforms and integrate them into the lesson. According to the DigComp framework, the teacher has moved from consuming ready-made digital content to creating its architecture. This will allow you to work on startups and projects together with talented students.

3. Psychological and didactic conditions (creativity and motivation). Gifted students quickly get bored with standard schemes. The immersive environment gives them the freedom not to be afraid of making mistakes and to conduct unlimited experiments in virtual laboratories. Since the future teachers in the experimental group mastered this specific didactic pattern, the results demonstrated by their students were high.

The results of this study align with international experience in applying immersive technologies in education and enrich the local methodological base for digitalizing the teacher training system.

In the future, in the process of training future informatics teachers, it is important to widely implement immersive learning environments, integrate VR/AR and artificial intelligence technologies, improve methodological support for working with gifted students, and develop criteria for assessing immersive pedagogical competence. Furthermore, conducting large-scale experimental research in various educational institutions and creating a national database of digital educational resources will serve to further develop the scientific and methodological foundations of this field.

Conclusion. Improving the methodology for future informatics teachers to work with gifted students through an immersive learning environment is an urgent pedagogical need of today. Ensuring the synergistic integration of TPACK and DigComp models in the design of an immersive educational environment and training future teachers not only as VR/AR users but also as its pedagogical designers is the main factor guaranteeing the quality of education.

Based on the research results, the following practical recommendations were developed:

1. It is necessary to introduce the "Immersive Educational Technologies" module for future computer science teachers in higher education institutions and to focus on forming immersive environment competencies in their professional development programmes;

2. In educational practice, it is advisable to emphasise the teaching of differentiated methodologies for working with gifted students and to establish a mentoring system and practical laboratories between general education schools and higher education institutions.

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DIGITAL PEDAGOGY: PATHWAYS OF TRANSITION FROM THE TRADITIONAL LESSON TO AN INNOVATIVE LEARNING ENVIRONMENT

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Abstract. *In the digital era, education places growing emphasis on richer interaction realised through information and communication technologies. The integration of such technologies enables the use of video lessons, online educational games, internet-based quizzes, and diverse forms of interaction mediated by cyber-networks. The present article examines the theoretical and practical pathways through which the traditional, teacher-centred lesson is being transformed into a modern, innovative, learner-oriented digital learning environment. Drawing on a review of existing learning theories, an analysis of the characteristics of the traditional model, and a comparative study of traditional and digital instruction, the study identifies the constituent components of the innovative learning environment and proposes a phased strategy for transition to digital pedagogy. The findings indicate that digital pedagogy does not negate established teaching methods but modernises them, repositioning the learner as the active subject of the learning process and the teacher as a guide and mentor. The work concludes that the move toward digital pedagogy is not merely a technical innovation but a fundamental renewal of the philosophy of education.*

Keywords: *digital pedagogy, innovative learning environment, traditional education, digital transformation, information and communication technologies, learner-centred learning, gamification, learning management systems, digital competence.*

1. Introduction

It is now widely recognised that, in the twenty-first century, technology has become an inseparable component of human life, and this process exerts a profound influence on the system of education. Education is no longer confined to the walls of the classroom; it is increasingly delivered through a global network that reaches learners irrespective of their physical location. Within contemporary society, digital technologies create an objective necessity for the modernisation of the educational system. Digital transformation raises the efficiency of the educational process, refines the cooperation between teacher and learner, and expands the scope for an individualised approach to instruction.

In the digital era, education, and particularly information and communication technology, places a heightened emphasis on broader mutual interaction. The integration of these technologies makes it possible to draw on video lessons, internet-based games, online quizzes, and various forms of interaction mediated through cyber-networks. Determining the pedagogical functions of integrating such technologies is therefore of considerable importance. Reviewing the available theories of learning, in order to construct a pedagogical foundation capable of responding to

existing problems, constitutes the first step toward understanding what is genuinely required for learning to take place.

Technological change continually reshapes the priorities of what must be learned. New forms of literacy — such as the ability to create videos, animations, and websites — have become highly significant. The memorisation of knowledge is no longer regarded as central, because open educational resources deliver every kind of information through the internet. Priority is instead assigned to enhancing the learner's capacity to locate information, to comprehend it at the moment it is needed, and to evaluate the information that has been found. At the same time, education for adolescents and adults has become the responsibility of each individual person.

Within this shifting landscape several interrelated tendencies can be observed. Content is increasingly oriented toward general competencies, such as problem-solving, communication across multiple media, the locating of resources, and the ability to learn how to use those resources. Pedagogy is evolving toward a reliance on interaction; these interactions encompass technologies such as video lessons, online games, and exchanges with other people through computer networks. Assessment is conducted after learners have mastered a computer-based learning environment, in order to measure their success in attaining the stated learning objectives. The spaces of education are no longer restricted to educational institutions alone but extend to homes, offices, and study centres where learning materials may be accessed online. At the same time, peer culture may weaken, and learners may experience difficulty in completing homework and independent tasks with the support of parents and peers, or may even become isolated from others within the computer network. Consequently, the very forms of relationship within the educational process are being transformed.

The theoretical grounding of this transformation can be traced to several established traditions of learning theory. Constructivist accounts hold that knowledge is actively built by the learner rather than passively received, a premise that aligns naturally with the interactive affordances of digital media. Connectivist perspectives, developed in response to the networked character of contemporary information, emphasise the learner's capacity to form and navigate connections across distributed sources of knowledge. Socio-cultural theory, in turn, draws attention to the mediating role of tools and of collaborative interaction in cognitive development. When these traditions are read together, they suggest that the value of a technology in education lies not in the device itself but in the quality of the interaction and the learning design that surround it. It is precisely this insight that distinguishes digital pedagogy from the mere insertion of technology into an otherwise unchanged classroom.

Several of the changes outlined above are already pressing realities for many people in different corners of the world today. The paradigm shift in the governance of education has become a focal point of attention for diverse stakeholders. Traditional pedagogy must be adjusted to accommodate the emerging dynamics. The education now regarded as appropriate is a digital one, combined with internet-based instruction and character education. From this standpoint, digital pedagogy may be defined as the theoretical and practical direction of the transition from the traditional lesson form to a modern, innovative learning environment. The aim of the present study is to clarify the essence of this transition, to compare the traditional and digital models of instruction, to describe the components of the innovative learning environment, and to outline the strategies and the attendant problems involved in moving toward digital pedagogy.

2. Materials and Methods

The study is theoretical and analytical in character. Its methodological basis combines a review of the scholarly literature on educational technology with a comparative analysis of the traditional and digital models of instruction. The principal methods employed are the analysis and synthesis of pedagogical sources, the comparative method, systematisation, and generalisation. The comparative method is used to juxtapose the defining features of teacher-centred and learner-centred instruction across several parameters, including the role of the teacher, the position of the learner, the instructional tools, the form of assessment, and the spatial and temporal organisation of learning.

The empirical and conceptual material for the analysis was drawn from national strategic documents governing the digitalisation of education in Uzbekistan, from international scholarship on the role of digital technologies in teaching and learning, and from the author's own prior research on the digitalisation of the educational process and the professional preparation of future teachers. On the basis of these sources, the characteristics of the traditional model were identified, the essence and underlying principles of digital pedagogy were formulated, the constituent components of the innovative learning environment were classified, and a phased strategy for the transition to digital pedagogy was constructed. The problems impeding this transition were likewise identified through documentary analysis, and corresponding solutions were proposed.

3. Results and Discussion

3.1. Characteristics of traditional education

It is appropriate to begin with the traditional model of education. In this system, the teacher occupies the centre of the process, the lesson is conducted on the basis of uniform methods, and the learner plays a largely passive role. The system of assessment, too, is in most cases founded on a single set of standards, leaving little room for an individualised approach. Such a model was effective in its own time; however, in the present information age it is increasingly unable to satisfy the demands of flexibility and creativity that contemporary education requires.

3.2. The essence of digital pedagogy

Digital pedagogy is a model of education organised on the foundation of digital technologies, one that transforms the learner into the active subject of the learning process. Within this model, the teacher is no longer the source of knowledge but performs the function of a guide and mentor. Digital pedagogy rests upon several interrelated principles: the stimulation of the learner's independent learning activity; a reliance on interactivity and cooperation; the creation of individual learning pathways; and the analysis of learning outcomes through analytical instruments. By way of illustration, a learner may study a topic on an online platform, complete a virtual test, and view the result immediately. This renders the learning process rapid, transparent, and oriented toward the individual. These principles and their pedagogical functions are set out in Table 2.

Table 2. Core principles of digital pedagogy and their pedagogical functions.

Principle	Pedagogical function
Stimulation of independent learning	Develops learner autonomy and self-regulation of the learning process
Interactivity and cooperation	Enables dialogue, peer collaboration, and co-construction of knowledge

Principle	Pedagogical function
Creation of individual learning pathways	Tailors pace, content, and sequence to each learner's needs
Analysis of outcomes via analytical tools	Provides immediate feedback and data-informed adjustment of instruction

3.3. A comparison of traditional and digital education

Today the educational system is moving beyond the confines of the traditional classroom toward a digital environment. Whereas in traditional education the teacher stands at the centre, digital education turns the learner into an active participant. Learners now study not only with books and notebooks but also through digital platforms, video lessons, and artificial-intelligence tools. Assessment, too, is changing, shifting toward online tests and systems that monitor individual development. Most importantly, digital education has dissolved the boundaries of time and place: study may be undertaken anywhere and at any moment. The contrast between the two models is summarised in Table 1, while Figure 1 illustrates the same divergence across five key dimensions of the learning experience.

Table 1. Comparative characteristics of traditional and digital education.

Parameter	Traditional education	Digital education
Centre of the process	The teacher	The learner
Role of the learner	Passive recipient of knowledge	Active subject and participant
Instructional tools	Books, notebooks, blackboard	Digital platforms, video lessons, AI tools
Assessment	Uniform standards, final examination	Online tests, monitoring of individual progress
Time and place	Fixed classroom, fixed schedule	Any place, any time

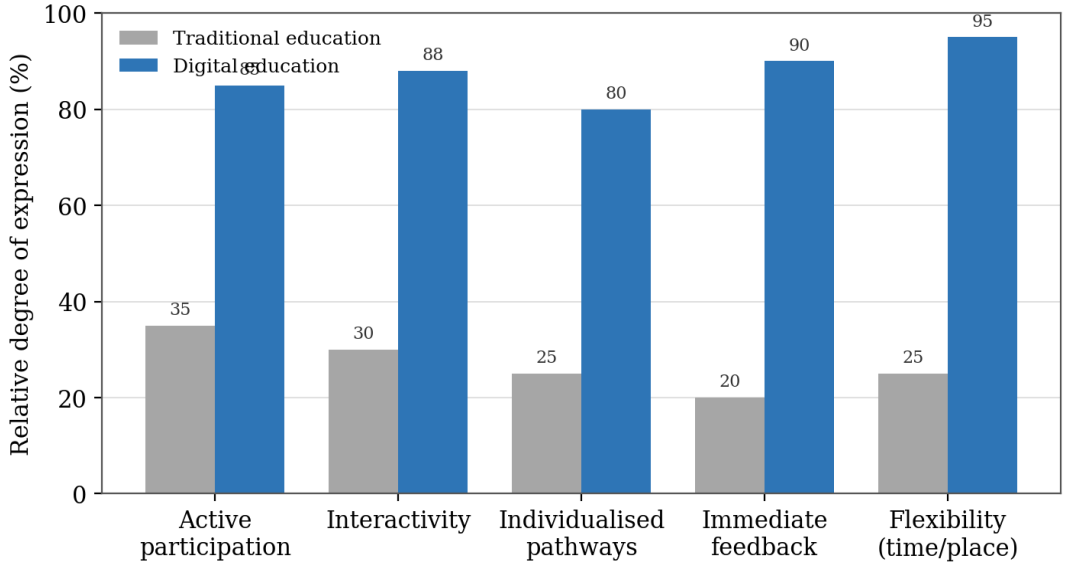


Figure 1. Comparative expression of five learning dimensions in traditional and digital education.

3.4. The innovative learning environment

The innovative learning environment constitutes the principal component of digital pedagogy. It may be understood as an educational space created on the basis of digital technologies and designed to ensure interactive cooperation between teacher and learner. Such an environment activates the learning process, fosters creativity, and raises the quality of education. It is composed of several characteristic elements, which together transform the conditions under which learning occurs.

These elements include: virtual classrooms (such as Google Classroom, Moodle, and Edmodo); online laboratories and simulators; multimedia resources, including video, interactive tests, and animation; gamification, whereby motivation is generated through game-based elements; and cloud-based learning systems that afford the storage and sharing of materials. Collectively, these elements encourage the learner toward active engagement, while affording the teacher the means to monitor and analyse the activity of each individual learner. The relative weight of these components within a representative innovative learning environment is depicted in Figure 2.

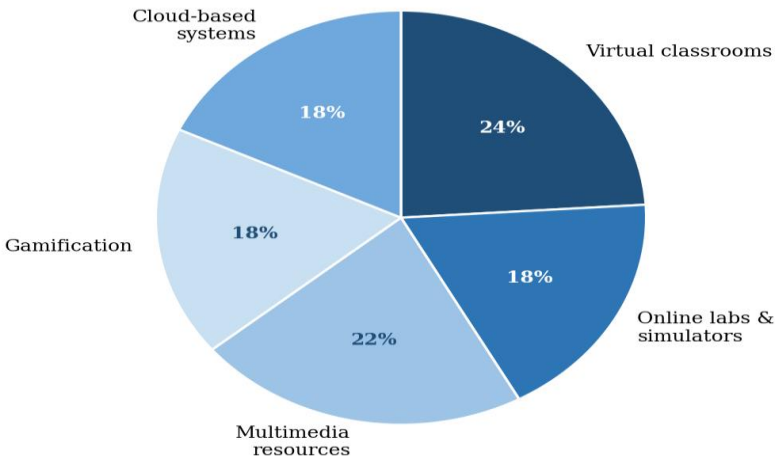


Figure 2. Composition of the innovative learning environment by component.

3.5. Pathways and strategies for the transition to digital pedagogy

The transition to digital pedagogy is not accomplished in a single day; it demands a phased and systematic approach. The first requirement is the enhancement of the digital competence of teachers, for which trainings, webinars, and certification programmes must be introduced. The second is the adaptation of curricula to the digital environment, in which interactive lesson plans, video lectures, and online assignments serve as the principal instruments. The third is the automation of assessment on digital platforms; with the assistance of artificial intelligence, test results are analysed and the individual achievements of the learner are identified. The fourth, and most important, is the formation of a digital culture: learners must be acquainted with internet safety, information culture, and the concept of plagiarism, which together constitute one of the central values of digital education. Figure 3 presents the projected growth of institutional digital competence across these four phases.

3.6. Problems and their solutions

It is not possible to overlook certain problems within the field. Among the most salient are the insufficiency of internet infrastructure, the low level of digital preparedness among teachers, and the incomplete implementation of online assessment systems. As solutions to these difficulties, the following measures may be proposed: strengthening the digital technical base within

educational institutions; establishing courses for the digital professional development of teachers; and introducing learning management systems (LMS) grounded in international experience. It is worth noting in this connection that, within the framework of the Republic of Uzbekistan's "Digital Education 2030" strategy, wide-ranging work is being carried out precisely along these lines. Table 3 maps each principal problem to its corresponding proposed solution.

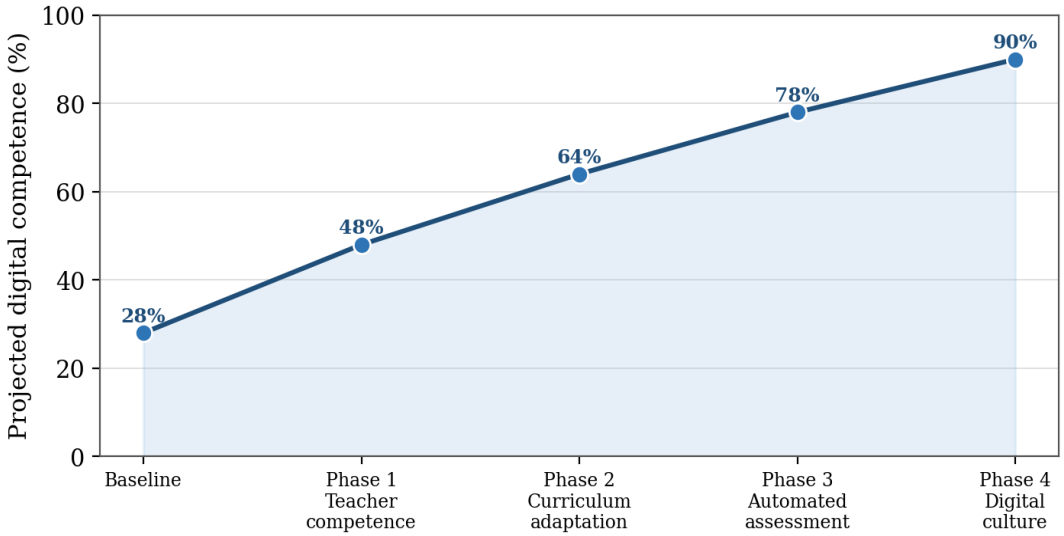


Figure 3. Projected growth of digital competence across the four phases of transition to digital pedagogy.

Table 3. Principal problems of the transition to digital pedagogy and proposed solutions.

Problem	**Proposed solution**
Insufficient internet infrastructure	Strengthen the digital technical base within educational institutions
Low digital preparedness of teachers	Establish courses for the digital professional development of teachers
Incomplete online assessment systems	Introduce LMS platforms grounded in international experience

Taken together, these results indicate that the digital learning environment reconfigures the relationship between the principal actors of education. The teacher ceases to be the sole transmitter of knowledge and becomes additionally a co-author of information, a consultant, and an evaluator. The learner, in turn, gains the means to manage the flow of information independently, to select individual pathways, and to receive immediate feedback. This redistribution of roles is the defining feature of the shift from the traditional model to the innovative environment, and it is consistent with the broader international tendency toward learner-centred, technology-mediated instruction.

These findings also resonate with experience accumulated internationally, where the rapid expansion of remote and blended provision — accelerated in particular by the disruptions of recent years — has demonstrated both the practical advantages of time- and place-independent learning and the differentiated needs of teachers across disciplines. The evidence cautions against treating digitalisation as a uniform process: support and training must be calibrated to the specific requirements of each field, and a sustained dialogue between pedagogical and technological interests is essential if the introduction of tools is to yield genuine pedagogical benefit. In this respect, the phased strategy proposed here — progressing from teacher competence, through

curricular adaptation and the automation of assessment, to the cultivation of a digital culture — is best understood not as a rigid sequence but as a set of mutually reinforcing dimensions that must advance in parallel. The strengthening of technical infrastructure, for example, delivers little benefit unless it is accompanied by a corresponding rise in the digital readiness of teachers and a value framework that addresses information ethics, safety, and academic integrity.

4. Conclusion

Digital pedagogy may justly be regarded as the future of education. It does not entirely reject the traditional methods of teaching; on the contrary, it modernises them. This process requires of the teacher a new mode of thinking, a capacity for creativity, and the effective application of digital tools. As a result, the learner is formed as an independently thinking individual capable of self-development. The transition to digital pedagogy is therefore not merely a technical novelty but a fundamental renewal of the philosophy of education itself. Future work should focus on the empirical evaluation of the proposed transition strategy within concrete institutional settings, and on the development of validated instruments for measuring the digital competence of both teachers and learners.

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GEOMETRIC VISUALIZATION AS A FACTOR IN THINKING DEVELOPMENT

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Abstract. *This article analyzes the role of geometric visualization in the formation and development of students' thinking from a scientific and methodological perspective. Geometric visualization not only facilitates the visual perception of shape, space, size, relationships, and position, but also activates intellectual processes such as logical reasoning, abstract thinking, modeling, analysis, and generalization. The article highlights the interrelationship between geometric visualization and mathematical thinking, the didactic conditions necessary for its development, methods of enhancing spatial imagination in school mathematics education, and the possibilities of using modern digital tools for this purpose. Geometric visualization is considered an important factor in the development of students' logical, visual, algorithmic, and creative thinking. Furthermore, the purposeful use of visual aids, dynamic models, drawings and diagrams, practical tasks, and digital visualization tools in teaching geometric concepts contributes significantly to improving the effectiveness of education.*

Keywords: *geometric visualization, thinking, mathematical thinking, spatial perception, visualization, geometric model, logical reasoning, abstraction, mathematics education, didactic approach.*

Introduction

In the modern educational system, it is important not only for students to acquire ready-made knowledge but also to develop the ability to think independently, analyze information, draw conclusions, and find rational solutions in problematic situations. In particular, the development of thinking occupies a central place in mathematics education. The content of mathematics contributes to the formation of logical consistency, a culture of reasoning and proof, abstraction, generalization, modeling, and analytical thinking among students.

Geometry is one of the most important branches of mathematics that exerts a strong influence on students' cognitive development. In geometry, students work not only with formulas and theorems but also perceive and interpret relationships involving shape, space, size, movement, symmetry, angles, distance, similarity, and spatial arrangement. In this process, geometric visualization plays a particularly significant role.

Furthermore, geometric visualization can be understood as a system of mental images representing geometric objects, concepts, laws, principles, and facts that may not have been previously encountered by an individual. In students' minds, fundamental geometric concepts such as point, line, plane, belonging, inclusion, position, and spatial relations are gradually accumulated and organized. As a result of this cognitive accumulation, new and more complex mental images and representations emerge. Consequently, students' geometric visualization develops, expands, and becomes enriched, enabling them to create higher levels of abstraction and engage in more sophisticated mathematical reasoning.

The relevance of this topic lies in the fact that, in many general secondary schools, the teaching of geometry often leads students to focus primarily on memorizing theorems, applying formulas, and working with ready-made diagrams. However, they frequently encounter difficulties when required to visualize the essence of a geometric problem, understand relationships among geometric figures, construct diagrams independently, analyze spatial situations, and identify alternative solution strategies. This situation highlights the necessity of purposefully developing students' geometric visualization skills.

The aim of this article is to provide a scientific and methodological justification of the role of geometric visualization in the development of students' thinking and to analyze the didactic approaches that contribute to its formation and enhancement.

The main objectives of this article are: to reveal the scientific and methodological essence of the concept of geometric visualization; to analyze the relationship between geometric visualization and thinking; to identify the pedagogical conditions necessary for the development of geometric visualization; to substantiate methods for fostering geometric visualization in school mathematics education; and to demonstrate the potential of visual models and digital technologies in enhancing students' geometric visualization skills.

Literature Review

The problem of geometric visualization and spatial thinking has been studied across various fields, including mathematics education methodology, psychology, pedagogy, and cognitive sciences. This issue is closely connected with students' cognitive activity, visual perception, abstract thinking, and the process of mathematical modeling.

In psychological research, imagination is interpreted as the ability of the human mind to reconstruct, transform, and create new images of objects and phenomena. Geometric visualization represents a mathematically enriched form of this general psychological process. In this context, students perceive geometric figures not merely as objects to be seen or drawn, but as mental objects that can be analyzed, transformed, and modeled.

In the methodology of mathematics education, the importance of geometric visualization has been emphasized by many scholars. In particular, it is noted that visualization, drawing, modeling, construction, proof, and problem-solving processes in geometry contribute significantly to the development of students' thinking. The effective acquisition of geometric knowledge is directly related to the learner's ability to mentally visualize figures, their elements, and the relationships between them.

Jean Piaget emphasizes that the development of children's thinking occurs in stages, and the understanding of spatial relations is considered one of the key indicators of cognitive development. L.S. Vygotsky, in turn, substantiates the relationship between learning and development, showing that tasks given within the learner's zone of proximal development expand their cognitive capabilities. From this perspective, geometric tasks serve as a mediator between students' existing knowledge and new intellectual operations.

The theory of geometric thinking levels developed by the Dutch scientist P. van Hiele plays an important role in the methodology of teaching geometry. According to this theory, students first perceive geometric objects at a visual level, then identify their properties, understand relationships between these properties, and subsequently progress toward deductive reasoning and axiomatic thinking. This theory explains the transition of geometric visualization from simple visual perception to higher-level logical thinking.

In Uzbekistan, research in the methodology of mathematics teaching has also focused on developing students' mathematical thinking, spatial visualization, independent reasoning, and problem-solving skills. The analysis of existing literature shows that although the development of geometric visualization has been widely studied, its comprehensive treatment as an independent factor in the formation of thinking remains an important scientific and methodological issue in contemporary education.

Methodology

In this article, a set of research methods was used to determine the role of geometric visualization in the development of students' thinking, including analysis and synthesis, comparative analysis, generalization, modeling, and pedagogical observation.

The method of analysis and synthesis was applied to study the scientific and methodological essence of the concepts of geometric visualization, spatial perception, mathematical thinking, and visual modeling. Through comparative analysis, different aspects of geometric visualization were examined in relation to visual, logical, abstract, and creative thinking.

The method of generalization was used to identify the key pedagogical conditions that contribute to the development of students' thinking in the process of teaching geometry. The modeling method was employed to analyze the possibilities of explaining geometric concepts through drawings, diagrams, dynamic models, and spatial representations.

Results

The research findings indicate that geometric visualization develops several key components of students' thinking. Through geometric visualization, students are able to mentally represent figures, identify their properties, analyze relationships, predict transformations, and draw conclusions. In this process, different forms of thinking become actively engaged.

In geometry, every concept is to a certain extent based on a mental image. For example, concepts such as triangle, circle, parallel lines, prism, or cone are formed in the student's mind as specific visual representations. If students are unable to correctly visualize these images, they also cannot deeply understand their properties.

Visual thinking enables the holistic perception of a geometric object and the ability to mentally represent its shape and structure. For instance, the ability to visualize a cube unfolding into its net and then reconstructing it in three-dimensional space is an important manifestation of spatial thinking.

Geometric visualization is not limited to perceptual imagery; it is also closely connected with logical reasoning. In geometry, proving theorems, justifying properties, determining necessary and sufficient conditions, and identifying relationships between given and unknown quantities all require logical thinking.

For example, the conclusion "if two lines are perpendicular to the same line, then they are parallel to each other" can be visually represented through a diagram, but its true meaning is understood through logical justification. Thus, the diagram initiates thinking, while logic provides its justification.

Geometric figures in mathematics may resemble real-world objects; however, they are treated as mathematical abstractions. For instance, a point has no dimensions, a straight line extends infinitely, and a plane is considered an ideal geometric object. In the process of understanding these concepts, students move from real-world perception to mathematical modeling.

Geometric problems often have multiple solution approaches. A single problem can be solved using synthetic, analytic, algebraic, coordinate, or vector methods. As students explore different solution strategies, their creative thinking becomes significantly developed.

The Relationship Between Geometric Visualization and Types of Thinking

Geometric Visualization Activity	Type of Thinking Developed	Methodological Significance
Visualizing a geometric figure	Visual (imagery-based) thinking	Helps perceive geometric objects as a whole
Analyzing relationships in a diagram	Logical thinking	Supports identifying cause–effect relationships
Transition from real object to mathematical model	Abstract thinking	Ensures generalization of mathematical concepts
Mentally rotating or transforming a figure	Spatial thinking	Strengthens the ability to visualize spatial situations
Searching for different solution methods	Creative thinking	Develops independent and non-standard thinking
Proving a theorem	Deductive thinking	Forms a culture of logical justification

Discussion

Viewing geometric visualization as a factor of thinking requires a new approach to the content and methodology of teaching geometry. In traditional education, geometry is often taught as a system of theorems, definitions, formulas, and proofs. Although this approach is necessary, it is not sufficient. If students do not properly visualize geometric content, they cannot fully understand the logical structure of proofs.

Several methodological conditions are essential for developing geometric visualization. First, visualization and logical reasoning must be integrated in the teaching of geometry. Relying solely on drawings may strengthen students' perceptual understanding, but it does not fully develop logical thinking. Therefore, every diagram, scheme, or model should be connected with questions, analysis, and conclusions.

Second, students should be taught not only to use ready-made drawings but also to construct geometric figures independently. During the process of constructing a diagram, students analyze the conditions of the problem, identify given and unknown elements, and determine relationships between geometric objects. This significantly activates their thinking processes.

Third, it is important to present geometric objects in different positions and representations. For example, a triangle should not always be shown in a standard orientation; it should also be presented in various rotations, positions, and scales. Otherwise, students may memorize only a specific visual appearance of the figure rather than understanding the geometric concept itself.

Fourth, the use of models, mock-ups, nets, and digital visualization tools is highly effective in studying spatial figures. In particular, software such as GeoGebra, Desmos 3D, and Cabri 3D allows students to observe figures dynamically, rotate them, create cross-sections, and modify parameters interactively. These tools significantly enhance spatial understanding and engagement.

Fifth, comparing multiple methods of solving geometric problems contributes to the development of students' critical and creative thinking. For instance, after solving a problem using

the synthetic method, analyzing it again through coordinate or vector approaches helps students understand the multidimensional nature of mathematical relationships.

Methodological Model for Developing Geometric Visualization

The process of developing geometric visualization can be organized through the following stages: visual perception, analytical understanding, modeling, logical justification, and creative application.

At the stage of visual perception, students observe a geometric object, identify its external features, and name its shape and elements. At the stage of analytical understanding, the components, properties, and relationships of the figure are examined in detail. For example, elements such as sides, angles, diagonals, heights, and medians are identified and analyzed.

During the modeling stage, real objects or problem conditions are represented through geometric models. Diagrams, schemes, or spatial models are constructed to represent the given situation. At the stage of logical justification, the properties of the figure are used to prove theorems, rules, or solution paths.

Finally, at the stage of creative application, students apply geometric knowledge in new situations, explore different solution strategies, and draw independent conclusions. This stage is particularly important for developing flexible and innovative thinking skills.

Problems

For instance, the well-known property that the medians of a triangle intersect at a single point and divide each other in the ratio 2:1 (measured from the vertex) can be generalized through the development of geometric thinking (Figure 1). As a result of such generalization, it becomes possible to imagine a situation in which segments drawn from the vertices of a triangle intersect at a single interior point and intersect the opposite sides at specific points. In this case, a more generalized geometric representation can be mentally constructed and visualized, extending beyond the standard case of medians.

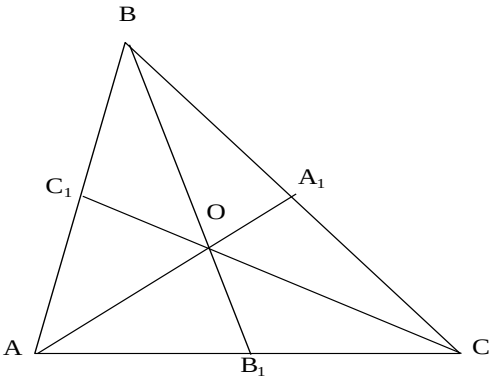


Figure 1

This form of visualization teaches students to construct generalized geometric patterns that arise from a logical sequence of reasoning, often leading to previously unconsidered generalizations. Therefore, the closest and most frequently accompanying cognitive process of imagination is logical thinking, which not only ensures a complete and coherent mental representation of geometric objects but also plays a crucial role in the formation of such representations.

In geometry, visualization is of fundamental importance, since only when a student can fully imagine a theorem, a geometric problem, and its content together with its diagram in their mind, are they able to prove the theorem or solve the problem without difficulty. This, in turn, contributes to the development of students' mathematical culture and modern forms of thinking.

For example, a median of a triangle divides the opposite side into two equal parts. If a student perceives the median not merely as a line segment but as an element that divides the area of the triangle into two equal parts, their geometric understanding becomes significantly deeper.

In this case, visualization leads to a logical conclusion: if two triangles have equal heights and equal bases, then their areas are also equal.

A diagram is an important tool when explaining the relationship between a central angle in a circle and its corresponding arc. However, the diagram should not be used only for illustration; it must also serve to develop understanding of the relationship itself. If a student is able to mentally visualize that when the measure of an angle changes, the length of the corresponding arc also changes, they will gain a deeper understanding of the meaning of the formula.

Section formation: predicting the shape of a cross-section formed when a prism is intersected by a plane requires spatial thinking. In such problems, students analyze the relationships between points, edges, and planes in space. This type of reasoning develops their ability to mentally manipulate three-dimensional geometric structures.

Novelty of the Research

The scientific novelty of this article lies in the fact that geometric visualization is interpreted not merely as an auxiliary tool for developing students' thinking, but as an independent didactic factor that significantly influences the formation of mathematical thinking. In addition, the interrelated aspects of geometric visualization with visual, logical, abstract, spatial, and creative thinking are systematically substantiated.

The following components necessary for the formation and development of students' geometric visualization skills have been identified:

- the mathematical content required for forming and developing students' geometric visualization skills, along with the hierarchical structure of its development;
- the internal and external relationships of geometric laws, rules, and formulas, as well as teaching methodologies that integrate them with other branches of mathematics;
- the content, structure, and implementation mechanisms of learning material that ensure the dynamic development of geometric visualization and its components;
- the levels and hierarchical structure of students' geometric visualization development within the system of continuous education.

Conclusion

Based on the conducted analysis, the following conclusions can be drawn: geometric visualization is an important didactic factor in the development of students' mathematical thinking; it integrates visual perception, logical analysis, abstraction, modeling, and creative thinking into a unified cognitive process; and the effective teaching of geometry requires the purposeful use of diagrams, models, schemes, and digital visualization tools.

Students should be taught not only to work with ready-made drawings but also to construct geometric figures independently, transform them, and mentally visualize spatial situations. Solving geometric problems using different methods enhances students' creative and critical thinking abilities.

If the process of developing geometric visualization is organized in a step-by-step manner, students' skills in theorem proving, problem solving, and mathematical modeling will be significantly strengthened. In modern mathematics education, the development of geometric visualization is not only essential for mastering geometry but also a key condition for improving overall intellectual capacity.

Recommendations

In geometry lessons, it is advisable that each new concept be explained through diagrams, practical examples, and logical analysis. Students should be given tasks that involve representing geometric figures in different positions, rotating, transforming, and reconstructing them.

When teaching spatial figures, it is necessary to use models, nets, and 3D representations. The use of digital tools such as GeoGebra, Desmos, and Cabri 3D enables the creation of dynamic geometric models and significantly improves the effectiveness of instruction.

When solving geometric problems, it is recommended not to rely on a single method but to compare synthetic, analytic, coordinate, and vector approaches. Such comparative analysis helps students develop a deeper understanding of mathematical relationships and enhances their problem-solving flexibility.

The approaches presented in this article can be used in the teaching of geometry in general secondary schools, in the development of methodological recommendations for mathematics teachers, and in the selection of geometric problems and organization of lesson processes. Furthermore, the materials of this article may serve as a theoretical and practical resource in higher education institutions for teaching the course “Methods of Teaching Mathematics.”

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PEDAGOGICAL STRATEGIES FOR DEVELOPING COMPETENCE IN UNIVERSAL HUMAN VALUES IN STUDENTS

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Abstract. *This article provides a scientific-theoretical and practical analysis of the pedagogical strategies for developing competence in universal human values in students. It substantiates universal human values as an important factor in shaping the student's spiritual and moral maturity, social responsibility, tolerance, cooperation, humanism, and intercultural communication skills. The article reveals the pedagogical possibilities of using value-oriented education, interactive methods, a reflective approach, socially oriented practical projects, educational activities, and interdisciplinary integration within the higher education process. It also emphasizes that, in developing a worldview based on universal human values in students, the harmony between educational content, the pedagogical environment, teacher–student cooperation, and practical activity is of great importance. The research findings serve to substantiate the effectiveness of systematic, step-by-step, and person-oriented pedagogical strategies in developing this competence.*

Keywords: *universal human values, competence, student personality, pedagogical strategy, higher education, spiritual and moral upbringing, reflective approach, social responsibility.*

Introduction

Under today's conditions of globalization, the acceleration of information flows, and the expanding intercultural relations, the higher education system faces the task of forming a well-rounded individual who possesses not only professional knowledge and skills but also comprehends universal human values and is able to apply them in personal and social activity. Indeed, values such as humanism, tolerance, justice, responsibility, cooperation, peacefulness, intercultural communication, and social activeness are among the important criteria that determine the spiritual and moral maturity of the student's personality and his or her civic position.

A pedagogical strategy is a set of purposeful, systematic, and step-by-step pedagogical guidelines selected to achieve a goal set within the teaching and upbringing process. It serves to organize the activity of the teacher, the content of education, methods, means, the educational environment, and the expected results in an interrelated manner. Pedagogical strategies are of particular importance in developing competence in universal human values in students. This is because values are not taught merely as theoretical concepts; rather, they must be manifested in the student's worldview, attitude, moral choice, and practical behavior.

In higher education institutions, developing students' competence in universal human values is inseparably linked with the content, methods, and pedagogical environment of the teaching–upbringing process as well as with social practice. This is because such competence is not limited to the mastery of theoretical knowledge; it is formed through the student's

comprehension of values, the expression of a personal attitude toward them, the making of correct decisions in real-life situations, and the demonstration of socially responsible behavior.

At present, alongside traditional approaches, the need to effectively use modern pedagogical strategies in instilling the content of universal human values into students' consciousness within the educational process is increasing. In particular, value-oriented education, the person-oriented approach, interactive methods, problem-based learning, reflective analysis, project-based activity, volunteer practice, and interdisciplinary integration may be regarded as important pedagogical means for developing competence in universal human values in students.

The relevance of this problem lies in the fact that a high level of students' knowledge does not always guarantee that they will adopt a tolerant, responsible, just, and humane position in social relations. Therefore, it is expedient to develop values within the educational process not only within the framework of educational activities but also in harmony with the content of academic subjects, independent study, practice, group work, social projects, and the educational environment.

This article analyzes the pedagogical strategies for developing competence in universal human values in students. It also provides a scientific-theoretical substantiation of the role of educational content, pedagogical technologies, teacher–student cooperation, reflective activity, and socially oriented practical sessions in this process. The main aim of the article is to identify effective pedagogical strategies that serve to form and develop competence in universal human values in students under higher education conditions.

Literature Review

The issue of developing competence in universal human values in students has been studied in foreign scholarly literature mainly within the directions of values education, global citizenship education, intercultural competence, moral upbringing, reflective learning, and the formation of social responsibility. In these studies, the main attention is directed not only to developing knowledge and professional skills in students but also to cultivating human dignity, justice, tolerance, cooperation, responsibility, empathy, and an active position relevant to sustainable development.

In international approaches, competence in universal human values is, first of all, regarded as the unity of an individual's knowledge, skills, attitude, and value system. For example, in the OECD "Future of Education and Skills 2030/2040" project, alongside knowledge and skills, attitudes and values are also defined as a core component for pupils and students in 21st-century education. There, "student agency," that is, the student's responsible decision-making, the sense of accountability for one's own actions, and active participation in the life of society, is interpreted as an important competence. This approach is important for the topic of the article, because competence in universal human values is likewise related not only to the student's knowledge of values but to the ability to realize them in personal and social activity.

In UNESCO research and recommendations, this issue is illuminated in connection with peace, human rights, international solidarity, global citizenship, and education for sustainable development. The "Recommendation on Education for Peace, Human Rights and Sustainable Development," adopted in 2023, emphasizes that education must serve to ensure human rights, peace, democracy, the rule of law, global citizenship, and sustainable development. In a 2026 UNESCO review, it is noted that global citizenship education should serve to prepare students as individuals who value human dignity, are ready for cooperation and dialogue, and approach different cultures and views with respect. These ideas make it possible to provide a scientific basis

for strategies that develop tolerance, humanism, and intercultural communication in the student's personality.

In foreign studies, global citizenship education is regarded as an important direction for developing competence in universal human values. UNESCO interprets this type of education as one that helps pupils and students understand the world, comprehend global problems, and actively participate in building a just and inclusive society. Franch's study emphasizes that, through global citizenship education, students comprehend universal values such as human rights, peaceful coexistence, solidarity, and sustainability, and develop commitment to them. Thus, research in this direction can serve as an important theoretical source for substantiating, in the article, the strategy of integrating national and universal values into educational content.

Among foreign studies on the theory of values, Shalom H. Schwartz's "basic human values" theory occupies a special place. Schwartz interprets human values as stable criteria that direct an individual's actions, decisions, and social relations. His theory substantiates the existence of value orientations that are common to different cultures. This approach shows that, in forming competence in universal human values in the student's personality, values must be studied not merely as a moral concept but as an internal mechanism that governs behavior.

Foreign studies on intercultural competence are also directly relevant to this topic. In the intercultural competence model developed by Deardorff, this competence is interpreted in connection with the individual's attitude, cultural knowledge, communication skills, and reflective ability. There, openness, respect, awareness of cultural differences, and the ability to communicate effectively with representatives of other cultures are defined as the main criteria. This approach is of great importance for substantiating pedagogical strategies that develop tolerance, empathy, intercultural communication, and social adaptability in the student's personality.

In foreign studies on higher education, approaches such as service learning, community-based learning, volunteering, problem-based learning, dialogic learning, and reflective learning are frequently mentioned as effective methods for developing universal human values. What these approaches have in common is that they aim to form the student not as a passive recipient of knowledge but as an active subject who comprehends social problems, works with the community, evaluates his or her own activity, and makes moral decisions. From this point of view, engaging students in socially oriented practical projects and volunteer activity is an effective mechanism for mastering universal human values through practical experience.

Analysis of foreign studies shows that three important directions are prioritized in developing competence in universal human values in students. The first is the cognitive direction, that is, forming in students knowledge about human rights, justice, peace, cultural diversity, and sustainable development. The second is the emotional-axiological direction, that is, developing empathy, tolerance, humanism, and a value-based attitude. The third is the activity-oriented direction, that is, transforming values into practical behavior by engaging students in social projects, collective activity, volunteering, and civic initiatives.

On the whole, in foreign studies the development of competence in universal human values in the student's personality is interpreted in the harmony between educational content, the pedagogical environment, social practice, and personal reflection. This makes it possible, within the framework of the article's topic, to put forward the following conclusion: effective pedagogical strategies should not be limited to making students aware of values; rather, they should be directed at forming in them value-based thinking, moral choice, intercultural communication, social responsibility, and an active civic position.

Results and Discussion

In particular, the President of the Republic of Uzbekistan, Shavkat Mirziyoyev, dwelling especially on the decisive role of spirituality and education in the development of society, emphasized: “If the body of society’s life is the economy, then its soul and spirit are spirituality.” The head of state also noted that in building New Uzbekistan it is necessary to rely on two firm pillars - a strong economy and a strong spirituality based on national values. From these ideas it can be understood that, within the educational process, the development of concepts such as universal human values, humanism, tolerance, justice, conscience, duty, and responsibility is of strategic importance.

The idea expressed by the President of the Republic of Uzbekistan at the meeting of the Republican Council on Spirituality and Enlightenment on 22 December 2023 - that “science, education and upbringing, and spirituality are a priority issue” - further reinforces the relevance of this topic. This is because such an approach shows that, in the higher education system, it is necessary to prepare students not only for professional activity but also for a spiritual and moral life, for establishing effective relations within a community, for understanding human dignity, and for feeling civic responsibility. Thus, developing competence in universal human values is consonant with the priority spiritual and enlightenment tasks of state policy.

Table 1. Pedagogical strategies for developing competence in universal human values in students

№	Direction of the pedagogical strategy	Content of the strategy	Forms of implementation
1	Integrating national and universal human values into educational content	Instilling values such as humanism, justice, tolerance, goodness, responsibility, and cooperation into the content of academic subjects	Lectures, seminars, independent study, interdisciplinary assignments, analysis of texts and sources related to values
2	Using problem-based, interactive, and reflective methods	Directing students toward thinking, evaluating, expressing an attitude, and making independent decisions on the basis of real-life situations	Discussion, debate, case study, “brainstorming,” reflective essay, group analysis
3	Engaging students in socially oriented practical projects and volunteer activity	Teaching students to manifest values in real life by directing them toward practical activity that serves the interests of society	Volunteer campaigns, social projects, cooperation with neighborhood communities (mahalla) and educational institutions, charity events

№	Direction of the pedagogical strategy	Content of the strategy	Forms of implementation
4	Forming an environment of intercultural dialogue and tolerance	Developing a culture of treating different nationalities, religions, cultures, and social views with respect	Intercultural meetings, round-table discussions, analysis of international experience, collaborative project work
5	Organizing educational situations that serve the understanding of one's personal value system	Helping the student understand his or her own life position, moral views, and personal responsibility	Reflective journal, educational conversation, analysis of moral situations, individual development map

This table systematically presents the effective pedagogical strategies for developing competence in universal human values in students. The table consists of several columns, in which the name, content, and expected result of each strategy are indicated. This structure clearly reveals through which directions value-based attitudes, moral consciousness, and social activeness can be formed in students within the pedagogical process.

The first item of the table addresses the issue of integrating national and universal human values into educational content. Here it is envisaged that, by introducing ideas, concepts, and real-life examples connected with values into the content of academic subjects, students' knowledge about values and their value-based attitude will be formed.

The second item presents the strategy of using problem-based, interactive, and reflective methods in the educational process. Through this, students acquire the skills of independent thinking, moral analysis, and self-assessment of their own conduct on the basis of discussion, cases, problem situations, and reflection.

The third item is devoted to engaging students in socially oriented practical projects and volunteer activity. This direction serves to develop social responsibility, cooperation, humanism, and civic activeness in students.

In the fourth item, forming an environment of intercultural dialogue and tolerance is presented as an important strategic direction. By ensuring a respectful attitude toward different cultures, views, and social experiences, it forms in students tolerance, empathy, and intercultural communication competence.

The fifth item is aimed at organizing educational situations that serve the understanding of one's personal value system. This encourages students to reflect on their own values, life position, and moral choices, and develops the ability to understand oneself, to engage in spiritual reflection, and to make value-based decisions.

In conclusion, the figure presents the main pedagogical directions for developing competence in universal human values in students as an integral system, which serves to organize the educational process on a value-oriented basis.

When these pedagogical strategies are applied in interrelation with one another, the cognitive, axiological, communicative, activity-related, and reflective components of competence in universal human values develop consistently in students. This serves to form the student not only as a knowledgeable specialist but also as a humane, justice-loving, socially responsible individual who holds an active civic position.

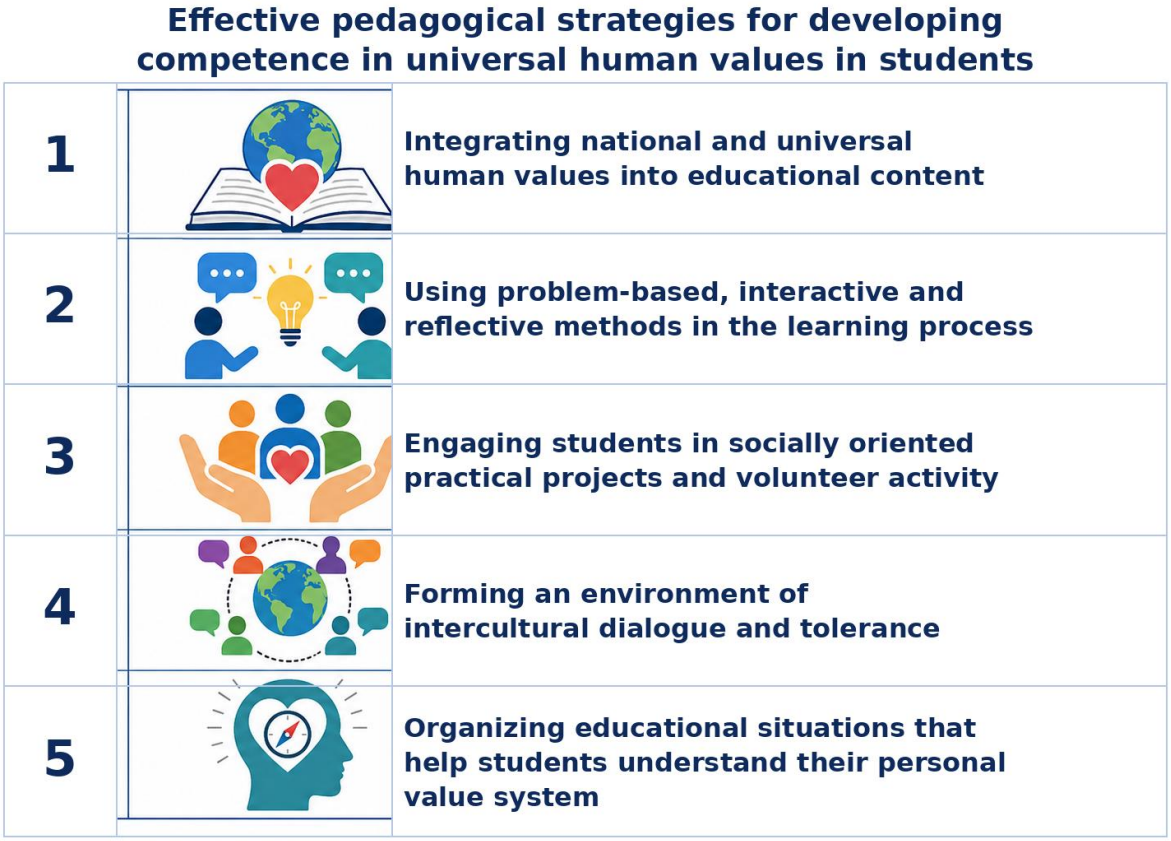


Figure 1. Analysis of the pedagogical strategies for developing competence in universal human values in students

The issue of developing competence in universal human values in students is one of the important pedagogical directions of modern higher education. This process is not limited to providing students with theoretical information about values; it also envisages forming in them the ability to manifest qualities such as humanism, justice, tolerance, responsibility, goodness, cooperation, and social activeness in practical activity. In this respect, the pedagogical strategies for developing competence in universal human values in students are determined on the basis of harmonizing educational content, the educational environment, teacher–student cooperation, reflective activity, and socially oriented practical experience.

Conclusion

In conclusion, developing competence in universal human values in students is one of the important pedagogical tasks of modern higher education. This competence is directly connected with forming in students the understanding of human dignity, justice, tolerance, humanism, responsibility, cooperation, empathy, and an active civic position. For this reason, this process should not be limited to imparting theoretical knowledge; it should be organized on the basis of the harmony between educational content, the educational environment, socially oriented practical activity, and personal reflection.

The analyses show that value-oriented education, interactive and problem-based methods, the reflective approach, intercultural communication, social projects, and volunteer activity emerge as effective pedagogical strategies for developing competence in universal human values in students. Such strategies teach students to think independently, to make moral choices, to work in cooperation with a community, to treat different cultures and views with respect, and to evaluate their own actions from the standpoint of values.

International studies likewise define the development of attitudes and values, alongside knowledge and skills, as an important task within the educational process. The OECD, in its future models of education, indicates the development of the harmony between knowledge, skills, attitudes, and values in students as one of the main directions. UNESCO, for its part, emphasizes that education should serve to shape the ideas of peace, human rights, international solidarity, global citizenship, and sustainable development. These approaches further reinforce the scientific and practical significance of the article's topic. Thus, in developing competence in universal human values in students, pedagogical strategies must be implemented in a systematic, step-by-step, and person-oriented manner. Integrating these strategies, in higher education institutions, with the content of academic subjects, independent study, educational activities, social projects, and an environment of intercultural communication serves to develop students' spiritual and moral maturity, social responsibility, and active life position.

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A SYSTEM OF CLIL-BASED EXERCISES FOR DEVELOPING ENGLISH GRAMMATICAL COMPETENCE IN HIGHER EDUCATION

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Abstract. *The development of English grammatical competence in higher education requires methodological approaches that go beyond the mechanical explanation of grammar rules and isolated sentence-level practice. In modern language education, grammar should be taught as a functional tool for understanding content, expressing academic ideas, solving communicative tasks and participating in professional discourse. Content and Language Integrated Learning (CLIL) provides such an opportunity because it combines subject-related content with purposeful language development. This article examines a system of CLIL-based exercises aimed at developing university students' English grammatical competence. The study is based on theoretical analysis, methodological modelling and instructional design. It analyzes the relationship between grammatical competence, communicative competence and content-based language learning, and proposes a structured set of exercises that gradually moves students from content comprehension to grammar noticing, guided grammar practice, content-based production and reflective correction. The suggested exercise system includes input-based tasks, grammar noticing tasks, scaffolded transformation tasks, problem-solving tasks, academic speaking tasks, reflective writing tasks and error-mapping activities. The article argues that grammar should not be treated as an isolated linguistic component in higher education, but as an integral part of academic communication and cognitive activity. The results of the study show that CLIL-based exercises can help students understand grammar in meaningful contexts, use grammatical structures for content expression, reduce formal errors through reflection and develop greater independence in academic language use. The article also provides practical recommendations for organizing grammar-oriented CLIL lessons, selecting content materials, designing tasks and assessing students' grammatical performance according to accuracy, appropriateness, communicative effectiveness and academic relevance.*

Keywords: *clil, grammatical competence, exercise system, higher education, English grammar.*

INTRODUCTION

The development of grammatical competence remains one of the central issues in teaching English as a foreign language in higher education. University students are expected not only to know grammatical rules, but also to use grammatical structures appropriately in academic, professional and communicative contexts. In this regard, grammar is no longer viewed only as a set of forms to be memorized; it is increasingly understood as a functional resource for constructing meaning, organizing discourse and expressing complex ideas.

In traditional grammar teaching, the learning process often begins with the explanation of a rule and continues with controlled exercises such as gap-filling, sentence transformation or translation. Although such exercises may be useful at the initial stage, they do not always lead to

the independent use of grammar in meaningful communication. As Ellis emphasizes, grammar teaching should help learners notice the relationship between form, meaning and use rather than memorize rules in isolation [9]. Therefore, higher education requires a more integrated methodology in which grammatical competence is developed through meaningful content and purposeful communication.

Content and Language Integrated Learning (CLIL) is one of the most relevant approaches for this purpose. CLIL is generally understood as a dual-focused educational approach in which an additional language is used for both content learning and language development [1]. In the CLIL framework, students learn language not separately from content, but through subject-related materials, academic texts, discussions, projects, diagrams and problem-solving activities. This makes grammar more meaningful because grammatical forms are connected with real communicative needs.

The methodological value of CLIL is closely related to the 4C framework proposed by Coyle, Hood and Marsh: Content, Communication, Cognition and Culture [1]. Content provides the thematic and conceptual basis of learning; Communication creates the need to use language; Cognition activates thinking processes; Culture connects language with social and intercultural meanings. When applied to grammar teaching, these components make it possible to develop grammatical competence as part of academic and communicative competence.

Grammatical competence is an essential part of communicative competence. Canale and Swain included grammatical competence among the basic components of communicative competence and associated it with knowledge of lexical items, morphology, syntax, sentence grammar and linguistic accuracy [6]. However, in contemporary language education, grammatical competence should also include the ability to use grammar appropriately according to communicative purpose, discourse type and academic context. This is particularly important for university students who need English for reading academic texts, writing summaries, presenting research, discussing professional topics and participating in international academic communication.

The problem addressed in this article is the lack of a systematic set of CLIL-based exercises specifically aimed at developing grammatical competence in higher education. In many cases, CLIL lessons focus mainly on content comprehension and vocabulary development, while grammar remains either implicit or secondary. Dalton-Puffer notes that CLIL classrooms provide rich opportunities for language learning, but they require explicit language goals in order to fully develop learners' linguistic competence [3]. This means that grammar should be deliberately planned within CLIL instruction.

The aim of this article is to develop and describe a system of CLIL-based exercises for improving English grammatical competence among university students. The article focuses on the methodological principles, stages and practical types of exercises that can be used in higher education. The main research question is: how can a system of CLIL-based exercises be designed to develop students' grammatical competence through meaningful content, communication and reflection?

METHODS

This article is based on a theoretical and methodological research design. It does not present experimental statistical data; instead, it develops a methodological model and a system of exercises grounded in CLIL theory, communicative language teaching and grammar pedagogy. The research was conducted through the following methods.

First, theoretical analysis was used to examine scientific literature on CLIL, communicative competence, grammatical competence, language teaching methodology and CEFR-based assessment. The works of Coyle, Hood and Marsh [1], Marsh [2], Dalton-Puffer [3], Llinares, Morton and Whittaker [4], Mehisto, Marsh and Frigols [5], Canale and Swain [6], Hymes [7], Ellis [9] and Larsen-Freeman [10] were analyzed as the theoretical basis of the study.

Second, comparative-methodological analysis was applied to compare traditional grammar exercises with CLIL-based grammar exercises. The comparison focused on the role of context, communication, cognitive activity, scaffolding and reflection in grammar learning.

Third, methodological modelling was used to design a structured system of CLIL-based exercises. The model was developed according to the principle of gradual transition from receptive understanding to productive use. It includes five main stages: content input, grammar noticing, guided practice, content-based production and reflective correction.

Fourth, instructional design was applied to formulate practical exercise types that can be used by English teachers in higher education. The exercises were designed for students of philology, pedagogy and other humanitarian fields, but they can be adapted to other academic specializations.

The methodological basis of the proposed system relies on three assumptions. The first assumption is that grammar is learned more effectively when it is connected with meaningful content. The second assumption is that grammatical competence develops through repeated use of grammatical structures in communicative and academic tasks. The third assumption is that students need scaffolding and reflective feedback to move from controlled practice to independent language production.

RESULTS

The analysis made it possible to develop a system of CLIL-based exercises aimed at forming and improving English grammatical competence in higher education. The system is based on a gradual movement from content understanding to grammatical awareness and then to communicative production.

1. Methodological principles of the CLIL-based exercise system

The proposed exercise system is based on several methodological principles.

The first principle is content-grammar integration. Grammar should be selected according to the content topic. For example, Passive Voice may be taught through texts about scientific discoveries, educational reforms or environmental processes. In this case, students do not learn the passive form only as a grammar rule; they see how it is used to describe processes, research methods and institutional changes.

The second principle is communicative relevance. Every grammar exercise should have a communicative purpose. If students practice modal verbs, they may use them to discuss academic rules, environmental responsibilities or health recommendations. If they practice conditionals, they may use them to propose solutions to educational or social problems.

The third principle is cognitive engagement. CLIL-based grammar exercises should activate thinking processes such as comparing, classifying, explaining, hypothesizing, evaluating and concluding. This principle corresponds to the cognitive dimension of CLIL and to the idea that language learning is connected with thinking [1], [12].

The fourth principle is scaffolding. Students should not be required to produce complex grammatical structures independently from the beginning. They need models, sentence frames,

tables, key phrases, visual organizers and teacher support. The importance of guided support is consistent with Vygotsky's concept of the zone of proximal development [11].

The fifth principle is reflective correction. Students should be able to identify, classify and correct their own grammatical errors. This is especially important in higher education, where learners are expected to develop independent academic language skills.

2. Structure of the CLIL-based exercise system

The CLIL-based exercise system proposed in this article consists of five interrelated stages. Each stage has a specific methodological function and prepares students for the next level of grammar use.

Figure 1. Structure of the CLIL-based exercise system

Content input → Grammar noticing → Guided grammar practice → Content-based production → Reflection and correction

As shown in Figure 1, the system begins with meaningful content and ends with reflective correction. This sequence is important because grammar is first encountered in context, then analyzed, then practiced with support, then used in communication and finally improved through feedback.

Table 1. Stages of CLIL-based exercises for developing grammatical competence

Stage	Main purpose	Teacher's role	Student's role	Expected result
1. Content input	To introduce meaningful academic content	Provides text, video, diagram or case	Understands main ideas and key vocabulary	Content comprehension
2. Grammar noticing	To help students notice target grammar	Highlights grammar in the content	Identifies form, meaning and function	Grammatical awareness
3. Guided grammar practice	To practice grammar with support	Gives models, frames and prompts	Completes, transforms and reconstructs sentences	Controlled accuracy
4. Content-based production	To use grammar in meaningful tasks	Organizes discussion, writing or presentation	Produces oral or written output	Communicative grammar use
5. Reflection and correction	To analyze and improve grammar use	Provides feedback and error map	Corrects errors and rewrites output	Independent improvement

Table 1 demonstrates that CLIL-based grammar teaching is not limited to rule explanation. It includes comprehension, noticing, practice, production and reflection. This makes the learning process more systematic and pedagogically complete.

3. Types of CLIL-based grammar exercises

The proposed system includes several types of exercises. Each type has a specific methodological purpose and can be used for different grammar topics.

Table 2. Types of CLIL-based exercises and their grammatical functions

Type of exercise	Description	Example grammar focus	Example content topic
Content prediction task	Students predict the content of a text using key terms and grammar prompts	Future forms, modal verbs	Future of education
Grammar noticing task	Students find target grammar in a content-based text	Passive Voice, Present Perfect	Scientific discoveries
Form-meaning matching task	Students match grammatical forms with their meanings in context	Conditionals, relative clauses	Environmental problems
Scaffolded sentence-building task	Students create sentences using models and content vocabulary	Complex sentences, connectors	Academic writing
Content reconstruction task	Students reconstruct a text using grammar cues	Tenses, cohesive devices	Historical development
Problem-solving task	Students solve a content-related problem using target grammar	Modals, conditionals	Social responsibility
Mini-presentation task	Students present content using required structures	Passive Voice, academic phrases	Research methods
Reflective writing task	Students write a short reflection on the topic	Present Perfect, linking words	Learning experience
Error-map task	Students classify and correct grammar errors	All grammar topics	Student-produced texts

As shown in Table 2, CLIL-based exercises are not purely linguistic or purely content-based. They combine both dimensions. For example, a grammar noticing task develops awareness of form, while a problem-solving task encourages students to use grammar for communication and reasoning.

4. Sample CLIL-based exercise sequence

The following sequence may be used for teaching the Present Perfect through the content topic “Changes in Higher Education”.

Stage 1: Content input. Students read a short text about recent changes in higher education, such as digital learning, international cooperation and student-centered methodology. The teacher asks students to identify the main changes described in the text.

Stage 2: Grammar noticing. Students underline examples of the Present Perfect in the text: “Universities have introduced online platforms”, “Students have become more independent”, “Teaching methods have changed significantly”. Then they discuss why the Present Perfect is used in these sentences.

Stage 3: Guided grammar practice. Students complete sentence frames: “In recent years, universities have …”, “Teachers have …”, “Students have …”. They use content vocabulary from the text.

Stage 4: Content-based production. Students work in groups and prepare a short presentation on the topic “How higher education has changed in the last decade”. They are required to use at least five Present Perfect structures.

Stage 5: Reflection and correction. Students exchange their written summaries and identify grammar errors. The teacher prepares an Error-Map showing the most common mistakes: incorrect auxiliary verb, wrong past participle, confusion with Past Simple and word order errors.

This sequence shows how one grammar topic can be taught through content, communication and reflection. The grammar structure is not separated from meaning; it becomes a tool for expressing academic content.

5. Assessment criteria for CLIL-based grammar exercises

Assessment is an important part of the proposed system. In traditional grammar teaching, assessment often focuses only on correctness. In CLIL-based grammar learning, however, assessment should include accuracy, appropriateness, content relevance and communicative effectiveness. CEFR-based language assessment also emphasizes language use in communicative activities and meaningful contexts [8].

Table 3. Assessment criteria for CLIL-based grammatical competence

Criterion	Description	Indicators
Grammatical accuracy	Correct use of target grammar structures	Few errors in form, tense, agreement and word order
Content relevance	Connection between grammar use and content topic	Sentences express meaningful content ideas
Communicative effectiveness	Ability to communicate clearly	Ideas are understandable and logically organized
Academic appropriateness	Use of grammar in academic style	Use of complex sentences, passive structures and connectors
Reflective improvement	Ability to correct errors	Student revises and improves grammar after feedback

The criteria in Table 3 allow teachers to evaluate grammatical competence more comprehensively. A student may make minor grammatical errors but still demonstrate meaningful and communicative use of grammar. At the same time, repeated formal errors should be corrected through scaffolding and reflection.

DISCUSSION

The proposed CLIL-based exercise system shows that grammar can be taught more effectively when it is integrated with academic content and communicative tasks. In higher

education, students need grammar not only for passing tests, but for reading academic sources, writing summaries, presenting information and expressing professional opinions. Therefore, grammar instruction should be connected with authentic or semi-authentic content.

One of the advantages of CLIL-based exercises is that they create a natural need for grammar use. For example, Passive Voice becomes necessary when students describe scientific procedures or educational reforms. Modal verbs become meaningful when students discuss rules, recommendations or responsibilities. Conditionals become useful when students propose solutions to problems. In this way, grammar is not simply practiced; it is used as a tool for thinking and communication.

Another advantage is that CLIL-based exercises develop several competences at the same time. Students improve content knowledge, vocabulary, grammar, speaking, writing, critical thinking and academic communication. This corresponds to the integrated nature of CLIL, where content and language are developed together [1], [5].

However, the successful implementation of the proposed system requires careful planning. Teachers should not assume that grammar will develop automatically in CLIL lessons. Dalton-Puffer's research shows that CLIL environments offer many opportunities for language learning, but explicit attention to language form is still necessary [3]. Therefore, grammar objectives should be clearly stated in every CLIL lesson.

For example, a lesson topic may be "Environmental Problems", but the grammar objective may be "using modal verbs to express obligation and recommendation". A lesson topic may be "Research Methods", but the grammar objective may be "using Passive Voice to describe procedures". This combination of content objective and grammar objective makes the lesson more systematic.

Practical recommendations for teachers are as follows. First, teachers should select content topics that naturally require the target grammar. Second, grammar should be introduced through texts, diagrams, cases or videos rather than isolated rules only. Third, students should be given scaffolding tools such as sentence frames, grammar tables and model answers. Fourth, productive tasks should require students to use the target grammar in speaking or writing. Fifth, feedback should focus not only on mistakes but also on the relationship between grammar and meaning.

The proposed exercise system may be especially useful in English classes for university students of philology, pedagogy and other academic fields. It can also be adapted for ESP courses, academic writing courses and professional English classes. For stronger students, tasks may include research summaries, debates and academic presentations. For weaker students, the same system may be simplified through more controlled scaffolding.

The main methodological contribution of this article is that it treats CLIL not only as a content-learning approach, but also as a purposeful tool for developing grammatical competence. This is important because grammar often remains implicit in CLIL practice. The system proposed in this article makes grammar visible, meaningful and functional.

CONCLUSION

The development of English grammatical competence in higher education requires a systematic, meaningful and communicative methodology. Traditional grammar exercises may help students understand rules, but they do not always prepare them to use grammar independently in academic and professional contexts. CLIL-based exercises provide a more integrated solution because they connect grammar with content, communication, cognition and reflection.

The article proposed a system of CLIL-based exercises consisting of five stages: content input, grammar noticing, guided grammar practice, content-based production and reflection and correction. This system allows students to encounter grammar in context, analyze its form and meaning, practice it with support, use it in communicative tasks and improve their performance through feedback.

The main conclusion is that grammar should be taught not as an isolated set of rules, but as a functional resource for academic communication. CLIL-based exercises help students understand why a grammatical structure is needed, how it functions in a text and how it can be used to express content-based ideas. This increases the practical value of grammar learning and supports the development of communicative competence.

The proposed system may be used in higher education English classes, especially in courses focused on academic English, professional communication and content-based language learning. It can also serve as a methodological basis for future empirical research on the effectiveness of CLIL-based grammar instruction.

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MODEL OF DEVELOPMENT OF SOCIAL-EMOTIONAL COMPETENCES IN CHILDREN

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Abstract. *This article examines the development of social-emotional competencies in preschool children and explains their importance for successful learning, communication, and personal growth. It discusses the psychological and pedagogical foundations of emotional and social competence, emphasizing the role of emotions, peer interaction, family support, and culturally appropriate communication in early childhood education. The paper also highlights the significance of positive parent-child relationships, eye contact, constructive questioning, play-based activities, and supportive classroom environments in shaping children's emotional intelligence and social behavior. Special attention is given to the pyramid model of social-emotional competence development, which includes responsive relationships, high-quality learning environments, and individualized intervention for children with persistent behavioral difficulties. The article concludes that social-emotional development should be supported in natural educational and family settings, where children can practice cooperation, self-control, empathy, and communication through meaningful interaction with adults and peers for academic success, healthy relationships, lifelong emotional well-being, resilience, and overall development.*

Keywords: *communication, personality, socialization, influence, psychological influence, socio-emotional competence.*

INTRODUCTION

In our homeland, where we live in peace and tranquility, just as there are reforms in all areas, extensive reforms are being carried out in the education system. We all know that the teaching methodology in educational organizations determines the quality and competitiveness of education. Therefore, new standard methodologies that have been tested and are giving good results in countries with a significantly developed education system are being widely introduced. We all know that exchange of experience and training of experienced foreign teachers has been established in schools and higher educational institutions.

The President's resolution of June 21, 2024 " On the establishment of the National Institute of Educational Pedagogy named after Qori Niyazi" set the task of gradually introducing the world-renowned social and emotional learning methodologies in secondary education institutions in the 2025-2026 academic year. Therefore, every active educator in society asks the question: why is such a methodology being introduced in education? After all, in the case of a child's preparation for education, social and emotional preparation takes precedence over educational preparation.

MATERIALS AND METHODS

If a child is psychologically ready for education, his or her learning process will be easier. [1]

First, let's look at the theoretical background of social competence and emotional competence.

The physiological basis of human emotion is, first of all, the processes that occur in the cerebral cortex. The cerebral cortex controls the strength and stability of emotions. In the areas below the cerebral cortex are the centers that control the autonomic nervous system. These centers are strongly associated with emotional experiences.[3]

Emotional experiences are primarily expressed in involuntary muscle movements. During positive emotions, these movements are usually directed in the opposite direction from the thing that caused these feelings. For example, when we see an artistic picture and enjoy it, we feel a pleasant feeling, so we involuntarily approach this picture. Our emotional experiences are especially clearly expressed in facial expressions, body movements, and gestures. A person's emotional experiences are also manifested in physiological processes such as crying, laughing, and so on. [3]

The manifestations of emotions that arise in children are: mood, enthusiasm, excitement, curiosity, a sense of wonder, a sense of surprise, a sense of trust, a sense of doubt, a sense of community, a sense of camaraderie and friendship, shame, and a sense of patriotism.

A child's sense of community is manifested in the ability to feel the feelings of his peers as if they were his own. If a child in a team cries, the rest of the children will sympathize with his mood, and they will also feel sad. If part of the team is cheerful and happy, the rest of the children in the team will also follow the happy children. Such feelings play an important role in the team at school, in preschool educational organizations, and in various district educational institutions. After all, social competence is manifested in the unity and well-being of the team in its life and activities, in its efforts to successfully fulfill the tasks facing the team, in friendship and camaraderie. If a preschool child has difficulties in emotional-social or educational adaptation and mastery at later stages of education, various district changes occur. For example, parents and educators can detect such situations by observing a child's mood, such as irritability, increased attention span, and incontinence, which is common among children.

RESULTS AND DISCUSSION

Emotions have become one of the most widely discussed topics today, and have been included in the children's education program in most countries. Millions of scientific studies are being conducted on this topic. The results of the research show that high emotional intelligence in a child is an important factor in living a healthier life.

Children with high emotional intelligence:

- are healthier physically and mentally
- perform better in education
- are more successful in relationships with people
- have a positive approach to themselves and those around them
- understand their own and others' emotions better
- can more easily get out of situations of despair and depression
- feel happier.

On the contrary, children with low or undeveloped emotional intelligence (in scientific language, "Emotional illiteracy") face many problems not only in childhood, but also in adulthood.

Problems observed in children with low emotional intelligence:

- prone to strong levels of anger, frustration, and depression
- harm themselves and others
- use unhealthy methods in raising their children in the future
- are more likely to become addicted to alcohol, drugs, or other addictions

- have an increased risk of committing crimes. [4]

Table 1: Correct approaches to developing a child's social and emotional competence:

	Methods for developing a child's social-emotional competence:	Mistakes parents make:	Error correction methods:
1	Your child can read your emotional state.	Expressing your feelings about kindergarten in front of your child	It is better to discuss it with the teacher.
2	Guiding the child towards positive thinking	What happened in kindergarten today?	What activities did you enjoy today?
4	Look into the eyes (Eyes are the mirror of the soul)	If your child looks away or appears uncomfortable during a conversation, this is a sign that eye contact is not being established sufficiently.	The eyes are the windows to the soul. Look your child in the eyes and talk to them.

It's natural to worry about your child when they first start kindergarten. Every mother has thoughts like, "Will they adapt?" But excessive anxiety on the part of the mother can also have a negative impact on the child. The child internally concludes, "If my mother is worried, then there must be something dangerous here." This complicates the process of his adaptation to kindergarten. For this reason, it is better to discuss your feelings about kindergarten with the teacher, not in front of the child.

Guide your child to think positively. When your child returns from kindergarten or school, asking positive questions about the educational institution and its lessons will lead to positive thinking about the place of study. For example, instead of “What happened today,” you can guide them to think positively by asking questions like “What did you do today from your favorite activities?” If you are a person full of negative energy, this will take a lot of work. But guiding your child to think positively regularly will form a person who can be optimistic in any situation in the future. Regularly talking to your child is one of the most important factors in establishing a healthy relationship with him. But it is a familiar situation to many. Parents and children living in the same house rarely talk. Pretending that there is no topic to talk about as a reason is actually a form of not being able to ask the question correctly. The way you ask the question determines the quality, content, and quantity of the conversation:

- Were the lessons interesting today?
- Did you eat on time?
- What did you learn today? When we ask questions like this, we get a short answer from the child like “yes” or “no” and the conversation ends.

On the contrary,

- What was the most interesting lesson today and how was it?
- What did your teacher say that you remember the most? What was the reason for this?
- What activities did you do?

- How would we solve this problem? When we ask a child questions like this, there is definitely a difference in the answers he gives.

Looking into the eyes Eyes are the mirror of the soul. How much do you or can you look into the eyes of your child? This is a simple but not easy task. How much we can look into the eyes of a child clearly shows the level and quality of our emotional closeness with him. Let's talk while looking into the eyes of our child, if we or he feels discomfort or strange feelings - this is a sign that eye contact is not enough, and the relationship needs to be reconsidered. The table above contains recommendations for parents and those responsible for the child.

Russian educator A.S. Makarenko attached great importance to the internal aspects of team relations. He singled out the following most important signs formed in the team:

-Constant cheerfulness, readiness of pupils for activity;

-Understanding the essence of the values of their team, awareness of their own value based on pride in it;

-Friendly unity between its members;

-Friendly unity in each member of the team;

-Activity leading to orderly, productive action;

-The ability to control their emotions and words.

Children are divided into several groups depending on their attitude to the team in which they live. The first group is made up of children with a positive attitude, who are respected by team members. Children of this category are active members of the team, and the educator relies on them to establish team relations.

Those in the second group join the activists' initiative, but remain steadfast. [2]

Play is very important from a child's earliest years. Play helps to form a strong system of the baby's brain. It is through play that the foundation for health, stable mental development and flexibility is laid. Communication with adults in the form of play helps to develop executive functions in babies. Hide and seek, finger games and communication allow the child to practice the initial skills of concentration, memory and self-control. An important principle is to continue the game that the child is interested in and, if possible, allow the child to determine the duration of the game.

Recommended games to play with 6-month-olds:

“Peekaboo”

Hide-and-seek games develop the child’s ability to remember who is hiding and practice the first elements of self-control. The game can be varied: for example, wait a moment before revealing your face or let the child control the time

“Rocking on the knee game” (“Trot Trot to Boston”)

Sit the baby on your knee and gently rock him to the rhythm of a poem or song. You can change the speed and play with the melody. This game strengthens the sense of rhythm, attention and social closeness

“Singing with hand movements” (“Pat-a-Cake”)

Singing and slowly clapping, rotating and repeating the movements of the child’s hands develop the skills of remembering sequences and repeating the movement. The speed can be gradually increased

“Conversation games”

Six-month-old babies begin to make sounds. Sit face to face with the child, make sounds and pause to wait for his “response”. Repeat the sounds and facial expressions made by the child.

This process teaches the principle of turn-taking in communication and serves the development of language

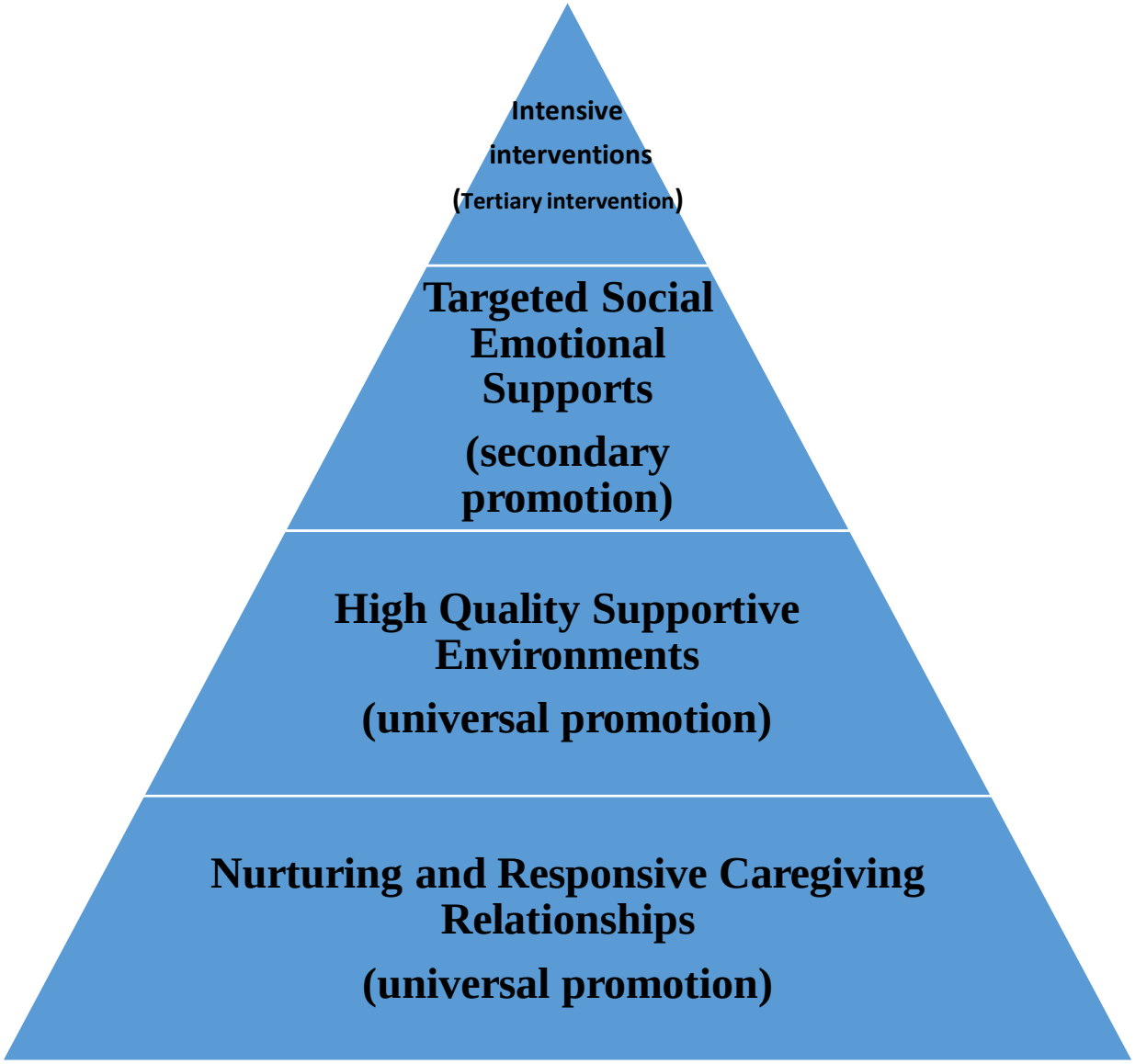
"Hide and seek"

Hide a toy under a cloth, glass or box and encourage the child to look for it. Then move the toy to another place and ask the child to find it again. When the child finds it, respond with joy.

"Finger games" (Fingerplays)

Songs and poems with simple hand movements teach the child to transfer the movement and remember the sequence.

The next pyramid model reflects the model of developing social-emotional competencies in children:



This pyramid model reflects 3 levels of support for preschool children's social and emotional competencies. The first level of the pyramid model includes two levels of practices that are very important for promoting the social development of young children. The first level of practices is to provide a caring and responsible caregiving relationship with the child. In addition to focusing on the relationship with the child, this level also describes the need to develop partnerships with families and develop cooperative relationships between group members. The relationship level of the pyramid model includes: actively supporting children's participation;

incorporating instructions into children's routine, planned and play activities; responding to children's conversations; encouraging children's attempts to communicate with language and providing supportive environments.

Level 2 of practice refers to designing classrooms and programs that meet high-quality educational standards. This includes implementing developmentally and culturally appropriate and effective teaching approaches, designing safe physical environments that encourage active learning and appropriate behavior, providing children with positive and clear instructions about rules and expectations, and designing schedules and activities that maximize children's participation and learning.

Level 3 of the pyramid model involves individualized intervention with the child when the first and second levels of the model are not sufficiently effective. When persistent challenging behavior is present, a comprehensive socialization-based strategy is developed to address the problem behavior and support the development of new skills. At this level, positive behavior support is used to develop and implement an intensive, individualized intervention plan. Thus, addressing the child's problem behavior requires an individually designed pedagogical approach that can be applied by the child's daily caregivers in all natural settings and that focuses on the child's development of new skills.

CONCLUSION

The main goal of the pyramid model is to promote socioemotional development. This requires a rich social environment as the context for intervention and instruction. Thus, the model is designed to be implemented in the natural environment, in the child's interactions with natural caregivers and peers, and in classroom settings that provide opportunities for interaction with socially competent peers. Interventions do not involve the abandonment of these environments; rather, they depend on a rich social context in which the number of opportunities for learning and practicing social skills can be optimized.

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DIDACTIC AND INNOVATIVE FOUNDATIONS OF WORD-LEVEL INSTRUCTION METHODOLOGY IN PRIMARY SCHOOL NATIVE LANGUAGE LESSONS

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Abstract. *This article examines the didactic and innovative foundations of word-level instruction in primary school native language lessons. It highlights vocabulary work as a key means of enriching pupils' lexical repertoire, improving oral and written speech, and developing logical, creative, and communicative competence. The study analyzes methods for explaining word meanings, including contextual explanation, dictionary use, synonyms, antonyms, descriptive clarification, essential characteristics, and examples. Particular attention is given to practical work with synonyms, antonyms, polysemous words, homonyms, proverbs, and phraseological units as effective tools for strengthening students' expressive ability and speech culture. The article also emphasizes the importance of interactive methods, digital technologies, and teacher methodological competence in increasing lesson effectiveness and learner motivation. It concludes that systematic, purposeful, and innovative word-level instruction supports linguistic development and contributes to improving the quality of primary education and preparing learners for more independent, meaningful, and accurate language use in subsequent stages of schooling.*

Keywords: *word-level instruction, didactic foundations, innovative approach, vocabulary, synonyms, antonyms, speech development, communicative competence, interactive methods, pedagogical technologies, educational effectiveness, linguodidactics.*

Introduction

The normative-directive documents defining the content of the continuous education system of the Republic of Uzbekistan - including the Law on Education, Presidential Decree No. PQ-4623 on Further Development of the Pedagogical Education Sector, Presidential Decree No. PF-6079 approving the "Digital Uzbekistan–2030" Strategy and measures for its effective implementation, speeches and works of the President of the Republic of Uzbekistan regarding teachers and the improvement of education, resolutions of the Government of the Republic of Uzbekistan, and orders of the Ministries of Higher and Secondary Specialized Education and of Preschool and School Education - along with pedagogical and psychological sources related to the topic, constitute the documentary basis of this study.

Explaining the meanings of words enriches students' vocabulary and promotes speech development. The terminology of subjects taught in primary grades is also included among words whose meanings must be clarified. Explaining the meaning of a term helps students gain a thorough understanding of the concept it denotes. For example, by explaining the meaning of the term "subject" (predmet), students learn that it is used broadly - that all objects, phenomena, and concepts in nature are called subjects. This helps them quickly grasp terms such as noun, adjective, numeral, and verb. Explaining word meanings should take very little time and must not distract students' attention from the main topic of the lesson. To this end, the teacher, while preparing for

each lesson, identifies words whose meanings need to be clarified, selects the most convenient method of explanation, and determines at which point in the lesson the clarification should occur. Certain words appearing for the first time in reading texts - words students do not know - are explained before reading the text. Interrupting the reading process to explain word meanings should be avoided. If it becomes necessary to clarify a word during reading, a brief explanation is given without distracting students' attention from the content of the text.

Literature Review

T. G. Ramzayeva developed a methodological system for word-level instruction in primary school native language lessons, substantiating ways to enhance students' verbal activity through work with synonyms, antonyms, and homonyms [9].

Research devoted to the lexical-semantic features of words has been conducted by linguists such as V. V. Vinogradov [10] and N. M. Shanskiy [11], whose works contributed to establishing the scientific foundations of word-level instruction in native language education.

Uzbek scholars have also extensively addressed the issue of developing primary school students' speech and working with vocabulary. In particular, the research of A. Gulomov [8], N. Mahmudov [12], H. Nematov [13], R. Qo'ng'urov [14], and Sh. Rahmatullayev [15] provides in-depth analysis of vocabulary enrichment, speech culture formation, and work with lexical units.

In the field of primary education methodology, the scholarly works of S. Matchonov [16], B. Xodjayev [17], M. Abdullayeva [18], and Z. Ismoilova [19] have developed effective methods and techniques for speech development in native language lessons, illuminating the didactic potential of word-level instruction.

Figurative words used in a transferred sense and artistic speech units are explained after the text has been read, since their meaning is best understood from the content and context of the text. This is especially true when reading fables: allegorical and figuratively used words cannot be explained before or during the reading of the work.

Research Methods

In many cases, a student may know the meaning of a word yet rarely use it in speech. To overcome this, practical exercises are highly effective: replacing a specific word in a text with its synonyms, related words, or antonyms, and finding and inserting an appropriate word in place of ellipses in accordance with the meaning [8, p. 313].

Methodology employs the following techniques for explaining words:

1. Contextual explanation**.** Here, the unfamiliar word is explained through a sentence (or text) containing words familiar to the students.

2. Dictionary-based explanation**.** The word's meaning is clarified using a dictionary or the annotations provided beneath the text in reading books. It is essential to train students to use annotations independently and to derive word meanings on their own.

3. Explanation through synonyms**.** For example: sabo - shabada (breeze), mudofaa - himoya (defense), sozanda - musiqachi (musician), diyor - vatan (homeland), inshoot - bino (building), samo - osmon (sky). When explaining a word by selecting a synonym, its stylistic significance must also be indicated.

4. Explanation through contrast (antonyms). An unfamiliar concept is explained by comparing it to a familiar concept - its antonym. For example, the concept of "industrious" (ishchan) can be explained by contrasting it with "lazy" (dangasa); the word "truthful" (rostgo'y) by contrasting it with "liar" (yolg'onchi). Words and phrases used in a figurative sense, figures of speech, and proverbs may also be explained using the contrast method.

5. Paraphrase (descriptive explanation). The explanation must be brief and precise. For example: o'zboshimchalik - acting entirely according to one's own will, doing things as one pleases; mutaxassis - a specialist in a particular craft; shunqor - a far-flying, sharp-sighted bird; mesh - a vessel made from cattle hide; guldon - a vessel used to hold flowers.

Some words are explained by describing their function. For example: kombayn (combine harvester) - an agricultural machine that simultaneously reaps, threshes, and cleans grain; ekskavator (excavator) - a machine that simultaneously digs soil and loads it onto a truck; aerodrom (aerodrome) - a place where aircraft are parked, take off, and land.

6. Explanation through essential characteristics. For example: yantoq - a thorny, needle-like plant growing in arid areas; akula (shark) - a very large predatory fish living in the oceans.

7. Explanation through examples. Words expressing ethical or abstract concepts are explained by analyzing the actions of a literary character with the relevant moral quality from a work students have studied [1].

Working on the explanation of word meanings enriches students' vocabulary and promotes fluency of speech.

Work on Synonymous Words

Synonymous words (synonyms) are words that differ in form and spelling but express one shared concept (meaning). Synonyms differ from one another in terms of additional semantic nuances, emotional coloring, and usage. Among the words forming the synonymic series katta, ulug', buyuk, zo'r, azim, ulkan, bahaybat, haybatli, yirik, gigant (all broadly meaning 'large/great'), the word katta conveys a broad concept and can be used with reference to both concrete and abstract notions. Ulug', buyuk, zo'r, and azim are used for things of considerably large size; bahaybat and haybatli refer to things of enormous dimension. Yirik is used infrequently. Gigant belongs to the literary register and is primarily used in relation to locations and construction projects.

Synonyms enrich the language lexically; therefore, working with such words is of great importance. The more synonyms a person has in their vocabulary, the greater their expressive capacity in language.

Uzbek is a language rich in synonyms. The Explanatory Dictionary of Uzbek Language Synonyms lists 11 synonyms for the word katta (large) and 13 synonyms for the word marta (time/occasion) [2].

In primary grades, no theoretical information about synonyms is provided; however, an understanding of synonyms is developed through practical exercises. Work with synonyms begins at an elementary level in Grade 1, where students learn to find the synonym of a given word and explain how it can be said differently. In Grades 2 and 3, students are taught to find and produce 2–3 synonyms for a given word.

The following types of exercises with synonymous words are used in primary grades:

1. Grouping given synonymous words. Two synonymic series belonging to the same part of speech are presented, with one or two additional unrelated words mixed in. Students sort the synonyms into two groups. Words may be presented as follows: vatan, maqsad, diyor, niyat, mamlakat, murod, yurt.

2. Selecting a synonym for a given word. The teacher provides the words osmon (sky) when teaching nouns, mazali (delicious) when teaching adjectives, and ko'nikmoq (to get used to) when teaching verbs. Students select synonyms: osmon - ko'k, samo, falak; mazali - lazzotli, laziz, totli; ko'nikmoq - o'rganmoq, odatlanmoq, odat qilmoq.

3. Copying the text by inserting missing synonyms. The synonyms to be written are provided in a list for reference. Students insert each synonym in its appropriate place and explain the difference in their usage.

4. Copying sentences by selecting the most appropriate synonym. A series of synonyms is given in parentheses; the student selects the one that fits the meaning of the sentence and copies it: Daryo suvini (bahor, ko'klam) toshirar, odam qadrini (mehnat, ish) oshirar. Oltin (o't, olov, alanga)da, odam (ish, mehnat)da bilinadi. Birlashgan (yov, dushman)ni qaytarar.

5. Composing didactic material using synonymic series and practicing with it. Four synonymic series are selected and their words are arranged randomly in 16 cells. The teacher says one word - for example, chiroyli (beautiful) - and students find a synonym in the cells: go'zal, dilbar, sohibjamol, husndor. Students then form word combinations: chiroyli shahar (beautiful city), go'zal manzara (beautiful scenery), sohibjamol malika (beautiful princess), etc.

Work on Words with Opposite Meanings

Words that express contrasting, opposite meanings are called antonyms. Antonyms are most commonly found among words denoting qualities and attributes. Antonymic relations can also exist between a word and a phraseological unit (e.g., yalqov - yuragida o'ti bor, meaning 'lazy' vs. 'energetic').

Primary school students are introduced to antonyms through practical activity. Work with antonyms begins with identifying antonyms in a text, followed by specialized exercises:

1. Selecting an antonym for a given word. For nouns: azob–..., do'stlik–..., oq–..., yoshlik–...; for adjectives: dangasa–..., anqov–..., rostgo'y–..., dono–..., kasal–...; for verbs: kasallandi–..., yondi–..., boshladi–.... Students pair each word with its antonym: rohat, dushmanlik, qora, qarilik (for nouns); mehnatkash, hushyor, yolg'onchi, nodon, sog' (for adjectives); sog'aydi, o'chdi, tugatdi (for verbs).

2. Composing sentences using antonyms. The teacher provides a word for constructing a sentence with an antonym; students select the antonym and compose sentences using both words.

3. Finding and inserting antonyms in given sentences. The teacher provides sentences such as: "To'g'ri odam ... so'zdan or qilur. Yosh kelsa ishga, ... ketsa oshga. Yaxshi gap - moy. ... gap - loy. Gapni oz so'zla, ishni ... ko'zla." Students find the antonym that fits the meaning of each sentence and read (or write) the completed sentence.

Enriching students' vocabulary with synonymous and antonymous words helps them express their thoughts precisely, fluently, and expressively.

Work on Polysemous and Homonymous Words

Students frequently encounter polysemous words, but often do not fully realize that such words carry multiple meanings. In the process of working on literary texts, the teacher gradually introduces students to words used in a figurative sense, helping them understand that certain words can carry several meanings. Specialized exercises are also employed:

1. Comparing the meanings of words in word combinations: soat yurdi (the clock moved), poyezd yurdi (the train moved), ukam yurdi (my brother walked); tosh yo'l (stone road), tosh yurak (heart of stone); kumush qoshiq (silver spoon), kumush osmon (silver sky), kumush qish (silver winter).

2. Reading sentences and identifying the meanings of highlighted words: Bu yil yoz issiq bo'ldi. (This year summer was hot.) / Sen o'rtoging'a xat yoz. (Write a letter to your friend.)

In primary grades, no theoretical information is provided on polysemous and homonymous (homonym) words; rather, preparatory groundwork is laid for forming these concepts.

Proverbs play a significant role in enriching students' speech. Proverbs are highly convenient material for reading, conversation, storytelling, grammatical analysis, and writing. They are concise, meaningful, and expressive; they cultivate students' aesthetic sensibility, teach careful attention to language, promote correct and logical thinking, and hold an important place in aesthetic education.

Students read proverbs and connect them to the moral themes of the text they have studied and to life situations, explaining their figurative meaning and the meanings of specific words and expressions. As a result, students begin to use proverbs appropriately in context.

Proverbs are used as conclusions to literary works and help students grasp the meaning of many texts. Taking this into account, the teacher uses varied exercises with proverbs to practically instill in students an understanding of the figurative and polysemous nature of words.

The use of phraseological units (idioms) in speech enhances its expressiveness and artistic quality. In everyday life, we constantly employ various phraseological expressions. Below is an analysis of several examples:

"Boshida yong'oq chaqmoq" - This frequently used idiom means to take revenge on someone, to settle scores. For example: "Hali qarab turgin, naq boshinda yong'oq chaqmasammi…" [4, p. 17].

"Aqldan ozmoq" [4, p. 29] - means to lose one's mind, to go mad. Its variants include "fahmi yetadi" and "fahm-farosati yetadi." Examples: "Onang aqldan ozibdi, qizim, ol, yig'ishtirib qo'y bularni!" (I. Rahim, "Chin muhabbat"). "…lekin Salimov aqldan ozib, olti oy psixik kasalxonada yotib chiqqanidan xabari bor." (P. Qodirov, "Uch ildiz").

"Bel(i)ga tepmoq" [4, p. 36] - means to obstruct or hinder at an unwanted, unexpected moment. Its variants include "xalal yetdi" and "xalaqit bermoq." Example: "Shirin kampirxonimizning oldida meni qo'llab-quvvatlamasangiz, ikki gapning birida suhbatning beliga tepadiganga o'xshaydi." (M. Muhamedov, "Yurak so'zlari").

"Ichagi uzildi" [4, p. 114] - used to mean to laugh uncontrollably. Its variants are "ichagi uzilguday" and "ichagi uzilib." Example: "Hamma to'xtaganda ham, Pochchayev ichagi uzulguday bo'lib qah-qah otardi." (A. Muxtor, "Tug'ilish"). "Chipor ilonni ko'rgan odamlar o'rinlaridan turib ketishdi. Sohib bo'lsa ichagi uzilib xaholab kula boshladi." (Mirmuhsin, "Oq kamar").

"Kavushini to'g'rilab qo'ymoq" [4, p. 124] - another widely used idiom, meaning to dismiss or expel someone. Examples: "Kavushini to'g'rilab qo'yish kerak, qurilishni ham, kollektivni ham sariq chaqaga sotadi bu." (A. Muxtor, "Tug'ilish"). "Kavushini to'g'rilab qo'yaman men uni shu bugunoq." (A. Muxtor, "Opa-singillar").

Additional examples of phraseological units include: "kalavani uchini topmoq" (to find the end of the thread - to get to the bottom of something), "kapalagini uchirmoq" (to make someone's butterfly fly - to get on someone's nerves), "kekirdagini cho'zmoq" (to stretch one's gullet - to chatter endlessly), "kecha-kunduz demay" (without distinguishing day from night - working around the clock), "mijja qoqmay" (without blinking an eyelash - without hesitation), and "moy tomsa – yalagudek" (so clean you could lick it). We frequently hear these expressions in everyday oral speech. Their use in spoken language serves to intensify the force of the utterance.

Discussion

One of the factors that further amplifies the emotional power of a literary work, arouses strong interest in the reader, and broadens their imagination is the wider use of phraseological units. Among writers who placed particular emphasis on this is O'tkir Hoshimov. His works are distinguished by their thorough revelation of each character's not only external but also inner

world. A reader engaging with his works lives alongside the characters at every moment, breathes with them - weeps with them when needed, sharing their joys and sorrows. In descriptions of nature, the reader feels as though they have literally been transported to the depicted place. While reading Hoshimov's works such as "Ikki eshik orasi", "Bahor qaytmaydi", "Dunyoning ishlari", and "Tushda kechgan umrlar", one encounters numerous phraseological units [5, p. 28]. Upon close examination, some idioms appear in their original form, while others are found in modified variants.

"Pinakka ketmoq" - this idiom is used to mean to fall asleep or to become lost in thought [6, p. 10]. "Alimardon yaproqlarning pirpirab uchishini tomosha qila-qila pinakka ketdi…" In Sh. Rahmatullayev's dictionary, similar expressions include "ko'zi ketibdi" and "ko'zi ilinibdi."

"Damini rostlamoq" - meaning to pause and catch one's breath, to rest [4, p. 207]. Its synonym is the idiom "nafasini rostlamoq." An example from "Bahor qaytmaydi": "…Onam 'oq o'rab' kelganidan beri quda tomonni og'zidan bol tomib maqtaydi...", "Matematika o'qituvchisi Xakimov katta tanaffusda og'zidan bol tomib yaponlarni maqtabdi..." [6, p. 7].

If we pay close attention to most phraseological units, we observe that they originally consisted of separate, independent words in the language. Over time, through their constant use in fixed communicative patterns, they gradually merged into single unified units - phraseological units. As the language actively develops, the positions of certain words within phraseological expressions are replaced by other words. For example, the word salla (turban) in the idiom "sallani ol desa, kallani olmoq" (asked for the turban, takes the head) has undergone change over time, and since salla is now an archaic word, do'ppi (skullcap) is used in its place: "do'ppini ol desa, kalla olmoq."

The method must be chosen in such a way that the student can feel at ease, express thoughts fluently, and achieve thorough mastery of the topic. It is known that there are currently more than one hundred types of interactive methods, the majority of which have been tested and shown to yield strong results.

Conclusion

In conclusion, systematic and purposeful word-level instruction in primary school native language lessons constitutes an important didactic factor in expanding students' vocabulary, developing their oral and written speech, and forming independent and logical thinking skills. Lessons oriented toward teaching the meaning, form, scope of use, and stylistic features of words serve to develop students' communicative competence.

The innovative pedagogical approaches, interactive methods, and digital educational tools analyzed in this article were shown to enhance the effectiveness of word-level instruction and to promote greater student engagement and motivation in the learning process. At the same time, it was emphasized that the teacher's methodological proficiency, the organization of the lesson in accordance with contemporary educational requirements, and consideration of students' age and individual characteristics are among the primary conditions for achieving high results.

In the future, the broader application of digital technologies, artificial intelligence-based educational tools, and competency-based approaches in refining word-level instruction methodology will serve to improve the quality of primary education and to further develop students' linguistic competence.

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CONCEPTUAL FRAMEWORK FOR THE TARGET-BASED DEVELOPMENT OF PATRIOTIC EDUCATION OF FUTURE TEACHERS IN THE CONTEXT OF HIGHER EDUCATION IN THE NEW UZBEKISTAN

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Abstract. *This article examines the conceptual framework for the targeted development of patriotic education among future teachers in higher education institutions of New Uzbekistan. The study emphasizes that patriotic culture should be formed through a systematic pedagogical process that integrates goals, content, methods, resources, and organizational forms. Special attention is given to the role of universities in developing students' civic responsibility, national identity, moral values, and readiness for educational work. The article discusses theoretical approaches to patriotic education, including competency-based, humanistic, personality-oriented, cultural, and activity-based perspectives. It also highlights the importance of classroom instruction, extracurricular activities, discussion clubs, museums, educational projects, and professional practice in strengthening patriotic consciousness. The findings suggest that future teachers should act both as objects and subjects of patriotic education. Developing their patriotic culture is essential for preparing socially responsible, morally mature, and professionally competent educators.*

Keywords: *patriotism of New Uzbekistan, professional competencies, object and subject of the higher education system, future teacher, patriotic culture.*

INTRODUCTION.

The strategy for further development of New Uzbekistan, "Improving the quality and effectiveness of higher education institutions through the implementation of international standards for assessing the quality of education and training"[1], as well as measures to further improve the field of pedagogical education, set such important tasks as "Development of modern teaching staff with a high level of culture, practical professional skills and a deep understanding of educational, methodological and assessment criteria"[2]. This requires clarification of the pedagogical and psychological characteristics of preparing students for educational activities, improvement of organizational and pedagogical conditions, as well as information and methodological support.

Developing spiritual and moral qualities in students at higher education institutions is a multifaceted and complex process. Spiritual and moral education requires the systematic and consistent implementation of comprehensive educational work, which is inextricably linked and mutually beneficial. Only a clear and comprehensive system of educational interventions, a holistic, systemic approach, ensures effective education.[4]

Today, reforms in the education system are radically changing the requirements for teachers. In particular, the training of future teachers not only as specialists imparting knowledge,

but also as educators, mentors, and public figures is becoming increasingly important. Therefore, the use of modern approaches in preparing them for educational work is a pressing issue.

The targeted development of patriotism in future teachers is achieved through engaging future teachers in active patriotic activities at the university, taking into account their gradually emerging internal, individual needs.

The driving force behind the development of patriotic culture is the demands that New Uzbekistan places on modern teachers. The development of patriotic culture in future teachers is a specially organized process within the university's patriotic educational environment, with clearly defined goals and objectives for all subjects in the higher education system. By "development," we mean the process and result of the future teacher's interaction with a range of objective, subjective, targeted, and spontaneous external influences. This leads to changes in their system of characteristics and is a manifestation of their qualities under the influence of specially created pedagogical conditions.

DISCUSSION OF RESEARCH ISSUES AND LEVEL IN NEAR ABROAD

More precisely, the concept in education is considered as a combination of various professional, thematic theoretical views on the idea of a "main criterion or project" and the attitudes toward it from various positions. They unite a very general (educational, cultural, social) meaning of the project, its purpose, and the definition of the final result for the specific implementation of the author's concept.

The concept of developing a patriotic culture in future teachers is based on the provisions of two concepts, which serve as the criteria for the theoretical justification of a new approach to patriotic education from the perspective of developing a patriotic culture in the individual. These concepts are the education of student youth and the theory of culture, presented by I.M. Ilyinsky, P.I. Babochkin, V.T. Lisovsky, A.I. Machulsky, I.I. Dark, V.E. Davidovich, L.N. Kogan, and A.N. Leontiev [5].

In their concept, I.M. Ilyinsky and P.I. Babochkin demonstrate the unity of cultivating patriotism, ideological orientation, and national sentiment in the individual. The authors see this unity as the key to the future unity of nations. They identified the most important qualities to be cultivated: honor, duty, discipline, loyalty, and selflessness. This concept focuses on the ideological aspect of fostering patriotism and developing a sense of national identity in young people [3].

The second concept of student education by V.T. Lisovsky, A.I. Machulsky, and I.I. Dark, which expresses the approach in the aspect of interest to us, emphasizes the unity of fostering patriotism, a sense of national identity, and an individual's legal consciousness.

This position is expressed in the following content: effective methods of development include the targeted development of such qualities in students as love for their homeland, kindness and generosity of nature, high moral standards, determination, a desire for action, perseverance in trials, self-sacrifice, a willingness to survive in difficult times, the ability to defend oneself, justice, and correctness. The authors also emphasize that the position of patriotic activity among university students is, first of all, freed from the manifestation of a sense of responsibility for the effectiveness of the system of which they are subjects.

The development of patriotic activity in future specialists directly depends on the development of personal responsibility for everything that happens at the university, students' active participation in self-governance, a sense of responsibility for their career choices, an

understanding of the social significance of their current and future work, and a desire and willingness to act.

In their theory of culture, A.N. Leontyeva, V.E. Davidovich, and L.N. Kogan present culture as a method of personal activity characterized by creative self-realization.

Comparing the essence of these conceptual approaches with our views, we can say that in the latter case, attention should be paid to the student's socio-patriotic activity and their proactive stance.

Today, one of the most pressing problems in our pedagogy is the creation of criteria that reflect a modern understanding of the process of preparing future teachers to educate schoolchildren in the spirit of patriotism and incorporate new works that reveal theoretical and methodological approaches

to the formation of patriots who will create a bright future for the New Uzbekistan.

Based on these, the theoretical foundations of this problem are defined and its practical solution is presented.

The concept represents a systematic and consistent presentation of the foundations, goals, objectives, functions, scientific approaches, principles, and mechanisms for implementing patriotic education in future teachers, as well as the conditions for shaping the education of young people toward big dreams, a new realization of the vision of the future of the New Uzbekistan, and criteria, results, and forecasts for improving this process.

The objectives are achieved through a range of activities conducted both in and outside the classroom.

The objectives of patriotic culture: - regulatory - ensuring the construction of relationships within the "Teacher-Student" system in a multinational society based on tolerance and self-determination; - educational - promoting the intellectual development of future teachers, the assimilation of moral norms, universal and national values, and the development of a conscious and active attitude toward professional activities in the field of patriotic education; - cognitive - equipping future teachers with a system of scientific knowledge necessary to instill in students a patriotism for the New Uzbekistan, ensuring historical continuity, accumulating experience, and developing a system for its transmission from generation to generation.

It should be noted that the cognitive function of patriotic culture is realized in three stages.

The first manifests itself in the context of family upbringing, where initial feelings of love for the Motherland, responsibility, and respect for traditions are formed, and universal human values are assimilated.

The second stage involves the continuity of the socio-historical experience gained at the university. At this stage, the professional and pedagogical qualities necessary for the effective implementation of patriotic teaching activities are developed.

The third stage emphasizes the role of future teachers in transmitting their personal needs to the next generation.

At the university, especially in the pedagogical field, the following scientific approaches are used to develop the patriotic culture of future teachers: competency-based, cognitive-informational, systematic-activity-based, humanistic, subjective, rationalistic, personality-oriented, cultural, hermeneutic, and integrative.

However, achieving concrete results is difficult if the above factors are not taken into account when developing each student's personal competence. Principles for developing personal competence: general pedagogical:

• fundamentalist, • continuity, • humanistic focus;

• the principle of aggregative activity, which implies the unity of activity of all subjects of the university educational field in solving the problems of patriotic development;

• the principle of differentiation of the educational system's content, aimed at selecting historical and cultural values designed to shape the patriotic and active position of pedagogical specialists, university faculty, and future teachers;

• the principle of determining the behavior of future teachers, which implies the design and construction of a patriotically oriented university educational field with the goal of stimulating their patriotic behavior;

• the principle of patriotically dominant activity, which includes the conscious participation of future teachers in patriotically oriented activities.

ANALYSIS RESULTS

The analysis revealed that the process of developing patriotism among future teachers should be considered an independent and holistic pedagogical system that integrates interconnected goals, content, methods, resources, and organizational forms. Such a system is aimed not only at providing knowledge about national values and civic responsibilities but also at fostering patriotic consciousness, emotional attachment to the homeland, social responsibility, and readiness for professional activities related to patriotic education.

From a methodological perspective, the development of patriotism is ensured through the application of various teaching methods. Reproductive methods contribute to the acquisition and reinforcement of knowledge related to national history, culture, and traditions. Analytical methods encourage students to critically examine social and historical events, allowing them to form their own civic positions.

Discussion-based methods create opportunities for expressing opinions, defending viewpoints, and developing communicative competence. Problem-solving methods stimulate independent thinking and active participation in addressing social and civic issues, thereby strengthening patriotic beliefs and values.

An important component of the system is the effective use of educational resources. The study showed that discussion clubs, patriotic campaigns, museums, libraries, extracurricular activities, specialized courses, and educational projects create favorable conditions for the development of patriotic culture. In addition, teaching materials, methodological guides, lecture packages, monographs, dictionaries, practical training programs, and curricula serve as valuable resources that support both theoretical understanding and practical application of patriotic values.

The analysis also demonstrated the significance of diverse organizational forms in the development of patriotism. Classroom instruction provides a foundation for acquiring systematic knowledge, while extracurricular activities allow students to apply patriotic values in real-life situations. Individual work promotes self-reflection and personal responsibility, whereas group and paired activities encourage cooperation, mutual support, and collective problem-solving. Furthermore, seminars, binary lectures, independent study, professional internships, and advanced training programs contribute to the formation of professional competencies necessary for implementing patriotic education in future pedagogical practice.

The findings suggest that the effectiveness of patriotic development increases when methods, resources, and organizational forms are integrated into a unified pedagogical system. Such integration enables future teachers to develop not only knowledge and skills but also stable

patriotic attitudes, civic responsibility, and professional readiness to educate younger generations in the spirit of patriotism and national values.

CONCLUSION

The results of the study indicate that the formation of patriotic culture among future teachers is a multifaceted pedagogical process that requires a systematic and scientifically grounded approach. Modern higher education institutions should not limit themselves to defining a set of requirements and competencies for future teachers as educators of patriotic values. Rather, they must establish comprehensive mechanisms for assessing and monitoring the development of students' patriotic consciousness, civic responsibility, national identity, moral convictions, and readiness to carry out educational activities aimed at fostering patriotism among younger generations.

Practical experience demonstrates that the effectiveness of patriotic education largely depends on the extent to which future teachers internalize patriotic values and transform them into personal beliefs and professional principles. Therefore, teacher training programs should incorporate not only theoretical knowledge related to patriotism and civic education but also practical activities that encourage students to participate in socially significant projects, community service, cultural initiatives, and educational events aimed at strengthening national values and social responsibility.

In the process of developing patriotic culture, future teachers act simultaneously as both objects and subjects of education. As objects, they acquire knowledge, values, attitudes, and behavioral norms associated with patriotism. As subjects, they actively contribute to the preservation, promotion, and transmission of these values within educational and social environments. By assuming an active subjective position, future teachers demonstrate a conscious patriotic attitude toward socially significant activities, particularly those related to the patriotic upbringing of students and the strengthening of civic engagement.

Furthermore, the development of patriotic views, beliefs, and value orientations among future teachers should be considered one of the key indicators of their professional and personal maturity. A well-developed patriotic culture enhances their ability to educate students in the spirit of respect for national traditions, cultural heritage, social solidarity, and responsibility toward society and the state. It also contributes to the formation of leadership qualities, ethical behavior, and active citizenship.

Thus, the formation of patriotic culture in future teachers should be regarded as an essential component of professional teacher education. Strengthening this process through innovative pedagogical approaches, value-oriented educational technologies, and meaningful practical experiences will contribute to preparing highly qualified specialists who are capable of effectively carrying out patriotic education and fostering socially responsible, nationally conscious, and morally mature younger generations.

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DEVELOPING CREATIVITY IN MUSIC LESSONS FOR PRESCHOOL CHILDREN

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Abstract. *This article examines the pedagogical significance of developing creativity in music lessons for preschool children. The study highlights the role of various musical activities, including singing, listening to music, rhythmic movements, musical games, and improvisation, in fostering children's creative abilities. It is argued that properly organized music lessons contribute to the development of imagination, independent thinking, emotional expression, and aesthetic perception. The article also emphasizes the importance of considering children's age-specific and individual characteristics when planning musical activities. The findings suggest that integrating creative tasks into music education creates favorable conditions for enhancing preschool children's creative potential and supports their overall personal development.*

Keywords: *preschool education, music lessons, creativity, creative abilities, musical activities, musical improvisation, aesthetic education, imagination, emotional development, preschool children, pedagogical approach.*

INTRODUCTION.

In recent years, the development of creativity has become one of the key priorities of modern preschool education. Rapid social, technological, and cultural changes require individuals who are capable of thinking independently, generating original ideas, and adapting to new situations. Therefore, fostering creativity from an early age has become an important objective of educational systems worldwide. Preschool childhood is considered a particularly sensitive period for the development of imagination, creative thinking, emotional responsiveness, and self-expression, making it essential to provide children with educational experiences that nurture these abilities.

Among the various means of supporting children's creative development, music occupies a special place. Music lessons offer unique opportunities for children to express their emotions, explore their imagination, and engage in creative activities in an enjoyable and meaningful way. Through singing, listening to music, rhythmic movements, musical games, and improvisation, children actively interact with musical experiences that stimulate both cognitive and emotional development. Such activities not only contribute to the acquisition of musical skills but also encourage creativity, independence, and self-confidence.

Contemporary pedagogical research emphasizes that music education in preschool institutions should go beyond the transmission of basic musical knowledge and skills. Instead, it should create conditions that allow children to experiment, explore, and express themselves creatively. Creative music activities help children develop original thinking, problem-solving abilities, and aesthetic sensitivity, which are important components of overall personality development.

Furthermore, the effectiveness of creativity development in music lessons largely depends on the pedagogical approaches used by educators. The selection of appropriate teaching methods, the integration of creative tasks, and the consideration of children's individual and age-related characteristics play a significant role in creating a supportive learning environment. When music lessons are organized in a child-centered and interactive manner, they become an effective tool for enhancing creative potential and promoting holistic development.

In this context, investigating the pedagogical possibilities of developing creativity in music lessons for preschool children is of both theoretical and practical significance. The study of effective methods and approaches for integrating creativity into music education can contribute to improving the quality of preschool education and fostering the comprehensive development of young learners.

LITERATURE REVIEW.

The growing attention to creativity development in preschool education has led researchers to explore various pedagogical approaches that support children's creative potential. As noted in the previous discussion, music lessons provide a favorable environment for the development of imagination, emotional expression, and creative thinking. Therefore, the issue of fostering creativity through musical activities has become an important subject of both theoretical and practical research in the fields of preschool pedagogy, psychology, and music education.

The scientific literature demonstrates that creativity is viewed as one of the essential components of a child's overall development. Researchers such as Sir Ken Robinson, Teresa Amabile, and Howard Gardner emphasize that creativity should be nurtured from early childhood through educational experiences that encourage exploration, experimentation, and self-expression. Their studies suggest that artistic activities, particularly music, play a significant role in stimulating children's creative thinking and developing their ability to generate original ideas.

Within the field of music education, numerous scholars have highlighted the relationship between musical activities and creativity development. Contemporary studies indicate that singing, listening to music, rhythmic exercises, movement activities, and musical improvisation contribute to the enhancement of children's imagination, divergent thinking, and emotional responsiveness. Researchers argue that music lessons provide opportunities for children to express their feelings freely, create musical images, and engage in creative problem-solving processes.

Recent pedagogical studies also emphasize the importance of child-centered approaches in music education. According to modern educational theories, creativity develops most effectively when children are actively involved in the learning process rather than acting as passive recipients of information. In this regard, interactive musical games, collaborative performances, and improvisational tasks are considered effective tools for promoting creative engagement and independent thinking.

A review of contemporary research allows the identification of two major directions in studying creativity development through music lessons. The first direction focuses on the psychological mechanisms of creativity formation. Researchers within this perspective examine how musical activities influence children's imagination, emotional intelligence, attention, memory, and creative thinking. Their findings suggest that music stimulates cognitive and emotional processes that are closely associated with creative behavior.

The second direction concerns the pedagogical potential of music education. Studies within this framework analyze how teaching methods, educational environments, and instructional strategies can be designed to foster creativity. Researchers emphasize that well-structured music

lessons not only develop musical abilities but also contribute to broader personal qualities such as independence, self-confidence, initiative, and creative self-expression.

Furthermore, recent studies in preschool education highlight the importance of integrating creative tasks into all forms of musical activity. Activities such as musical storytelling, role-playing, improvisation, movement interpretation, and collaborative musical performances are considered particularly effective in creating conditions for creative development. These approaches encourage children to move beyond simple reproduction of learned material and engage in original and meaningful creative experiences.

Overall, the analysis of scientific literature demonstrates that music lessons represent a powerful pedagogical means for developing creativity in preschool children. The findings of both psychological and pedagogical studies support the view that creativity can be effectively fostered through carefully organized musical activities that take into account children's developmental characteristics, interests, and individual abilities. Therefore, further investigation of innovative methods and strategies for integrating creativity into preschool music education remains an important area of educational research.

RESEARCH APPROACH

Building upon the findings of the literature review, this study examines the pedagogical potential of music lessons in fostering creativity among preschool children. The research is based on the assumption that creativity is not an innate quality that develops independently but a competence that can be stimulated and enhanced through purposeful educational experiences. Within this context, music education is viewed as an effective medium for encouraging children's imagination, self-expression, and creative thinking.

The study adopts a pedagogical perspective that considers music lessons as an integrated developmental environment where children actively engage in various forms of musical activity. Particular attention is given to singing, music listening, rhythmic movements, musical games, and improvisation, as these activities provide opportunities for children to explore ideas, express emotions, and create original responses to musical stimuli. Rather than focusing solely on the acquisition of musical knowledge and skills, the research emphasizes the role of music lessons in supporting broader creative development.

In examining the relationship between music education and creativity, the study also takes into account the age-specific and individual characteristics of preschool children. At this stage of development, children are naturally inclined toward exploration, fantasy, and spontaneous expression. Therefore, educational activities that encourage experimentation and active participation are considered especially valuable. From this perspective, music lessons become a space where children can develop confidence in their own ideas and learn to express themselves creatively in a supportive environment.

The research further assumes that creativity develops most effectively when children are provided with opportunities for independent action, imagination, and artistic exploration. Consequently, the study focuses on pedagogical practices that promote children's active involvement and creative initiative throughout the learning process.

DISCUSSION

The analysis of theoretical sources and pedagogical perspectives confirms that music lessons create favorable conditions for the development of creativity in preschool children. Musical activities stimulate children's imagination, enrich their emotional experiences, and encourage them to express their thoughts and feelings in original ways. As a result, music

education contributes not only to artistic development but also to the formation of creative thinking skills that are essential for lifelong learning and personal growth.

The discussion suggests that different forms of musical activity influence various aspects of creativity. Singing helps children develop emotional expressiveness and confidence in communication, while rhythmic movements encourage imaginative thinking and creative interpretation. Listening to music broadens children's aesthetic perception and enables them to construct mental images based on musical experiences. At the same time, musical games and improvisational activities provide opportunities for experimentation, originality, and independent decision-making. An important finding emerging from the analysis is that the effectiveness of music lessons largely depends on the pedagogical strategies employed by educators. Traditional approaches that focus primarily on repetition and imitation may support the development of basic musical skills, but they often provide limited opportunities for creative expression. In contrast, child-centered and interactive approaches encourage children to participate actively, explore alternative ideas, and engage in creative problem-solving processes. Furthermore, the findings indicate that creativity flourishes in educational environments where children feel psychologically secure and are encouraged to express their individuality. When teachers value children's ideas, support experimentation, and create opportunities for creative exploration, preschoolers become more willing to take initiative and demonstrate originality in their responses. Overall, the discussion highlights that music lessons represent a powerful pedagogical tool for fostering creativity during early childhood. By integrating creative tasks, improvisational activities, and interactive learning experiences into music education, educators can contribute significantly to the development of imaginative, confident, and creative young learners.

RESULTS. The analysis of theoretical and pedagogical sources revealed that music lessons play a significant role in fostering creativity among preschool children. The findings indicate that musical activities provide a supportive environment for the development of imagination, emotional expression, independent thinking, and creative self-realization. Unlike traditional instructional approaches that emphasize memorization and reproduction, creative music activities encourage children to explore, experiment, and generate original ideas. The study further demonstrates that various forms of musical activity contribute to creativity development in different ways. Singing enhances emotional expression and communication skills, while rhythmic movements stimulate imagination and creative interpretation. Music listening activities enrich aesthetic perception and help children construct mental images, whereas musical games and improvisation encourage originality, flexibility of thinking, and creative initiative. The results also suggest that creativity development is closely connected with the pedagogical organization of music lessons. Educational environments that support active participation, experimentation, and self-expression create more favorable conditions for creative growth than teacher-centered approaches focused primarily on performance and repetition.

The key findings of the study are summarized in Table 1.

Table 1. Contribution of Musical Activities to Creativity Development

Musical Activity	**Developmental Impact**	**Creativity Outcomes**
Singing	Emotional expression and communication	Self-confidence and creative expression

Music Listening	Aesthetic perception and imagination	Image creation and divergent thinking
Rhythmic Movements	Coordination and interpretation	Imaginative and creative responses
Musical Games	Social interaction and engagement	Creative participation and initiative
Improvisation	Independent thinking and experimentation	Originality and innovation

The analysis additionally revealed that creativity in preschool children develops most effectively when musical activities are integrated into a child-centered educational environment. Such an environment encourages curiosity, exploration, and active involvement in learning processes.

The broader educational outcomes identified in the study are presented in Table 2.

Table 2. Educational Outcomes of Creativity-Oriented Music Lessons

Area of Development	Observed Contribution of Music Lessons
Cognitive Development	Enhanced imagination, attention, and flexible thinking
Emotional Development	Improved emotional awareness and expression
Social Development	Better communication and collaborative skills
Aesthetic Development	Greater appreciation of music and artistic experiences
Creative Development	Increased originality, initiative, and self-expression

The results confirm that music lessons represent a multifaceted pedagogical tool capable of supporting the holistic development of preschool children while simultaneously fostering their creative potential.

CONCLUSION

The findings of this study confirm that music lessons constitute an important component of preschool education and provide significant opportunities for the development of children's creativity. Through singing, music listening, rhythmic activities, musical games, and improvisation, children acquire experiences that stimulate imagination, emotional responsiveness, creative thinking, and self-expression.

The literature analysis and discussion indicate that creativity should not be viewed as an isolated ability but rather as a complex personal quality that develops through meaningful educational experiences. In this regard, music lessons create favorable conditions for children to explore ideas, express emotions, and engage in creative activities in ways that support their overall development.

The study also highlights that the effectiveness of creativity development depends largely on the pedagogical approaches employed during music instruction. Child-centered, interactive,

and creativity-oriented teaching strategies enable children to become active participants in the learning process and encourage them to demonstrate initiative, originality, and independent thinking. Consequently, music educators should move beyond traditional reproductive methods and incorporate more opportunities for improvisation, exploration, and creative expression.

Based on the findings, several recommendations can be proposed for improving creativity development in preschool music education:

1. Integrate improvisational and creative tasks into regular music lessons.
2. Create supportive learning environments that encourage experimentation and self-expression.
3. Utilize musical games and movement-based activities to stimulate imagination and creative thinking.
4. Consider children's individual interests, abilities, and developmental characteristics when planning musical activities.
5. Promote child-centered pedagogical approaches that value originality and creative participation.

In conclusion, music lessons serve not only as a means of musical education but also as an effective pedagogical instrument for nurturing creativity in preschool children. Strengthening the creative dimension of music education can contribute to the formation of imaginative, confident, and innovative individuals capable of adapting successfully to future educational and social challenges.

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STUDENTS' OPINIONS ON THE EFFECTS OF EDUCATIONAL TECHNOLOGIES ON OPTIONAL MODULES

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Abstract. *This research paper explores the opinions of students about the effectiveness of educational technology for their studies of optional modules. To have a better understanding of how technologies influence understanding of optional modules, attention was paid to benefits, challenges, and students' opinions on implementing them. The data was collected by using a questionnaire. The study demonstrated that educational technologies have several benefits for boosting the quality of education, despite some disadvantages in implementation. In conclusion, further research is recommended for a better understanding of integration issues.*

Keywords: *educational technology, students' opinions, optional modules, academic performance, university students.*

1. Introduction

1.1 Background Information

Over time, digital technologies have different effects on students' education and its quality. This highlights the importance of the correlation between innovations and learning systems. Educational technologies have improved students' understanding of subjects by providing opportunities and a more comfortable environment for their studies (Bereczki & Kárpáti, 2021; Cabaleiro-Cerviño & Vera, 2020; Henderson et al., 2017; Vitoria et al., 2018). However, the implementation of these technologies requires new teaching methodologies, which result in challenges for both teachers and students (Henderson et al., 2017; Bereczki and Kárpáti, 2021).

1.2 Specific Information

Technologies have influenced different fields of study, such as finance, economics, law, programming, and business (Grabińska et al., 2021; Sandybayev, 2020; Vitoria et al., 2018). Now, most universities present information interactively, using e-boards, projectors, and graphs. This approach enables students to enhance their understanding and engagement in the study (Cabaleiro-Cerviño & Vera, 2020). On the other hand, the technology integration has changed teachers' roles in this process, shifting their responsibilities more to instructing rather than educating (Cabaleiro-Cerviño & Vera, 2020; Sandybayev, 2020).

1.3 Aim

This study will examine students' perceptions on the importance of educational technologies for their academic performance at the Westminster International University in Tashkent (WIUT). This research also aims to investigate the role of educational technology in students' understanding of optional modules by considering the benefits and challenges of educational technology for their studies.

1.4 Scope

This research paper explains the opinions of the university students about opportunities provided by educational technologies. The information is beneficial for both students, educators and WIUT administration due to providing insights about possible technology implementations. We studied the CIFS level students' opinions of WIUT and received 52 responses.

2. Literature Review

2.1 Introduction

Educational technologies play a significant role both for students and teachers (Cabaleiro-Cerviño & Vera, 2020; Henderson et al., 2017; Sandybayev, 2020; Vitoria et al., 2018). The implementation of technologies enhances students' engagement in the learning process and provides additional opportunity for improving the understanding of the studies (Cabaleiro-Cerviño & Vera, 2020; Henderson et al., 2017; Stosic, 2015; Vitoria et al., 2018). In this literature review, the implementation of educational technologies for improving studying and teaching, its influence on understanding optional modules, and teachers' beliefs about the role of technologies will be covered.

2.2 Implementing Educational Technologies to Enhance Teaching and Learning

The implementation of educational technologies beneficially influences learners' educational performance and productivity. For example, educational technologies have several advantages to improve the quality of education by increasing students' involvement, positively affecting information reception, expediting the recognition process, and boosting understanding of material (Cabaleiro-Cerviño & Vera, 2020; Henderson et al., 2017; Vitoria et al., 2018). However, Henderson et al. (2017) found that varying considerably on institution, subject disciplines, and study levels, educational technologies have been proved inconsistent.

Smart learning environments and various technology-based approaches can facilitate the learning process. A number of studies highlight the use of educational technology as helpful for students due to allowing them to have independent access to multimedia materials, diagrams, and video lectures (Cabaleiro-Cerviño & Vera, 2020; Vitoria et al., 2018). Nevertheless, Sandybayev (2020) stated that digital technologies for learning are not able to fully replace traditional education because the role of educational technology is to change the interaction between teacher and student. Furthermore, educational technologies are useful to collect and evaluate information more effectively, as well as to develop creative thinking, collaborations, and communication skills (Bereczki & Kárpáti, 2021; Omirzak et al., 2022). Meanwhile, the research conducted by Henderson et al. (2017) suggests that the belief about students being digitally adapted is inaccurate.

2.3 Influence of Educational Technologies on Optional Modules

Studies show that educational technologies have impacted different fields of study. According to Grabińska et al. (2021), it is essential to integrate innovations in accounting and finance fields. Artificial Intelligence aspects, such as automation, biometrics, and cybersecurity surveillance should be taught at universities, leading to new changes in these fields. Meanwhile, in business classes, Sandybayev (2020) states that e-learning is more efficient than traditional educational practices. Moreover, to enhance students' motivation and willingness to work, platforms such as YouTube could facilitate a collaborative approach to learning through gaming (Sandybayev, 2020; Vitoria et al., 2018).

Technologies, particularly Blackboard Learn, increase students' interest, and motivate them to achieve higher results. Interaction is a key factor in e-learning that boosts the teaching and learning environment (Sandybayev, 2020). Additionally, Vitoria et al. (2018) suggest updating the development of e-education with the latest trends.

2.4 Teachers' Beliefs about the Role of Educational Technologies

The integration of educational technologies has led to different outcomes. Some studies have shown technologies as beneficial instruments, increasing students' productivity and results (Bereczki & Kárpáti, 2021; Cabaleiro-Cerviño & Vera, 2020), while others have revealed negative effects such as disruption and suppression of thinking (Bereczki & Kárpáti, 2021) or were unsure about the significance of technologies on education (Sandybayev, 2020). According to Bereczki and Kárpáti (2021), some studies explored teachers' beliefs that supported the concept of technology as a tool to improve students' creativity. Similarly, Cabaleiro-Cerviño and Vera (2020) found that e-learning expanded opportunities for students, which resulted in an increase in the quality of education. However, the findings by Sandybayev (2020) revealed that the main aspect of education was the learning outcomes of students, their abilities, understanding of the concepts, and knowledge, not the teaching methods and implementations of technologies.

Since technologies were integrated into education, they created new opportunities for students, which changed traditional ways of learning. Now, we can see that most university assignments are completed online, through different websites or applications, resulting in an improved learning process (Khanlarian & Singh, 2015). Additionally, the research by Stosic (2015) showcased that the application of educational technologies enabled students to follow their own pace of studying, repeat materials, watch online lessons for better understanding, and receive immediate feedback through performing tests. Together, these findings suggest that technologies positively impacted the process of education. Furthermore, Cabaleiro-Cerviño and Vera (2020) highlighted that educational technologies influenced teachers' roles and responsibilities and reduced classroom constraints.

The implementation of technologies has changed the role of a teacher. Teachers used to be seen as the sole source of knowledge; however, now they have the responsibilities of a facilitator (Cabaleiro-Cerviño & Vera, 2020). As per Sandybayev (2020), teacher responsibilities shifted to instruction and motivation, helping with the organization of studies, and resolving detected gaps, whereas students are now required to be more involved in the learning process, work with data, and develop skills for practical implementation.

2.5 Conclusion

The review of the existing literature demonstrated that digital technologies, depending on students' educational level and ability to apply them in their studies, have a positive impact on education. Also, educational technologies beneficially influence financial and business fields of study through engaging learning. Additionally, the literature review showed teachers' beliefs that the implementation of educational technologies has different effects on students' performance. Nevertheless, a significant gap exists in WIUT students' attitudes toward educational technologies' impact on the academic environment. As a result, this research explores WIUT students' opinions about the impact of how educational technologies influence understanding of optional modules.

3. Method

3.1 Overview

The main purpose of this section is to address the information about research participants, also provide information on how ethical considerations were followed and which research instrument was used.

3.2 Research Participants

In this research, the participants were CIFS level students of WIUT. The number of male participants was 31 (59.6%), while the number of female students who participated in this research was 21 (40.4%), consequently the total number of participants was 52.

3.3 Ethical Considerations

In the description part of the questionnaire, the participants were made aware of the aim of study and informed that all personal information would be kept anonymous. The questionnaire was developed by avoiding questions which could cause confusion or discomfort for participants.

3.4 Research Instrument

The quantitative research method was chosen for this study. The questionnaire was created in Google Forms and consisted of a description and 10 questions to gather necessary data for a deeper understanding of the research question. The types of questions used in the questionnaire were 3 demographic questions, 2 yes-no questions, 1 Likert scale question, 3 mixed type questions, and 1 open-ended. To distribute the questionnaire, several Telegram groups were used. For developing questionnaire questions, ChatGPT was used. For the literature review part, Poe AI tool was implemented to identify possible themes. The questionnaire was chosen since the aim of the study was to explore the perceptions of CIFS students on different optional modules. This approach enabled the collection of a larger size of data from various optional module students.

4. Results

4.1 Overview

The current research was conducted with 52 respondents to investigate students' perceptions on developing academic performance with educational technologies. The results section presents the most useful educational technologies, situations in which educational technologies were helpful, and challenges faced by students in integrating the educational technologies for their studies.

4.2 Students Perspectives on the Effectiveness of Educational Technologies

Table 1. Perceptions about the Helpfulness of Educational Technologies

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
25%	36.5%	34.6%	1.9%	1.9%

Table 1 provides information about students' perceptions on the statement "Educational technologies at WIUT have been helpful for a better understanding of my optional modules". For the purposes of this data set, student responses were classified into five levels of agreement. What stands out is that the percentage of people who agree (36.5%) and were neutral (34.6%) was almost the same. The next most common option was strongly agree, chosen by a quarter of the respondents (25%). Only 3.8% of participants disagreed with this statement.

4.3 Most Helpful Digital Tool for Understanding Optional Modules

Table 2. Most Useful Technology for Understanding Optional Modules

Computer	Wi-Fi	Turnitin	E-boards	Others
23.1%	55.8%	3.8%	11.5%	5.8%

The students were asked to comment on the helpfulness of technologies for their optional modules (See Table 2). The data illustrates the most used educational technologies at WIUT. Wi-Fi and computers were the most popular choices. To exemplify, more than half of the respondents

(55.8%) chose Wi-Fi as most beneficial for their studies, making it the most preferred technology for education. Computers were ranked second, receiving nearly a quarter of the votes (23.1%), twice as many as chose E-board (11.5%). Lastly, a small percentage of participants (9.6%) selected Turnitin, Intranet, and other learning tools.

4.4 Challenges Encountered in the Implementation of Educational Technologies

Table 3. Issues Associated with Using Educational Technologies

Struggle to adapt to the studies	Internet connection issues	Difficulties with access	Distractions while using	Others
21.2%	55.8%	44.2%	21.2%	3.8%

Students were asked to give their opinions about the challenges they encountered during the learning process while using educational technologies (See Table 3). The most frequently cited issue by students was *internet connection* problems. More than half of all respondents (55.8%) reported this challenge. Moreover, *difficulties with access* was chosen by 44.2% of respondents. *Struggling to adapt to the studies* and *distractions while using* were reported as equally important issues, at 21.2% for both options. Other specific problems were mentioned by 3.8% of respondents.

4.5 Effective Use of Educational Technologies in Varied Situations

Table 4. Beneficial Application of Educational Technologies in Different Situations

Group presentation	Completing coursework	Developing writing skills	Others
50%	65.4%	30.8%	1.9%

According to results shown in Table 4, students found educational technologies most beneficial in completing courseworks (65.4%). Also, the usefulness of digital technologies can be observed in the group presentations; half of all respondents chose it for its helpfulness (50%). Furthermore, 30.8% of participants used technologies for developing their writing skills.

4.6 Students Recommendations for Enhancing Educational Technologies

Table 5. Suggestions for Improving Educational Technologies Provided by Students

Improvements	**Example**	**n =**	**Percentage**
Access	More access to computers, more printers, make database easier to access	10	19.2%
Internet connection	Provide faster wi-fi, better level of internet	6	11.5%
Technological int'[[‘egration	Create more interactive activities, having quizzes in mobile app	5	9.6%
Tutorials	More tutorials and materials for visual programming module implement educational technologies	4	7.7%
Modernization	Smartboards for seminars, adaptive learning platforms, better interface and design	9	17.3%

No suggestions	Everything is great, no suggestions	18	34.6%

Finally, the study has shown participants' suggestions on which aspects of educational technologies could be improved to help them to develop a better understanding of optional modules (See Table 5). In summary, among 52 participants, 34.6% provided no suggestions for the improvement of educational technologies, as they claimed they were satisfied with the current level of technological facility on the campus. Meanwhile, suggestions on providing better access to educational technologies and their modernizations were the most common responses, at 19.2% and 17.3%, respectively. Responses in this category included expanding computer labs, improving access to databases, and providing more printers. Moreover, 11.5% of respondents suggested improving Wi-Fi related infrastructure to have a better internet connection. In addition, a small proportion of students (9.6%) suggested that integrations of educational technologies and more detailed tutorials (7.7%) on digital technology usage would be relevant in the case of WIUT. For instance, having more quizzes in seminars and teaching students how to implement technologies in their studies were some of the cited answers.

4.7 Conclusion

In conclusion, all students shared their opinion of using educational technologies for their studies. Factors such as accessibility, integration, and modernization of educational technologies were stated.

5. Discussion

5.1 Overview

This section summarizes, interprets, and compares the main findings of primary and secondary research papers. We also listed the limitations of this research paper to ensure that further investigations will be more accurate. After data from the questionnaire was collected, benefits and challenges of using educational technologies were identified.

5.2 Perceptions about the Helpfulness of Educational Technologies

According to this research, most of the CIFS WIUT students accept that educational technologies help them to improve understanding of optional modules, as they boost productivity and efficiency. Similarly, studies by Cabaleiro-Cerviño and Vera (2020), Henderson et al. (2017), and Vitoria et al. (2018) show the same findings. For example, technologies increase students' engagement and improve their learning process. Overall, we can see that educational technologies positively influence studying. It can be explained by benefits provided by technologies. They enhance studying and provide extra opportunities for revising materials and independent development.

5.3 Educational technology application problems

Henderson et al. (2017) showed that students are not proficient and comfortable using technologies. Additionally, Bereczki and Kárpáti (2021) found that technologies negatively influenced cognitive processes. The present survey reveals that despite the usefulness of educational technologies, some students struggle to adapt to them and even are distracted while using them. These findings confirm technologies being not fully consistent and uncertainty about their significance.

5.4 Most Useful Technology for Study Process

Students found educational technologies mostly useful in completing courseworks and group presentations. It can be associated with benefits technologies provide. With their help, students have access to various data, which can enhance their knowledge and understanding of the concepts, and they can utilize the digital tools for their presentations, such as e-boards, projectors,

and presentation-making programs, which make them more engaged and interested in the process. The same findings are revealed in studies by Cabaleiro-Cerviño and Vera (2020), Stosic (2015), and Vitoria et al. (2018), who showed that technologies stimulate creativity, improve the recognition process, increase the productivity of learning, and develop communication and collaborative skills.

5.5 Limitations and Further Research

Overall, the research was set up appropriately considering all essential factors and elements, but some barriers were faced. Firstly, to obtain more precise information, the number of participants must be expanded. A wide range of experience in different optional modules would demonstrate more accurate data and would allow for deeper investigations. Future studies on similar research issues could be more detailed and relevant for future conditions.

6. Conclusion and Recommendations

The research aimed to identify the perception of CIFS WIUT students about the effectiveness of educational technologies for enhancing academic performance. By analyzing the answers of students from the questionnaire, it has been confirmed that the main drawback of using educational technologies is distractions. Additionally, students have problems with the implementation of those technologies due to the lack of experience and understanding. However, integration of educational technology positively affects information perception and provides the opportunity to revise material and lecturer recordings independently. In addition, students find educational technology beneficial for group tasks and presentation preparations. Based on this finding, students find educational technologies positively influencing their academic level, despite some downsides of integrating them.

The findings of this investigation have several significant implications for future development of quality education. To address the issue of the low level of students understanding of how to effectively apply educational technology for studies, administration and lecturers could organize special seminars or tutorials to familiarize students with educational technologies. According to questionnaire responses, it is essential to solve this problem in the future and conduct further research about effective technology integration.

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PRELIMINARY EVALUATION OF TEAM-BASED LEARNING IN CLINICAL TEACHING FOR NURSING STUDENTS: A PILOT STUDY

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Abstract*. The modernization of healthcare systems requires the introduction of innovative educational approaches that promote critical thinking, independent learning, and professional competence among nursing students. Team-Based Learning (TBL) is a student-centered educational strategy that has demonstrated positive effects on student engagement, communication skills, and academic performance in health professions education. However, evidence regarding its implementation in nursing education programs in Uzbekistan remains limited. The aim of this pilot study was to develop a TBL-based educational module for the discipline "Nursing in Therapy," validate adapted assessment instruments, and evaluate the preliminary impact of TBL on educational outcomes among nursing students. A single-group pretest-posttest pilot study was conducted among ten second-year nursing students at Tashkent State Medical University. The intervention included structured self-study, individual readiness assurance testing, team readiness assurance testing, and clinical case discussions. Three educational outcomes were assessed using culturally adapted and validated questionnaires measuring self-directed learning, attitudes toward learning, and academic self-efficacy. Content validity was confirmed through expert review. Pre- and post-intervention scores were compared using the Wilcoxon signed-rank test with Holm adjustment for multiple comparisons. Following implementation of the TBL module, statistically significant improvements were observed in attitudes toward learning and academic self-efficacy. The median score for attitudes toward learning decreased from 2.41 to 1.44 (Holm-adjusted p = 0.00586), while academic self-efficacy improved from 2.21 to 1.95 (Holm-adjusted p = 0.00586). Self-directed learning demonstrated a slight numerical increase but did not reach statistical significance (p = 0.2617). These findings suggest that TBL may positively influence motivational and psychological aspects of learning among nursing students. Although limited by the small sample size and single-center design, the study demonstrates the feasibility of implementing TBL within undergraduate nursing education in Uzbekistan and provides a foundation for larger controlled studies in the future.*

Keywords*: team-based learning, nursing education, self-directed learning, academic self-efficacy, pilot study.*

Introduction

In the context of the modernization of the healthcare system and medical education, the necessity of implementing innovative, student-centered teaching methods aimed at the formation of clinical thinking, independence, and professional competencies of learners is increasing. Traditional lecture-based forms of instruction, predominantly based on passive assimilation of

information, do not fully ensure the development of critical thinking and decision-making skills in clinical practice.

One of the promising directions is the Team-Based Learning (TBL) method, which is actively applied in international medical education practice. This approach contributes to increasing student engagement, the development of communication skills, strengthening confidence in their own knowledge, as well as enhancing their ability to apply this knowledge in practical settings [1-3].

Despite previously reported positive effects of TBL, its systematic implementation in nursing education programs in Uzbekistan remains limited. Recent reviews have further confirmed that TBL improves student engagement, knowledge retention, teamwork skills, and academic performance across health professions education settings [7–10].

Aim of the Study

The aim of this study was ① to develop an educational module based on the Team-Based Learning method for the discipline "Nursing in Therapy," ② to validate assessment instruments and ③ analyze the impact of the implementation of this method on students' learning performance indicators.

Materials and Methods

A single-group pretest-posttest pilot study was conducted in two stages: first, the development and validation of the educational module and assessment instruments; second, the implementation of the pilot intervention and evaluation of its preliminary effectiveness.

At the first stage, a module was developed for the discipline "Nursing in Therapy," delivered at the nursing faculty of Tashkent State Medical University. The training was conducted among second-year students. The module included key clinical topics—arterial hypertension and anemia.

The educational process was reorganized in accordance with the principles of Team-Based Learning (TBL) and included the following stages: preliminary self-study preparation, individual readiness assurance testing (iRAT), team readiness assurance testing (tRAT), and the application of knowledge through solving clinical case scenarios. To ensure the proper implementation of the method, a training workshop was conducted for instructors.

To assess educational outcomes, three previously developed Korean instruments were used. Self-directed learning ability was measured using the Korea Educational Development Institute instrument developed by Lee et al. [4]. Learning attitude was assessed using a 16-item instrument adapted for nursing students by Hwang [5]. Academic self-efficacy was measured using the scale developed and validated by Kim and Park [6], consisting of three subdomains: task difficulty preference, self-regulation efficacy, and self-confidence. The questionnaires were translated into Uzbek, culturally adapted, and reviewed by experts in nursing education; content validity was assessed using the Content Validity Index (CVI).

At the second stage, a pilot study was conducted involving 10 second-year students of the nursing faculty of Tashkent State Medical University. The questionnaires were administered before and after the implementation of the TBL method.

Before statistical analysis, negatively worded items were reverse-coded according to the original scoring rules. For the self-directed learning instrument, higher scores indicated more favorable characteristics. For the learning attitude and academic self-efficacy instruments, lower scores indicated more favorable characteristics after reverse coding. Scale scores were then calculated at the participant level. Internal consistency of the translated/adapted versions was

additionally examined using Cronbach's α coefficients. In the present sample, Cronbach's α values were 0.898 and 0.433 for self-directed learning ability, 0.708 and 0.541 for learning attitude, and 0.632 and 0.782 for academic self-efficacy at pre- and post-intervention assessment, respectively. Given the pilot nature of the study and the very small sample size, these coefficients were interpreted as preliminary estimates of internal consistency. Because this was a pilot pre–post study with paired observations and a small sample size (n = 10), statistical power was limited and the findings should be interpreted with caution. Pre-intervention and post-intervention scores were compared using the Wilcoxon signed-rank test. Holm adjustment was applied to control for multiple comparisons. Due to the small sample size, the results cannot be generalized and require confirmation in larger studies.

Results

Within the framework of the conducted study, changes in students' learning performance indicators before and after the implementation of the Team-Based Learning (TBL) method were assessed using three scales: self-directed learning (Q1), attitudes toward learning (Q2), and academic self-efficacy (Q3).

Prior to inferential analysis, all reverse-coded items were recoded according to the scoring rules of each instrument. Given the pilot nature of the study and the small sample size (n = 10), descriptive statistics are presented as median and interquartile range (IQR), and pre–post comparisons were performed using the Wilcoxon signed-rank test with Holm adjustment for multiple comparisons. The direction of change was interpreted according to the scoring key of each instrument: higher scores were favorable for Q1, whereas lower scores were favorable for Q2 and Q3. Statistically significant favorable changes were identified for attitudes toward learning and academic self-efficacy, whereas the change in self-directed learning did not reach statistical significance. These findings should be interpreted with caution. The results of the pre–post comparison are presented in Table 1 and Figure 1.

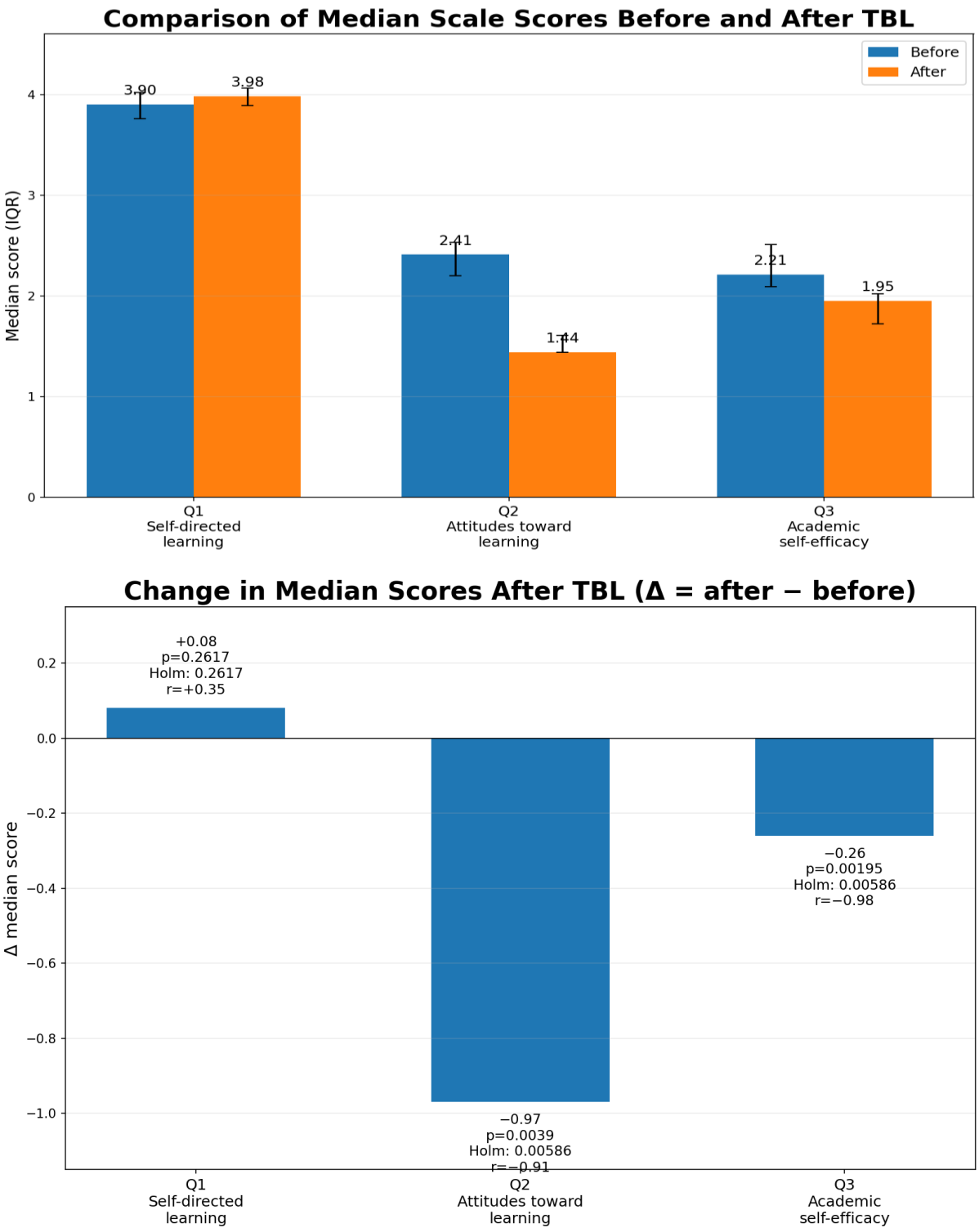
Table 1. Changes in Educational Outcome Indicators Before and After TBL Implementation (n = 10)

Indicator	Before, median (IQR)	After, median (IQR)	p-value	p (Holm)	Effect size, r
Q1 Self-directed learning	**3.90 (3.76–4.02)**	**3.98 (3.89–4.06)**	**0.2617**	**0.2617**	**+0.35**
Q2 Attitudes toward learning	**2.41 (2.20–2.53)**	**1.44 (1.44–1.61)**	**0.0039**	**0.00586**	**−0.91**
Q3 Academic self-efficacy	**2.21 (2.09–2.51)**	**1.95 (1.72–2.02)**	**0.00195**	**0.00586**	**−0.98**

Note. For Q1, higher scores indicate more favorable outcomes; for Q2 and Q3, lower scores indicate more favorable outcomes after reverse coding. Therefore, the direction of improvement/deterioration was interpreted according to the scoring key of each instrument. p-values were calculated using the two-sided Wilcoxon signed-rank test. Holm correction was

applied across the three comparisons. Wilcoxon effect size was calculated as r = Z/√N, where N = 10 paired observations; the sign indicates the direction of the median change.

Figure 1. Comparison of Median Scale Scores Before and After TBL



The analysis of the data presented in Table 1 showed that self-directed learning (Q1) did not demonstrate a statistically significant pre–post change following the implementation of the TBL module. The median score increased slightly from 3.90 (IQR 3.76–4.02) before the intervention to 3.98 (IQR 3.89–4.06) after the intervention; however, this shift did not reach statistical significance (p = 0.2617; Holm-adjusted p = 0.2617).

In contrast, statistically significant changes were observed in attitudes toward learning (Q2) and academic self-efficacy (Q3) in this pilot sample; however, due to the limited sample size, these findings should be interpreted as preliminary. For Q2, the median score decreased from 2.41 (IQR 2.20–2.53) before the intervention to 1.44 (IQR 1.44–1.61) after the intervention, indicating improvement according to the scoring direction of the instrument ($p = 0.0039$; Holm-adjusted $p = 0.00586$). Similarly, for Q3, the median score decreased from 2.21 (IQR 2.09–2.51) to 1.95 (IQR 1.72–2.02), also reflecting a favorable change ($p = 0.00195$; Holm-adjusted $p = 0.00586$).

Thus, within this pilot sample, the most consistent favorable changes were observed for attitudes toward learning and academic self-efficacy, whereas the change in self-directed learning remained statistically non-significant. Given the pilot nature of the study and the small sample size ($n = 10$), these findings should be interpreted with caution.

Individual directional changes across participants are summarized in Table 2 and illustrated in Figure 2.

Table 2. Individual Direction of Pre–Post Changes Across the Three Educational Outcome Scales (n = 10)

Indicator	**Improvement (n)**	**No change (n)**	**Deterioration (n)**
Q1 Self-directed learning	7	0	3
Q2 Attitudes toward learning	10	0	0
Q3 Academic self-efficacy	10	0	0

Improvement/no change/deterioration were defined according to the scoring direction of each instrument. For Q1 (self-directed learning), higher post-intervention scores indicated improvement. For Q2 (attitudes toward learning) and Q3 (academic self-efficacy), lower post-intervention scores indicated improvement.

Table 2 provides a descriptive summary of the individual direction of pre–post changes across the three scales. For self-directed learning (Q1), the directional classification was corrected according to the Q1 scoring key: 7 students showed improvement and 3 students showed deterioration. This correction resolves the apparent inconsistency noted by the reviewer, because the increase in the group median from 3.90 to 3.98 is consistent with a predominance of individual increases in Q1 scores. For attitudes toward learning (Q2) and academic self-efficacy (Q3), all 10 participants demonstrated a favorable directional change. These descriptive patterns should be interpreted with caution given the pilot nature of the study and the small sample size.

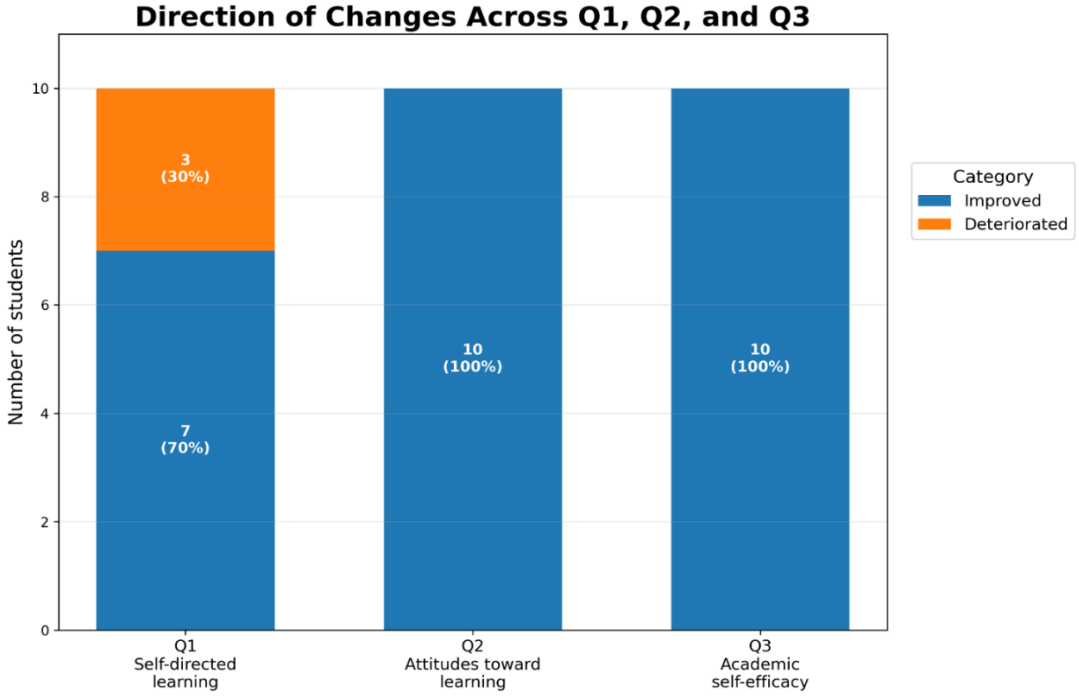
Discussion

The findings of this pilot study suggest that the implementation of the TBL method may be associated with favorable changes in selected motivational and psychological aspects of students' learning activity, particularly attitudes toward learning and academic self-efficacy. However, these findings should be interpreted with caution because of the small sample size.

Previous studies have reported that Team-Based Learning can improve student engagement, learning attitudes, and academic confidence [1–3, 7–10]. The present findings are

generally consistent with these reports, particularly regarding improvements in attitudes toward learning and academic self-efficacy. However, unlike some previous studies, self-directed learning did not show significant improvement in this pilot sample. While previous studies have often reported improvements in self-directed learning following TBL implementation, the present pilot study did not demonstrate a statistically significant change in this domain. Differences in sample size, intervention duration, educational setting, and prior experience with active learning methods may partially explain these inconsistent findings.

Figure 2. Direction of Changes Across Q1, Q2 and Q3



In addition, some students may have experienced difficulty adapting to a more active learning model that requires greater individual responsibility and independent preparation. Because the participants had limited prior exposure to student-centered learning approaches, the transition from traditional teacher-centered instruction to TBL may initially have increased uncertainty or learning burden for some students. This may partly explain the decline observed in several participants, particularly in the domain of self-directed learning. Another possible explanation is the relatively short duration of the intervention, since self-directed learning skills may require longer exposure and repeated practice to develop.

The improvement in attitudes toward learning may be related to the active involvement of students in the educational process, including group interaction, discussion, and the use of clinical case scenarios. These components may contribute to a more positive perception of the learning process and greater interest in the studied material.

The positive shift in academic self-efficacy may reflect increased confidence in students' own knowledge and abilities. This may be associated with core features of TBL, including teamwork, peer interaction, and immediate feedback during the learning process.

In contrast, self-directed learning did not demonstrate a statistically significant pre–post change. Moreover, individual responses on this scale were heterogeneous, suggesting that the effect of TBL on self-directed learning may be less immediate and may require a longer period of implementation. Self-regulation skills such as planning, sustained independent task performance,

and self-reflection are likely to develop more gradually than attitudes toward learning or confidence in one's academic abilities.

Taken together, these findings suggest that, within this pilot sample, TBL showed the most consistent positive association with attitudes toward learning and academic self-efficacy, whereas its influence on self-directed learning remains uncertain and requires further investigation in larger studies with longer follow-up.

Conclusion

In this pilot study, the developed Team-Based Learning module for the discipline "Nursing in Therapy," implemented among second-year nursing students of Tashkent State Medical University in Uzbekistan, was associated with favorable changes in attitudes toward learning and academic self-efficacy.

This pilot study suggests preliminary feasibility of implementing TBL in nursing education. However, given the small sample size and single-center design, the results should be interpreted with caution. Further studies involving larger samples, multiple institutions, control groups, and longer follow-up are needed to confirm these findings.

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THEORY AND METHODOLOGY OF APPLYING NEURAL NETWORK MODELS IN ASSESSING AND MONITORING STUDENTS' KNOWLEDGE IN HIGHER EDUCATION INSTITUTIONS

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Abstract. *This article systematically explores the theoretical and methodological foundations of applying Artificial Neural Network (ANN) models to predict and monitor student performance in higher education institutions. A deep comparative analysis of traditional and intelligent evaluation methods was conducted under the credit-module system (HEMIS) implemented in universities of Uzbekistan. Within the framework of the study, a mathematical and pedagogical predictive model was developed based on the Multi-Layer Perceptron (MLP) architecture and the Backpropagation algorithm to forecast students' final grades based on their continuous activity indicators during the semester. Experimental results demonstrated that the neural network model can predict academic outcomes with 92% accuracy at the early stages of the academic semester. The paper also outlines the ANN-based monitoring methodology for faculty members, the optimization of students' individual learning trajectories, and detailed practical recommendations for implementing educational decision-support systems (EDSS) in higher education institutions.*

Keywords: *e-learning, artificial intelligence, neural networks, multi-layer perceptron, credit-module system, HEMIS, academic monitoring, knowledge assessment, adaptive learning, educational data mining (EDM), individual trajectory.*

INTRODUCTION

Relevance of the topic

In the twenty-first century, the digital transformation of the higher education system requires a transition from the automation of educational processes to the stage of intelligent management. Relevant decrees and resolutions of the President of the Republic of Uzbekistan define the improvement of the quality of education in higher education institutions, the digitalization of management, and the broad introduction of artificial intelligence (AI) technologies into educational processes as priority tasks. Today, the credit-module system has been fully introduced in higher education institutions of the republic, and students' learning activities, attendance, and indicators of task completion are accumulated in the HEMIS (Higher Education Management Information System) information system. This system collects a large amount of Big Data; however, these data currently serve mainly for retro-analysis, that is, statistics of the past period, or administrative reports. Existing systems do not contain mechanisms for the proactive management of the educational process, namely, forecasting a student's semester-end result based on current activity and carrying out pedagogical correction on that basis.

Statement of the problem

Traditional systems for assessing and monitoring students' knowledge are mainly based on the principle of recording facts. In other words, a student participates in midterm or final assessments, and the score obtained is recorded as the student's level of knowledge. This approach does not make it possible to diagnose problems in the learning process in a timely manner. For example, if a student is experiencing difficulty in mastering learning materials in the middle of the semester, the teacher may identify this only through the results of the midterm assessment; by that time, the probability of academic debt or retaking the subject is often already high. In an e-learning environment, every student action leaves a digital trace, including logs, login frequency, the number of test attempts, and participation in forum discussions. These data have a nonlinear and complex structure and cannot be deeply analyzed through traditional statistical methods such as the arithmetic mean or linear correlation. Therefore, introducing artificial neural network (ANN) models into the education system and developing their pedagogical and methodological foundations is an objective necessity.

Research aim and objectives

The main aim of this study is to design a methodological system based on artificial neural networks in order to improve the effectiveness of monitoring students' academic activity and assessing their knowledge in the conditions of higher education institutions of Uzbekistan.

To achieve this aim, the following objectives were set:

1. To reveal the theoretical and methodological foundations of using intelligent systems in the educational process.
2. To systematize the main input parameters, or metrics, that assess students' activity in the credit-module system.
3. To construct a neural network model for predicting academic performance based on the Multi-Layer Perceptron (MLP) architecture.
4. To verify the accuracy of the model through a pedagogical experiment and compare it with traditional methods.
5. To formulate methodological recommendations for faculty members and university management to support decision-making.

LITERATURE REVIEW

Educational Data Mining (EDM) and Learning Analytics have been developing rapidly in the global scientific community since the beginning of the twenty-first century. The theoretical foundations of EDM were systematized by C. Romero and S. Ventura, who demonstrated in their studies the possibilities of optimizing curricula by clustering, classifying, and applying regression methods to data obtained from LMS (Learning Management System) platforms.

The studies conducted by B. M. Aboashour and co-authors on applying machine learning algorithms to predict students' academic results are also noteworthy. They compared neural networks, decision trees, and the support vector machine (SVM) method and found that neural networks have the lowest error rate when working with nonlinear educational data. T. Mishra and other international researchers used not only LMS logs in their models but also students' socio-demographic indicators, such as place of residence, amount of scholarship, and parents' education, as input parameters. However, since the use of such personal data may contradict data privacy rules, including GDPR requirements, relying only on educational metrics is considered more effective.

Uzbek researchers have also carried out significant work on the informatization of higher education and the creation of management systems. Academician A. A. Abduqodirov developed

the didactic foundations of applying information and communication technologies and distance learning in education. Professor M. M. Aripov worked on the mathematical modeling of educational processes. In addition, the pedagogical features and problems of introducing the credit-module system in the republic are reflected in the scientific works of B. Kh. Daniyarov and U. Sh. Begimqulov.

However, the issue of analyzing the specifications of the HEMIS information system currently used in national higher education institutions, namely the dynamics of students' absences (NB), weekly rating scores, and completion of independent learning loads, as a holistic system through artificial neural networks, and developing its pedagogical methodology within the framework of specialty 13.00.06, has not yet been studied systematically and at the monographic level in the republic. Filling this gap determines the scientific novelty and theoretical value of this article.

RESEARCH METHODOLOGY

In this study, the mathematical apparatus of neural network construction and the didactic principles of e-learning were applied in an integrated manner. Based on a systems approach, the student's activity during the semester was considered as a dynamic system.

Designing the neural network architecture

For assessing and monitoring students' knowledge, a Multi-Layer Perceptron (MLP) feed-forward neural network was selected. The model consists of three main layers: an input layer, one hidden layer, and an output layer.

The operating mechanism of the neural network is based on calculating the weighted sum of input signals in each neuron and transmitting it to an activation function. Mathematically, this process is expressed as follows:

$$z = \Sigma_{i=1}^{n} w_i x_i + b$$

$$y = \sigma(z) = 1 / (1 + e^{-z})$$

Here, $\sigma(z)$ is the logistic Sigmoid activation function that provides nonlinear relationships in the model. The number of neurons in the hidden layer was determined on the basis of the Kolmogorov-Arnold-Hecht-Nielsen theorems, and 8 neurons were experimentally found to be the most optimal.

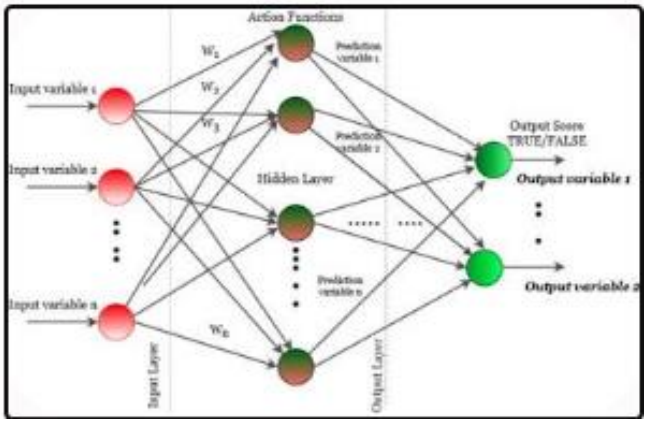


Figure 1. Multi-layer perceptron (MLP) architecture. Source: ResearchGate.

Selection of input and output metrics (Data Selection)

Taking into account the specific features of the HEMIS platform in the national education system, five main quantitative indicators, or metrics, reflecting student activity were introduced into the input layer (X) of the model. Before being transmitted to the neural network, the data were transformed into the [0, 1] interval by means of the min-max normalization formula:

$x_norm = (x - x_min) / (x_max - x_min)$

6. X_1 - Attendance indicator (Att): the percentage of the student's participation in classes. It is calculated on the basis of the ratio between the total class hours in the HEMIS system and the student's recorded absences marked as "NB".
7. X_2 - Current assessment activity (CA): the average score obtained from laboratory, practical, and seminar assignments completed during the semester.
8. X_3 - Digital activity on the LMS platform (LMS): the amount of time the student spends in the e-learning environment outside class hours, measured in hours, and the number of downloaded methodological materials.
9. X_4 - Quality of independent learning (IE): the number of independent assignments uploaded to the system and the coefficient of their completion in accordance with the deadline ($0 \leq IE \leq 1$).
10. X_5 - Midterm assessment result (MT): the score obtained from the written or test-based assessment held in the middle of the semester.

Output parameter (Y): the final rating score that the student is expected to receive in the subject at the end of the semester, from 0 to 100 points, or the letter-grade class according to the ECTS scale (A, B, C, D, F).

Pedagogical experiment and model training

The experiment was conducted on the basis of real, anonymized statistics collected during one semester from 120 students studying in the engineering field at one of the leading higher education institutions in Tashkent in the subject "Information Technologies".

The Backpropagation algorithm was used to train the model. Mean Squared Error (MSE) was selected as the function for minimizing network error:

$$E = 1/2 \sum_{k=1}^{m} (y_k - \hat{y}_k)^2$$

Here, y_k is the student's actual final score in HEMIS, and $\hat{y}_k$ is the value predicted by the neural network. The model was trained for 1000 epochs. Eighty percent of the database was directed to training the network, while the remaining twenty percent was used for validation and accuracy testing.

RESEARCH RESULTS

After the completion of the software modeling and training process of the neural network using the Python programming language and the TensorFlow/Keras libraries, its predictive efficiency was compared with the Linear Regression method used in traditional pedagogical analysis. The results showed that neural networks can analyze nonlinear educational relationships much more deeply.

Table 1. Comparative analysis of the effectiveness of models in predicting students' grades

Mathematical evaluation metric	**Traditional linear regression model**	**Proposed neural network (MLP)**
Coefficient of determination (R^2)	0.74	**0.92**
Root Mean Squared Error (RMSE)	5.4 points	**1.8 points**

Mean Absolute Error (MAE)	4.1 points	**1.2 points**
Accuracy of identifying low-achieving students	71%	**95%**

As can be seen from the analysis of the table, the coefficient of determination of the proposed neural network model was $R^2 = 0.92$. This indicator proves that the model fully accounted for 92% of the nonlinear factors involved in the formation of students' academic results and that its predictive accuracy was very high. The mean absolute error (MAE) was only 1.2 points, which makes it possible to determine a student's final grade almost without error.

In addition, a sensitivity analysis of the neural network was conducted, and the degree of influence of the input parameters on the final result, that is, the weight of the coefficients, was examined. As a result, the following relationship was identified in connection with the specific features of the credit-module system in higher education institutions of Uzbekistan:

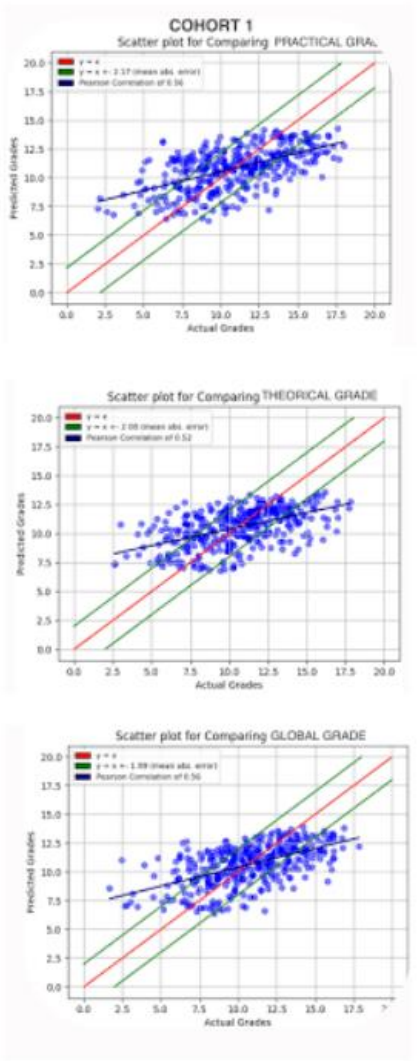


Figure 2. Real and neural-network-predicted grades.

- Independent learning assignments (X_4) had a 38% influence on the final result, which was the highest indicator.
- Current assessment activity (X_2) had a 29% influence.

- Attendance and system login logs (X_1, X_3) had a 23% influence.
- The midterm assessment examination (X_5) had a 10% influence.

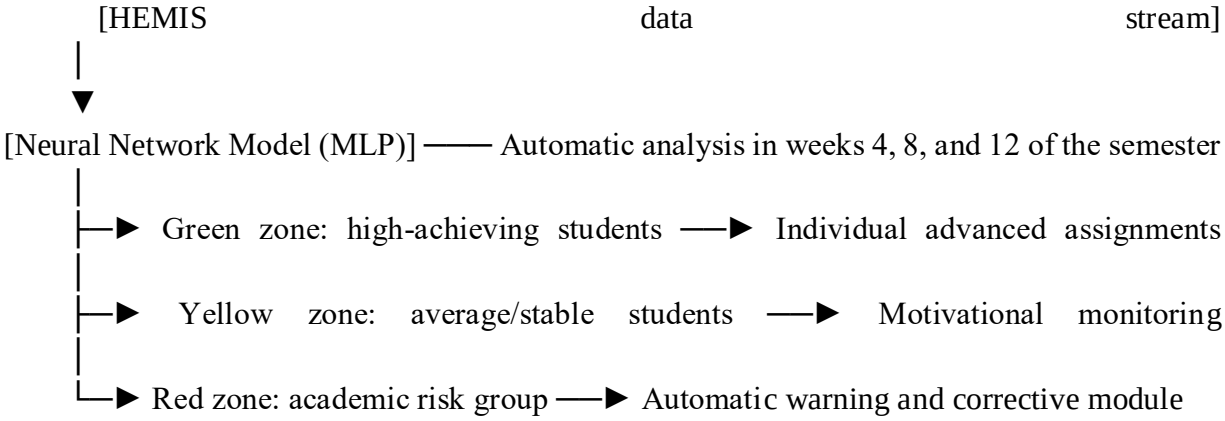
This finding shows that a student's weekly independent learning activity has almost four times greater pedagogical significance in determining the final level of knowledge than a one-time midterm examination.

DISCUSSION

The obtained scientific and practical results confirm that the use of neural networks in the e-learning environment is methodologically highly effective. From the perspective of the specialty of the theory and methodology of e-learning, this study fundamentally changes the traditional concept of pedagogical monitoring. While traditional monitoring is limited to recording errors from a previous stage, that is, passive diagnostics, the neural-network-based methodology forms proactive or warning-oriented pedagogical management.

Pedagogical model of ANN-based monitoring methodology

In the pedagogical process, the operating methodology of this model includes the following stages:



The teacher reviews this intelligent monitoring panel on a weekly basis. The system identifies students who have started missing classes or are uploading independent assignments of poor quality before the midterm assessment begins and sends a signal to the teacher's personal account.

Advantages and limitations of the methodology

The main didactic advantage of the system is the possibility of individualizing education. The system can automatically offer simplified adaptive and corrective learning materials corresponding to the weaknesses of students who fall into the "red zone". For example, if a student has good attendance but experiences difficulty only in laboratory work, the system can recommend corrective materials specifically related to that section.

However, it is also necessary to emphasize that there are several systemic problems in implementing the methodology:

Human factor and data validity: if faculty members do not mark classes in HEMIS on time or allow subjectivity in assessment by giving the same score to everyone, the neural network will learn incorrectly on the basis of incorrect data, in accordance with the principle "Garbage in, garbage out".

Pedagogical ethics: the conclusion of artificial intelligence must not cause the teacher to place a negative label on a student in advance, known as the halo effect. It must be explained to the pedagogical staff that the system is not a tool for punishing students but a means of providing timely support.

CONCLUSION. The theoretical and methodological research conducted on applying artificial neural network models to the process of assessing students' knowledge and monitoring their learning activity in higher education institutions made it possible to formulate the following conclusions:

Theoretically, it was substantiated that students' academic data in the conditions of e-learning constitute a complex, nonlinear, and multifactorial system. The use of the mathematical apparatus of artificial neural networks in analyzing them enriches the didactic and diagnostic possibilities of digital pedagogy.

Practically, the developed Multi-Layer Perceptron (MLP) model made it possible to predict students' academic performance with 92% accuracy. It was found that weekly independent learning activity (38%) was the strongest factor affecting the student's final result, more influential than midterm assessments.

Methodologically, a transition from a passive assessment system to a proactive, warning-oriented intelligent monitoring system was proposed through the introduction of neural networks into the management system of higher education institutions. Integrating this model into the national HEMIS system through special software API modules can serve to significantly reduce the rate of students' failure during the academic semester and their academic debt.

Future research direction

In the future, it is planned to continue research on developing a methodology for monitoring not only students' scores but also the dynamics of their psychological fatigue and declining motivation in the electronic environment over time, using more complex recurrent types of neural networks that account for dynamic sequences, especially Recurrent Neural Networks and LSTM models.

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TRAINING FUTURE SPEECH THERAPISTS TO USE SENSORY INTEGRATION TECHNOLOGIES: INTERNATIONAL EXPERIENCE AND AN EDUCATIONAL MODEL

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Abstract*. This article investigates the pedagogical foundations for preparing future speech therapists to use sensory integration technologies in speech-language therapy practice. The relevance of the study is determined by the increasing number of children with autism spectrum disorder, motor speech disorders, developmental language disorder, dysarthria, attention-deficit/hyperactivity disorder, and other neurodevelopmental conditions in inclusive and special education settings. The purpose of the study is to substantiate a competency-based educational model for developing sensory integration competence among undergraduate speech therapy students in higher education institutions of Uzbekistan. The research was conducted through document analysis, comparative analysis, theoretical modelling, and synthesis of scientific literature on sensory integration, speech-language pathology, competency-based education, and international professional training. The study analyzes the theoretical ideas of A. J. Ayres, contemporary evidence on Ayres Sensory Integration® intervention, research on sensory processing and autism, and studies related to childhood apraxia of speech and motor-learning approaches. International experience from the United States, the United Kingdom, and Canada is examined to identify the main structural elements of effective specialist preparation. The results show that effective training requires the integration of theoretical foundations, sensory assessment and profiling, clinical observation, guided practical training, and reflective supervision. On this basis, a four-component model consisting of motivational, cognitive, operational, and reflective components is proposed for the Uzbek higher education context. The model is supported by case-based learning, problem-based learning, team-based learning, simulation, video case analysis, microteaching, and digital learning resources. The proposed framework may improve the quality of speech therapist education and support evidence-based interdisciplinary practice.*

Keywords*: sensory integration, speech therapy, professional training, competency-based model, inclusive education.*

INTRODUCTION

In recent decades, speech-language pathology has increasingly recognized that speech and language development cannot be separated from the sensory, motor, cognitive, and emotional mechanisms that support a child's interaction with the environment. Children with complex developmental profiles often demonstrate not only linguistic or articulatory difficulties, but also problems in sensory modulation, postural control, motor planning, tactile-proprioceptive processing, attention regulation, and adaptive behavior. These factors may influence communicative engagement, speech motor planning, phonological perception, participation in therapy, and the child's capacity to learn new speech and language patterns.

The theoretical foundations of sensory integration were developed by Ayres, who described sensory integration as the neurological process through which the brain organizes sensory information for purposeful activity and adaptive behavior. Ayres argued that efficient processing of tactile, vestibular, proprioceptive, auditory, and visual input is necessary for learning, motor planning, emotional regulation, and interaction with the surrounding environment (Ayres, 1972, 1979). Although the original theory was developed mainly within occupational therapy, its conceptual framework is relevant for understanding the sensory-motor prerequisites of communication development.

Contemporary research has provided additional support for the importance of sensory processing in neurodevelopmental conditions. In a randomized controlled trial, Schaaf et al. (2014) reported significant improvements in goal attainment and functional performance among children with autism spectrum disorder who received Ayres Sensory Integration® intervention. Kilroy, Aziz-Zadeh, and Cermak (2019) further explained that atypical sensory processing is associated with differences in social interaction, adaptive functioning, and communication development in autism. These findings suggest that sensory integration principles may contribute to broader developmental outcomes when used in a scientifically grounded and interdisciplinary manner.

Sensory-motor mechanisms are also important in motor speech disorders. Murray, McCabe, and Ballard (2014) emphasized that deficits in motor planning and programming are central characteristics of childhood apraxia of speech. This position supports the need to integrate motor-learning principles, multisensory cueing, and sensorimotor activities into intervention planning. In dysarthria, tactile-proprioceptive stimulation and oral-motor control strategies may support the accuracy and coordination of speech movements when they are applied within evidence-informed speech therapy goals.

In the Russian and post-Soviet speech therapy tradition, researchers such as Arkhipova (2007) and Lalaeva (1999) have also emphasized the role of sensory, perceptual, and motor mechanisms in the development and correction of speech disorders. Although these approaches are not identical to Ayres Sensory Integration®, they demonstrate that multisensory stimulation, motor organization, and perceptual development have long been considered important in logopedic practice.

At the same time, sensory integration should not be interpreted as an independent method that replaces speech-language therapy. It should be understood as a complementary framework that helps the speech therapist consider the sensory-motor foundations of communication, participation, attention, and learning. Therefore, future speech therapists need not only isolated knowledge about sensory systems, but also an integrated professional competence that includes theoretical understanding, assessment skills, clinical reasoning, practical application, ethical awareness, and reflective evaluation.

The purpose of this study is to analyze international experience in preparing specialists for the use of sensory integration technologies and to develop a competency-based educational model adapted to the training of future speech therapists in higher education institutions of Uzbekistan. The research problem is formulated as follows: what structural components and pedagogical technologies are necessary for the systematic development of sensory integration competence among future speech therapists?

MATERIALS AND METHODS

The study used qualitative research methods appropriate for theoretical-pedagogical and comparative analysis. The methodological basis of the research included document analysis,

comparative analysis, content analysis of scientific literature, and theoretical modelling. These methods made it possible to identify the key concepts of sensory integration, analyze their relevance to speech-language therapy, and transform international training experience into a structured educational model for the Uzbek higher education context.

The materials of the study included scientific publications on sensory integration theory, Ayres Sensory Integration® intervention, speech-language pathology, motor speech disorders, autism spectrum disorder, and competency-based professional education. Special attention was paid to the works of Ayres, Schaaf et al., Kilroy et al., Murray et al., Arkhipova, and Lalaeva, as these sources represent the theoretical and empirical foundation of the article.

The comparative part of the research examined educational approaches used in selected universities and professional training centers in the United States, the United Kingdom, and Canada. The analysis focused on the following criteria: inclusion of sensory integration theory in the curriculum, connection between theory and practice, use of clinical observation, supervision, interdisciplinary collaboration, assessment and profiling, and reflective professional development.

The procedure of the study consisted of four stages. At the first stage, scientific literature was selected and analyzed according to its relevance to sensory integration and speech-language therapy. At the second stage, international educational experience was compared in order to identify recurring components of effective training. At the third stage, the identified components were adapted to the conditions of higher education institutions in Uzbekistan. At the fourth stage, a competency-based model was developed and described through motivational, cognitive, operational, and reflective components.

The study has a theoretical and model-building character. It does not present experimental data from students or clinical participants. Therefore, the proposed model should be considered a scientifically grounded pedagogical framework that requires further empirical validation in undergraduate speech therapy programs.

RESULTS

The analysis showed that sensory integration technologies may be used in speech therapy practice as supportive tools when they are directly connected with speech-language goals and the child's functional needs. Table 1 presents the main areas of application in relation to selected speech and neurodevelopmental disorders.

Table 1. Applications of sensory integration technologies in speech therapy practice

Speech disorder or condition	**Main sensorimotor difficulty**	**Applied sensory integration technologies**	**Expected speech-language or functional outcome**
Autism spectrum disorder (ASD)	Sensory modulation dysfunction, difficulties in self-regulation and participation	Vestibular and proprioceptive activities, structured sensory routines, environmental adaptation	Increased communicative engagement, participation, attention, and readiness for interaction

Childhood apraxia of speech	Difficulties in motor planning, sequencing, and praxis	Sensorimotor integration activities, multisensory cueing, movement sequencing tasks	Improved articulatory praxis, speech motor planning, and accuracy of speech movements
Dysarthria	Impaired oral-motor control and reduced proprioceptive feedback	Tactile-proprioceptive stimulation, oral-motor positioning support, controlled movement practice	Improved articulation accuracy, coordination, and awareness of speech movements
Developmental language disorder or severe speech-language delay	Insufficient sensory discrimination and weak phonological perception	Multisensory language activities, auditory-visual-tactile cueing, phonemic awareness tasks	Enhanced phonemic awareness, perception, and language learning readiness
Speech disorders associated with ADHD	Difficulties in sensory regulation, attention, and behavioral control	Sensory diet strategies, movement breaks, proprioceptive regulation activities	Improved attention, self-regulation, participation, and stability during speech therapy sessions

As shown in Table 1, sensory integration technologies are most useful when they are not applied mechanically, but are selected according to the child's sensory profile, speech-language diagnosis, functional limitations, and therapeutic goals. The expected outcomes are therefore formulated not as isolated sensory effects, but as communicative, behavioral, motor-speech, and participation-related changes.

International experience in specialist preparation

The analysis of international experience demonstrated that countries with developed rehabilitation and inclusive education systems usually do not limit sensory integration preparation to a single theoretical lecture. Instead, training is organized as a gradual process that connects neuroscience, sensory processing theory, assessment, case analysis, practical application, and supervision.

In the United States, sensory integration education has been strongly influenced by the tradition of occupational therapy and by the work of the USC Chan Division of Occupational Science and Occupational Therapy. Training programs emphasize clinical reasoning, sensory processing theory, structured assessment, and evidence-based intervention. For speech-language therapists, this experience is important because it shows the value of interdisciplinary cooperation with occupational therapists and other specialists.

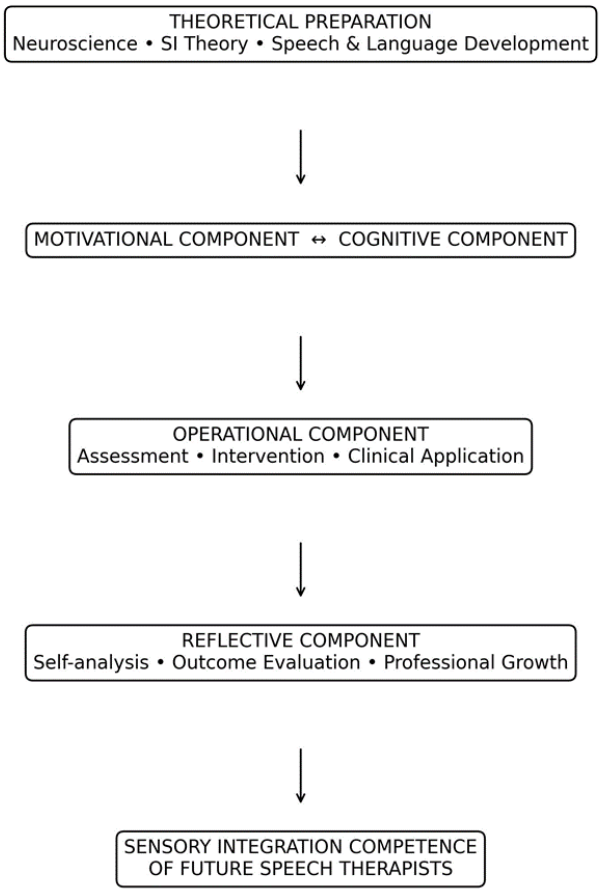
In the United Kingdom, postgraduate sensory integration programs offered in collaboration with professional educational organizations emphasize theoretical modules, clinical application, reflective assignments, and supervision. Students are required to analyze cases, develop sensory

profiles, plan intervention, and evaluate results. This demonstrates a competency-based approach in which knowledge, skills, and professional reflection are developed together.

In Canada, universities and professional programs increasingly include neurodevelopmental content, interprofessional education, and collaborative practice. Speech-language pathologists, occupational therapists, psychologists, and special educators are trained to understand children's needs from different professional perspectives. Such interdisciplinary preparation is especially important for children with autism spectrum disorder, developmental language disorder, motor speech disorders, and complex developmental delays.

The comparative analysis indicates that effective training for the use of sensory integration technologies includes five interconnected elements: theoretical foundations, sensory assessment and profiling, clinical observation and case analysis, guided practical training, and reflective supervision. These elements were used as the basis for constructing the model proposed in this article.

Figure 1. Structural model of sensory integration competence development among future speech therapists



Source: Developed by the author based on the analysis of international educational practices and competency-based approaches.

Figure 1 presents the structural model of sensory integration competence development among future speech therapists. The model is based on a competency-oriented approach and reflects the interrelationship between motivational, cognitive, operational, and reflective

components. The sequential and reciprocal interaction of these components ensures the acquisition of theoretical knowledge, practical skills, professional values, and reflective abilities required for the effective integration of sensory integration technologies into speech-language therapy practice. The model may serve as a methodological framework for modernizing speech therapist education in higher education institutions.

Table 2. Structure of sensory integration competence of future speech therapists

Component	Content	Indicators of development
Motivational component	Professional interest in sensory integration technologies, awareness of their relevance for speech therapy, readiness for innovation, and value orientation toward child-centered support.	Positive attitude toward sensory integration technologies, motivation for continuous professional development, and readiness to work in interdisciplinary teams.
Cognitive component	Knowledge of sensory integration theory, sensory systems, neuropsychological foundations of speech development, sensory processing difficulties, and principles of assessment.	Ability to explain the relationship between sensory systems and speech-language development and to justify intervention decisions theoretically.
Operational component	Practical skills in observation, sensory profiling, selection of sensory integration activities, integration of sensory strategies into speech-language therapy sessions, and intervention planning.	Ability to develop sensory profiles, select appropriate activities, plan sessions, and apply strategies according to the child's functional needs.
Reflective component	Ability to analyze, evaluate, and improve one's professional practice, including ethical awareness and recognition of limitations.	Ability to evaluate outcomes, identify difficulties, revise intervention plans, and plan further professional growth.

The results of the theoretical modelling show that the operational component is central, because it reflects the student's ability to apply knowledge in practice. However, the operational component cannot develop effectively without the motivational, cognitive, and reflective components. Motivation creates readiness for learning and innovation; cognition provides scientific grounding; reflection ensures professional self-correction and quality improvement.

The model can be implemented through pedagogical technologies that activate students' independent thinking, clinical reasoning, practical skills, and reflective analysis. Case-based

learning allows students to analyze real or simulated clinical situations involving children with sensory processing and speech-language difficulties. Problem-based learning develops inquiry skills and the ability to search for evidence-informed solutions. Team-based learning prepares students for interdisciplinary cooperation with psychologists, occupational therapists, special educators, and medical professionals.

Simulation-based learning provides safe conditions for practicing assessment, intervention planning, and professional communication before students work with children in real settings. Video case analysis connects theoretical knowledge with observation of clinical practice and helps students identify sensory-motor difficulties, communicative behavior, and intervention outcomes. Microteaching develops students' ability to plan and conduct short intervention fragments and receive feedback. Digital learning resources, including video lectures, electronic cases, multimedia presentations, and online assessment examples, support independent learning and make the training process more flexible.

DISCUSSION

The findings of this study confirm that sensory integration technologies can enrich the professional preparation of future speech therapists when they are introduced within a scientifically grounded, competency-based, and interdisciplinary framework. The international experience analyzed in the study demonstrates that effective training is not limited to memorizing theoretical concepts. It requires gradual development of clinical reasoning, observation, practical application, and reflective supervision.

For the Uzbek higher education context, the proposed model is significant because it provides a structured way to integrate sensory integration content into existing speech therapy curricula. It does not require replacing traditional logopedic disciplines. Instead, it complements them by strengthening the sensory-motor and neurodevelopmental foundations of professional training. This is especially relevant for courses related to speech ontogenesis, neuropsychology, dysarthria, childhood apraxia of speech, autism spectrum disorder, developmental language disorder, and inclusive education.

The model also supports the transition from knowledge-oriented teaching to competence-oriented professional preparation. Students are expected not only to know the definitions of sensory systems, but also to analyze a child's sensory profile, connect sensory difficulties with communication behavior, select appropriate strategies, and evaluate intervention outcomes. Such an approach corresponds to contemporary requirements for evidence-based and child-centered practice.

At the same time, several limitations should be acknowledged. First, the present article is theoretical and does not include empirical testing of the proposed model. Second, the effectiveness of sensory integration technologies may vary depending on the child's diagnosis, age, developmental profile, family context, and the professional competence of the specialist. Third, speech therapists should apply sensory strategies within their professional scope and cooperate with occupational therapists or other specialists when deeper sensory integration assessment is required.

Future research should therefore include experimental implementation of the model in undergraduate speech therapy programs, development of diagnostic tools for measuring sensory integration competence, and evaluation of student outcomes before and after specialized training. It is also necessary to develop Uzbek-language teaching materials, clinical cases, video resources, and assessment tasks adapted to the local educational and cultural context.

CONCLUSION

The study demonstrates that sensory integration technologies have important methodological value for speech-language therapy education when they are used as a complementary framework supporting communication, participation, attention, motor planning, and learning. International experience shows that effective preparation of specialists requires theoretical foundations, assessment and profiling, clinical observation, guided practical training, and reflective supervision.

On the basis of the analysis, a competency-based model for higher education institutions of Uzbekistan was developed. The model includes motivational, cognitive, operational, and reflective components and is supported by case-based learning, problem-based learning, team-based learning, simulation-based learning, video case analysis, microteaching, and digital learning resources. Its implementation may contribute to improving the quality of future speech therapists' professional training and strengthening interdisciplinary practice in inclusive and special education settings.

The proposed framework may serve as a methodological basis for integrating sensory integration technologies into speech therapist education programs. Further empirical research is needed to validate the model, measure its effectiveness, and develop practical tools for assessing the sensory integration competence of undergraduate speech therapy students.

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METHODS OF TEACHING THE MOTHER TONGUE IN GENERAL SECONDARY EDUCATION AND THEIR INTERPRETATION

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Abstract*. It is known that the effectiveness of the educational process depends on its organization on the basis of cooperation between the teacher and learners, on the full consideration of learners’ abilities within this cooperation, and on the correct selection of techniques, methods, and tools that activate learners.*

Keywords*: teacher and learners, techniques, methods, practical techniques: various types of exercises and practical work.*

INTRODUCTION

It is known that the effectiveness of the educational process depends on its organization on the basis of cooperation between the teacher and learners, on the full consideration of learners’ abilities within this cooperation, and on the correct selection of techniques, methods, and tools that activate learners.

The Concept of Teaching the Mother Tongue in General Secondary Education states that, “based on the main direction, aim, tasks, content, and principles of teaching the Uzbek language, and taking into account the latest achievements of linguistics and methodology, it is necessary to select from them those that correspond to learners’ life needs and thereby effectively organize Uzbek language education in educational institutions and raise it to a new stage in terms of practical effectiveness.”[1] This requirement calls for a particularly responsible approach to teaching the mother tongue.

METHODS

Based on the explanations of teaching techniques given in A. G‘ulomov and M. Qodirov’s textbook Methodology of Teaching the Mother Tongue[2] and in B. To‘xliyev, M. Shamsiyeva, and T. Ziyodova’s textbook Methodology of Teaching the Uzbek Language,[3] it is appropriate to state that a teaching technique[4] is a detail or component of a method, a type of practical activity directed toward independent thinking and serving to ensure the acquisition of knowledge and skills.

A method specifies the nature and direction of learning activity, whereas a technique is the teacher’s concrete action. According to the organization of joint activity between the teacher and students, the following techniques are distinguished: conversation, explanation, and independent work.

On the basis of sources of knowledge, the following techniques are distinguished:

observation and analysis of language material, such as phonetic analysis, lexical analysis, and grammatical analysis;

visual[5] observation (observing or seeing an object or event with the eyes or with binoculars), experimentation, and observation;

practical techniques: various types of exercises and practical work.

In methodological literature, the teacher's oral delivery of information to students, that is, the teacher's living word, lecture, and explanation, is being included both as a technique and as a method.

Teaching techniques are a complex process that requires alternation during the teaching of a topic. To this day, among methodologist scholars who deal with this issue, there are cases where "method" and "technique" are used without distinction. No single solution has been reached in understanding and interpreting the essence of this pedagogical category. The fact is that, despite the considerable attention paid to this problem, duality in views still persists. Developing samples for teaching topics on the basis of the diversity of techniques and the consistency of their application within a certain system, and recommending them to school education, helps to organize the activity of practicing teachers correctly. Thus, the following conclusion may be drawn about the evolution of teaching techniques:

1. No single technique can fully ensure the required results.
2. Good results can be achieved only through different techniques.
3. The greatest effect can be achieved through the use of mutually complementary techniques that form a system, rather than through techniques that are multidirectional and unrelated.

This raises the question of what a technique is and in what situations it is applied. We consider it appropriate to answer this question as follows:

1. A technique is not the activity itself, but the way of carrying it out. In practice, it turns into a technique.
2. A technique itself should not be considered wrong; only its application may be wrong. When applying a technique, all its requirements must be observed.
3. Each technique has its own specific subject, and each of them is a unique procedure.
4. A technique always belongs to the actor: the teacher recommends, and the student performs; the student is the actor. According to M. M. Levina, there is no activity without an object and no technique without activity. Any technique is applied in the educational process, or different techniques exist within different actions; techniques are not limited only to education.
5. The educational process must awaken in the child an intense inner desire for knowledge and vigorous mental work. The success of the entire educational process largely depends on the choice of the techniques applied.

The teaching technique is chosen by the teacher. In doing so, the teacher must follow a number of requirements.

RESULTS

A teaching technique is the orderly activity of the teacher and students aimed at achieving a given educational objective. Teaching techniques, in the didactic sense, are often understood as a set of ways to achieve goals and solve educational problems. In pedagogical literature, the concept of method is sometimes discussed only in relation to the teacher's activity or only in relation to students' activity.

In the first case, it is appropriate to speak about teaching techniques. If the joint work of the teacher and students is meant, then teaching techniques are undoubtedly manifested.

K. D. Ushinsky has a well-known statement: "The nature of children requires clear visibility. Teach a child five unfamiliar words, and he will suffer over them in vain for a long time; but connect twenty such words with pictures, and the child will learn them in an instant. You explain a very simple idea to a child and he does not understand you; explain difficult information

to the same child on the basis of a picture, and he understands you quickly ... If you show pictures, the class begins to speak."

Therefore, various techniques are important in a person's comprehension and knowledge of all things. A technique is directly connected with the aims and tasks of the lesson. Techniques are determined, first of all, by the effectiveness of teaching and learning methods. In general, a technique is called a way or a system of techniques by means of which a certain goal is achieved in the performance of a particular process. Thus, in determining the essence of a technique, two characteristic features can be identified.

First, there is the feature of the goal-oriented nature of the action; second, there is the feature of its regulation. These may be called the standard characteristics of a general technique. However, there are also characteristics that are specific only to teaching techniques.

These include, first of all: certain forms of cognitive activity; any means of information exchange between teachers and students; stimulation of students' learning and cognitive activity; control of the educational process; management of students' cognitive activity; and revealing the content of knowledge in an educational institution.

Therefore, attention must be focused specifically on the cognitive aspect of students. The age-related developmental characteristics of cognitive processes such as sensation, perception, memory, thinking, speech, imagination, and representation constitute the basis for mastering education.

The diversity of teaching techniques and their application in a definite sequence ensure the effectiveness of teachers' educational activity. The technique is chosen by the teacher.

Teaching techniques may be summarized as follows:

1. No single technique can fully ensure the expected result.

2. Expected results require a set of techniques that direct learners toward mental activity.

3. The effectiveness of learning and cognitive activity is achieved through the use of systematic techniques that are connected with one another. The effectiveness of techniques depends on the following:

1. A technique must serve as a way of carrying out learning activity.
2. Through each technique, a particular feature of the topic must be identified and revealed. Each technique must be directed toward its own task.
3. The teacher chooses the technique; a correctly chosen technique guarantees that the student's activity will be directed properly. The teacher recommends, and the student performs.

As M. M. Levina emphasizes, there is no activity without an object and no technique without activity. Any technique is applied in the educational process, or different actions are carried out through different techniques.

A teaching technique is the orderly activity of the teacher and students aimed at achieving a given educational objective. Teaching techniques, in the didactic sense, are often understood as a set of ways to achieve goals and solve educational problems.

In pedagogical literature, the concepts of method and technique are sometimes given the same explanation. During a lesson, sometimes only the activity of the teacher or only the activity of students is discussed. In the educational process, the activity of the teacher and the student is united by the teaching technique and the method.

A teaching method consists of a set of teaching techniques. If the joint work of the teacher and students is meant, teaching techniques are certainly manifested. K. D. Ushinsky has a well-known statement:

"The nature of children requires clear visibility. Teach a child five unfamiliar words, and he will suffer over them in vain for a long time; but connect twenty such words with pictures, and the child will learn them in an instant ...".

Thus, through various techniques, a person can understand and know everything. A technique must correspond directly to the aims and tasks of the lesson. With the help of techniques, a certain process is carried out, and this process ensures the achievement of the goal. In a set of techniques, each selected technique must have its own independent feature, function, and definite order in achieving the intended goal.

A teaching technique is characterized by its service to:

a) certain forms of cognitive activity;

b) a means of information exchange between the teacher and students;

c) stimulation of students' learning and cognitive activity;

d) control of the educational process;

e) management of students' cognitive activity;

f) revealing the content of knowledge in an educational institution.

The selected techniques ensure educational effectiveness through their ability to develop students' cognitive processes such as sensation, perception, memory, thinking, speech, imagination, and representation.

International integration in the field of education and the introduction of advanced foreign teaching and assessment techniques into national education have created opportunities to achieve teaching effectiveness.

DISCUSSION

One of the interactive techniques, the "Cluster" technique, is being referred to both as a method and as a technology. The word cluster means "bud" or "bundle." The Cluster technique is a structure that enables thinking about the relationships among various ideas. This technique ensures that students thoroughly master the topic. The "Cluster" technique may be used both for individual work with students and for group work. Each group of students is given tasks to complete independently.

With the help of "Cluster" technology, the internal parts of the phenomenon being studied and the divisions among them are clarified. For example, using "Cluster" technology to classify "word classes" according to their similar and different features ensures students' conscious thinking. Text analysis is carried out with students on the basis of the following tasks.

Text: The Moon is the celestial body closest to the Earth. It is four times smaller than the Earth, and its weight is 81 times less.

The Moon completes a full orbit around the Earth in one day and night. When viewed from the Earth, the Moon appears differently at different times.

The Moon also has mountains and plains similar to those on the Earth. However, there is no layer of air and no water, and for this reason many celestial bodies strike it. As a result, sloping craters have formed on the surface of the Moon. One of them is named after Ulugbek. There are dark spots on the surface of the Moon. They are called "seas." However, there is no trace of water in these "seas." (M. Mirakmalov)

Task 1. Read the text. Group the words on the basis of questions. Identify the words that do not answer any question on their own.

What? — Moon, Earth, sky, body, day and night, mountain, ...

Who? — Ulugbek, ...

Who? (plural) — they,

What does it do? — appears, ... What kind? — dark, ...

How many? — four, eighty-one, ...

Which? — this,

Words that do not answer a question on their own: esa, bor, yo‘q, lekin, va, ham, and so on.

Task 2. Think. What word class would you give to the words that answer questions? What would you call the words that do not answer questions?

On the basis of their previous knowledge, students name them as nouns, adjectives, numerals, and verbs.

Task 3. Read the sentences by omitting the words lekin and bilan. Say what purpose these words serve. Say what purpose the word ham serves.

A “Cluster” is formed on the basis of students’ answers. On the basis of the cluster, students’ opinions are heard about the principles used in classifying words into word classes, as well as their answers to the question: “How did the Cluster technology affect your mastery of knowledge?”

One of the methods created under the many abbreviations in Lean terminology (free translation), such as 4K, 5W+H, 3M, 7W, and others, is 5M. It is being applied to the field of mother tongue teaching, and experimental results are being noted as successful. Today, 5M technology also makes it possible to achieve good results in the field of education. Each component of this abbreviation is expressed under separate numbers, and students’ activity is organized on the basis of 5M technology:

1M — human, person (English: man; in education, a student or students).

2M — educational tools necessary in the educational process (car/machine, equipment).

3M — learning materials (materials).

4M — time allocated for learning activity (measure).

5M — method (method — way, technique).

Each abbreviation “M” given under the numbers describes the learning material necessary for organizing the activity of the student and the teacher, the time spent on teaching, and effective teaching methods and techniques. There are two situations in the use of these abbreviations, that is, they are classical tools used to analyze the causes of a problem. For example, using this technology gives good results in classifying lexical units according to meaning and form and in explaining the educational and pedagogical importance of studying historical and archaic words. Students are assigned the task of identifying and explaining historical and archaic words used in the historical works of Uzbek writers and writers of related peoples and of justifying their significance. For example, Abay’s Book of Words, Chingiz Aitmatov’s The Day Lasts More Than a Hundred Years, and Oybek’s Kutlug‘ Qon are recommended.

Students are asked to identify historical lexical units used in the languages of the related Kazakh, Kyrgyz, and Uzbek peoples; to identify, classify, and explain the historical and archaic lexical units common to these peoples’ languages; to classify and explain the historical and archaic lexical units specific to each people’s language; to write the identified lexemes on separate cards; and to indicate on each card the source, author, title of the work, publisher, and page. Students understand that historical and archaic words reflect the origins of Turkic peoples and their separate paths of development in the lexicon of their languages. They also come to realize that the lexicon of the Uzbek language has broad possibilities for expressing thought.

CONCLUSION

In conclusion, methods and innovative technologies such as associative series, supporting reminders, additions, brainstorming, group discussion, clusters, synchronization (aligning language phenomena with one another), essays, didactic games, and learning concepts through text analysis make it possible to achieve effective results in teaching the mother tongue. The demands being placed on the current educational process create a need to use world experience.

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CREATING PROGRAMMING-BASED PHYSICAL MODELS FOR STUDYING THE MOTION OF OBJECTS THROWN HORIZONTALLY, VERTICALLY, AND AT AN ANGLE

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Abstract. *This article examines the creation of programming-based physical models for studying the motion of objects thrown vertically, horizontally, and at an angle to the horizon. The main purpose of the study is to show how the laws of mechanics can be represented through mathematical formulas, algorithmic procedures, and computer simulations in order to make physical processes clearer for learners. The article describes the theoretical foundations of physical modeling, presents mathematical models for three forms of projectile motion, and explains how these models can be implemented in the Python programming language. Particular attention is given to the decomposition of motion into horizontal and vertical components, the role of initial velocity and launch angle, and the educational advantages of visual simulation. The results show that programming-based models allow students to observe changes in trajectory, flight time, maximum height, and flight distance when the initial parameters are modified. The article also discusses the role of computer modeling in physics lessons, its contribution to interdisciplinary STEM education, and the practical difficulties that may arise when integrating programming into the teaching of mechanics.*

Keywords: *physical modeling, programming, mechanics, free fall, projectile motion, horizontal throw, vertical throw, angular throw, algorithm, Python, computer simulation, STEM education.*

1. Introduction

The use of information technologies in the modern education system is becoming increasingly important. In natural science education, and especially in physics, many phenomena are difficult for learners to understand only through verbal explanation or static textbook diagrams. Motion, acceleration, velocity, force, and trajectory are dynamic processes. They change continuously over time, and this makes them suitable for computer-based representation. When students see a physical process not only as a formula but also as a moving or graphically represented model, the abstract law becomes more concrete and understandable.

Physics teaching traditionally relies on theoretical explanation, problem solving, laboratory work, and demonstration experiments. These methods remain essential, but they can be strengthened through computer modeling. A physical experiment may require equipment, space, safety conditions, or repeated measurements. In some schools, such resources are limited. Computer simulation does not replace real experimentation, but it gives teachers and students an additional educational tool. It allows them to repeat an experiment many times, change parameters quickly, compare outcomes, and visualize the trajectory of motion in a controlled virtual environment.

One of the basic topics in mechanics is the motion of objects thrown vertically, horizontally, and at an angle. These forms of motion are important because they combine the ideas of initial velocity, acceleration due to gravity, coordinate change, and time. A vertically thrown body demonstrates the relation between upward motion and free fall. A horizontally thrown body shows how uniform horizontal motion can occur simultaneously with accelerated vertical motion. A body thrown at an angle combines both components and produces a parabolic trajectory. Therefore, this topic is suitable for integrating physics, mathematics, and computer science.

The present article is based on the idea that programming can be used as a tool for creating physical models. A physical model begins with the analysis of a real process, continues with a mathematical description, and is then converted into an algorithm that can be implemented in a programming language. In this article, Python is used as an example because it allows simple mathematical calculation and graphical visualization. Through such modeling, learners can observe how an object moves over time and how changes in initial velocity, launch angle, or gravitational acceleration influence the result.

The aim of the article is to describe how programming-based physical models can be created for the study of vertically thrown, horizontally thrown, and angle-thrown objects. The article also explains the educational value of these models in physics lessons. The following tasks are addressed: first, to present the theoretical basis of physical modeling; second, to describe the mathematical models of the selected types of motion; third, to develop an algorithm for computer simulation; fourth, to demonstrate a Python-based model; and fifth, to discuss the advantages and limitations of using computer modeling in the teaching of mechanics.

2. Materials and Methods

2.1. Research Design and General Approach

The study has a theoretical and computational modeling design. It does not depend on a large-scale classroom experiment or a survey of participants. Instead, it focuses on how a physical process can be translated into a mathematical model, then into an algorithm, and finally into a computer program. This approach is appropriate because the objective of the article is not to measure students' achievement statistically, but to demonstrate the structure and educational potential of programming-based physical modeling.

The object of analysis is the motion of bodies thrown vertically, horizontally, and at an angle. These motions are studied under the standard school-physics assumption that air resistance is neglected and the acceleration due to gravity is constant. Under these assumptions, the motion of a body can be described by relatively simple equations. Such simplification is useful in education because it helps students understand the main laws of motion before moving to more complex real-world conditions.

The methodological sequence used in the article consists of six main stages. First, the physical process is analyzed in terms of forces, velocity, acceleration, time, and coordinate change. Second, a mathematical model is selected for each type of motion. Third, the model is transformed into an algorithm that can calculate the coordinates of the object step by step. Fourth, the algorithm is implemented in a programming language. Fifth, the computer produces numerical and graphical output. Sixth, the obtained results are interpreted from both a physical and an educational point of view.

2.2. Theoretical Foundations of Physical Modeling

Physical modeling is the process of representing a real physical phenomenon through a simplified mathematical and algorithmic structure. A model does not reproduce every detail of

reality. Instead, it identifies the most important variables and relationships that explain the process. In mechanics, such variables usually include time, position, velocity, acceleration, mass, force, and direction. In the case of projectile motion, the most important variables are initial velocity, launch angle, acceleration due to gravity, horizontal coordinate, vertical coordinate, and time.

The educational value of physical modeling is that it connects theory with observation. A formula such as $y = v_0t - gt^2/2$ may be mathematically correct, but many students find it difficult to imagine how this expression changes over time. When the same formula is used in a program and the graph is drawn, students can see the rise and fall of the object. This makes it possible to understand the relationship between algebraic expression and physical movement. Modeling also encourages students to ask questions such as: What happens if the initial velocity increases? Why does the object fall faster after reaching maximum height? Why is the trajectory parabolic?

In this article, physical modeling is treated as an interdisciplinary activity. Physics provides the laws of motion, mathematics provides equations and functions, and computer science provides algorithms and visualization tools. This integration supports modern STEM education because it develops not only subject knowledge but also computational thinking, data analysis, and problem-solving skills.

2.3. Mathematical Model of Vertical Motion

The motion of an object thrown vertically upward is based on the laws of uniformly accelerated motion. At the initial moment, the object has an upward velocity. However, gravity acts downward and gradually reduces this upward velocity. When the velocity becomes zero, the object reaches its maximum height. After that, the object begins to move downward, and its speed increases because of gravitational acceleration.

$$v = v_0 - gt$$

$$y = v_0t - (gt^2 / 2)$$

In these equations, v is the velocity of the object at time t, v_0 is the initial velocity, g is the acceleration due to gravity, and y is the vertical coordinate. The maximum height is reached when the velocity becomes zero. Therefore, the maximum height can be found with the following formula:

$$H = v_0^2 / (2g)$$

In a computer model, these equations can be calculated for small time intervals. For each value of time, the program calculates the corresponding velocity and height. As a result, learners can observe the complete motion of the object: upward movement, stopping at maximum height, and downward fall. This model is useful for explaining free fall, the effect of gravity, and the meaning of negative acceleration.

2.4. Mathematical Model of Horizontal Motion

A horizontally thrown object has an initial velocity only in the horizontal direction. At the same time, gravity acts on the object in the vertical direction. Therefore, the motion consists of two independent components: uniform motion along the horizontal axis and uniformly accelerated motion along the vertical axis. The horizontal velocity remains constant if air resistance is neglected, while the vertical velocity increases due to gravity.

$$x = v_0t$$

$$y = (gt^2) / 2$$

Here, x is the horizontal coordinate and y is the vertical displacement caused by gravity. The combination of these two motions produces a curved trajectory. Although the object moves

uniformly in the horizontal direction, it falls faster and faster in the vertical direction. This explains why the path of a horizontally thrown object is not a straight line but a parabolic curve.

Computer modeling makes this process especially clear. Students can change the initial horizontal velocity and immediately see how the range of the object changes. They can also observe that the time of falling depends on the vertical motion, while the horizontal distance depends on the horizontal velocity and the time available for motion. This separation of components is an important conceptual point in mechanics.

2.5. Mathematical Model of Motion at an Angle

The motion of an object thrown at an angle to the horizon is one of the most important cases of projectile motion. In this type of motion, the initial velocity has both horizontal and vertical components. The horizontal component determines how far the object moves along the x-axis, while the vertical component determines how high the object rises and how long it remains in the air.

$v_x = v_0 \cos \alpha$

$v_\gamma = v_0 \sin \alpha$

After the initial velocity is divided into components, the coordinates of the object at any time t can be calculated as follows:

$x = v_0 \cos \alpha \cdot t$

$y = v_0 \sin \alpha \cdot t - (gt^2 / 2)$

The total flight distance and the maximum height can also be expressed through the initial velocity, launch angle, and gravitational acceleration:

$L = (v_0^2 \sin 2\alpha) / g$

$H = (v_0^2 \sin^2 \alpha) / (2g)$

These formulas show that the trajectory depends strongly on the angle of launch. If the initial velocity is constant and the object starts and lands at the same vertical level, the maximum range is obtained at an angle of 45 degrees. Angles smaller than 45 degrees produce a lower trajectory with shorter flight time, while angles greater than 45 degrees produce a higher trajectory but not necessarily a longer horizontal distance. A computer simulation helps learners compare these cases visually.

2.6. Algorithmization of the Physical Process

Algorithmization is the process of converting a mathematical model into a sequence of computational steps. For projectile motion, the algorithm begins with the input of initial parameters, such as initial velocity, launch angle, gravitational acceleration, starting time, and time step. Then the program repeatedly calculates the horizontal and vertical coordinates for each small time interval. The values are stored in arrays or lists and later used to construct a graph.

The algorithm used in the article can be described in full form as follows. The user first enters the initial velocity and the angle of launch. The program converts the angle from degrees into radians, because trigonometric functions in most programming environments use radians. The time variable is set to zero, and a small time interval, for example dt = 0.01 seconds, is selected. At each step, the program calculates $x = v_0 \cos(\alpha)t$ and $y = v_0 \sin(\alpha)t - gt^2/2$. If y remains greater than or equal to zero, the coordinate is stored and the program continues. If y becomes negative, the object has reached the ground, and the calculation stops.

Such an algorithm has an important educational function. It helps students understand that a physical process can be represented not only as a final formula but also as a step-by-step

development in time. This strengthens algorithmic thinking and helps learners connect physics problems with programming logic.

2.7. Python-Based Implementation

Python is suitable for educational physical modeling because it has simple syntax and powerful libraries for numerical calculation and visualization. In the example below, the NumPy library is used for mathematical operations, and Matplotlib is used for drawing the trajectory. The program calculates the coordinates of an object thrown at an angle and displays the graph of its motion.

```
import numpy as np
import matplotlib.pyplot as plt

g = 9.8
v0 = 20
angle = 45
angle = np.radians(angle)
t = np.linspace(0, 5, 100)

x = v0 * np.cos(angle) * t
y = v0 * np.sin(angle) * t - 0.5 * g * t**2

plt.plot(x, y)
plt.xlabel("x")
plt.ylabel("y")
plt.title("Projectile motion")
plt.grid(True)
plt.show()
```

This program provides a basic visualization of projectile motion. For classroom use, the program can be expanded by allowing students to enter different values of velocity and angle, by plotting several trajectories on the same graph, or by calculating numerical values such as maximum height, flight time, and range. In this way, one short program can become a virtual laboratory for studying mechanics.

3. Results

3.1. Model Outputs

The programming-based models make it possible to obtain both graphical and numerical results. For vertical motion, the model shows that the object first moves upward, its velocity gradually decreases, and it reaches maximum height when the velocity becomes zero. After that, the object moves downward with increasing speed. This output corresponds to the law of free fall and visually demonstrates the effect of gravitational acceleration.

For horizontal motion, the model shows that the horizontal coordinate increases uniformly with time, while the vertical coordinate increases according to a quadratic relationship. This means that the object covers equal horizontal distances in equal time intervals but falls more rapidly as time passes. The resulting path is parabolic. This result helps explain why horizontal motion and vertical motion can be studied separately and then combined.

For motion at an angle, the model produces a parabolic trajectory whose shape depends on initial velocity and launch angle. Increasing the initial velocity increases the range and maximum

height. Changing the angle changes the balance between horizontal and vertical components. When the angle is too small, the object travels quickly in the horizontal direction but remains in the air for a short time. When the angle is too large, the object rises higher but has a smaller horizontal velocity component. Under ideal conditions, the angle of 45 degrees gives the greatest horizontal range.

3.2. Example of Calculated Results

As an example, the model was considered for an initial velocity of 20 m/s and gravitational acceleration of 9.8 m/s². The following table illustrates how the launch angle influences flight time, maximum height, and horizontal range under the ideal assumption that the object starts and lands at the same level and air resistance is ignored.

Launch angle	Flight time (s)	Maximum height (m)	Range (m)
30°	2.04	5.10	35.35
45°	2.89	10.20	40.82
60°	3.53	15.31	35.35

The table shows that 45 degrees gives the greatest range in the selected ideal model. The angles 30 degrees and 60 degrees produce the same range because their values of sin 2α are equal. However, their trajectories are different: the 30-degree trajectory is lower and faster, while the 60-degree trajectory is higher and lasts longer. This comparison is useful for teaching because it shows that identical range can be produced by different combinations of horizontal and vertical motion.

3.3. Educational Results of Modeling

The main educational result of the model is that learners can connect formulas with visible motion. Instead of memorizing separate equations, students can see how each variable affects the trajectory. The model also allows learners to compare theoretical results with computer-generated graphs. Such comparison strengthens conceptual understanding and develops research skills.

The modeling process also helps students understand the meaning of parameters. Initial velocity is not only a number in a formula; it determines how far and how high the object can move. The angle is not only a geometric value; it controls the distribution of velocity between horizontal and vertical directions. The gravitational acceleration is not only a constant; it determines the downward curvature of the trajectory. Therefore, computer modeling gives these physical quantities a clearer practical meaning.

The results show that programming-based modeling can be used as a virtual laboratory in mechanics. Students can change one parameter while keeping other parameters constant, observe the result, and then explain the change using physical laws. This supports active learning and encourages learners to think like researchers rather than only solve standard textbook exercises.

4. Discussion

4.1. Pedagogical Value of Computer Modeling

Computer modeling has several advantages in physics education. First, it visualizes processes that are difficult to observe in detail during a real experiment. A thrown object moves quickly, and students may not easily notice the change in velocity or the exact form of the trajectory. A computer model can slow down the process, repeat it, and display the path clearly on a coordinate plane. Second, modeling allows rapid experimentation. Students can change the velocity or angle and immediately compare the results. Third, modeling supports inquiry-based learning because it encourages students to make predictions and then test them.

Another important advantage is that computer modeling strengthens the connection between theoretical and practical knowledge. In many cases, students solve mechanics problems by substituting numbers into formulas. This may lead to mechanical memorization. When the same formulas are used to create a model, students understand why the formulas are needed and how they describe real motion. Thus, programming can become a bridge between mathematics and physical meaning.

4.2. Use in Physics Lessons

In the educational process, the proposed models can be used in several ways. A teacher may first explain the theory of projectile motion, then demonstrate the model, and finally ask students to change parameters and interpret the results. The model may also be used as part of a virtual laboratory, where students complete tasks such as finding the angle that gives the maximum range, comparing different initial velocities, or explaining why two different angles can produce the same range.

The topic can also be organized as an integrated lesson between physics and informatics. In such a lesson, students not only study projectile motion but also learn how to write a simple program, use variables, apply trigonometric functions, create arrays, and plot graphs. This form of instruction is especially useful for developing STEM competencies. It shows students that scientific knowledge is not isolated: physics, mathematics, and programming work together in modern scientific and engineering practice.

4.3. Interdisciplinary Integration

The integration of physics and computer science develops several important skills. From physics, students learn the laws of motion and the meaning of variables. From mathematics, they learn functions, trigonometry, coordinates, and graphs. From informatics, they learn algorithms, programming syntax, data processing, and visualization. When these subjects are combined, students gain a more complete understanding of both the physical process and the computational method used to study it.

Such integration is also important because modern science increasingly depends on computer modeling. Engineers, physicists, meteorologists, architects, and many other specialists use simulations to predict and analyze real processes. Introducing simple physical models at school or university level prepares learners for this modern scientific environment. It also helps them understand that programming is not only a technical skill but also a method of scientific thinking.

4.4. Difficulties and Possible Solutions

Despite its advantages, the integration of programming-based modeling into physics lessons may face certain difficulties. The first problem is the lack of technical equipment. Not all classrooms have enough computers, projectors, or stable software environments. The second problem is insufficient programming knowledge among some teachers and students. The third problem is limited lesson time, because teaching both physics content and programming skills may require more time than a traditional lesson.

Several solutions can reduce these difficulties. If individual computers are not available, the teacher can use one computer and a projector for demonstration. Simple programming environments can be selected so that students are not overloaded by technical details. Ready-made templates can also be prepared, allowing students to change only the key parameters at first. As their skills develop, they can gradually modify the program more independently. In addition, integrated lessons between physics and informatics teachers can make the process more effective.

4.5. Limitations of the Model

The proposed models are based on idealized assumptions. Air resistance is not included, the gravitational acceleration is taken as constant, and the object is assumed to start and land at the same vertical level in the angle-motion example. These assumptions are suitable for introductory mechanics, but real motion may be more complex. For example, air resistance can reduce the range and change the shape of the trajectory. Wind, object shape, and surface conditions can also influence real motion.

However, these limitations do not reduce the educational value of the model. On the contrary, they can be used as a basis for further discussion. After students understand the ideal model, the teacher can ask how real-world conditions might change the result. This leads to deeper scientific thinking and prepares students for more advanced modeling.

5. Conclusion

The study of objects thrown vertically, horizontally, and at an angle through programming-based computer modeling has significant value for physics education. Such models make it possible to represent the laws of mechanics in a visual and interactive form. They help students understand the relationship between formulas, algorithms, graphs, and physical processes. The models described in this article show how vertical motion, horizontal motion, and projectile motion at an angle can be represented through mathematical equations and implemented in Python.

The results demonstrate that computer modeling allows learners to observe the effects of initial velocity, launch angle, gravitational acceleration, and time on motion. The model clearly shows that projectile motion has a parabolic trajectory and that, under ideal conditions, a launch angle of 45 degrees produces the maximum horizontal range. It also shows that different angles can produce different combinations of flight time, height, and distance.

From an educational perspective, programming-based modeling strengthens theoretical knowledge, develops research skills, supports independent thinking, and increases students' interest in science. It also contributes to interdisciplinary STEM education by integrating physics, mathematics, and informatics. Although technical equipment, programming knowledge, and time limitations may create difficulties, these problems can be reduced through virtual laboratories, simple programming environments, prepared templates, and integrated lessons. Therefore, the use of programming-based physical models should be considered an effective method for teaching mechanics in modern education.

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WAYS TO DEVELOP THE PRACTICAL AND METHODOLOGICAL TRAINING OF PHYSICAL EDUCATION INSTRUCTORS

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Abstract. *The article examines the development of practical and methodological training of physical education instructors as an essential condition for improving the quality of physical education, health-oriented activity, and pedagogical support in educational institutions. The relevance of the topic is determined by the growing need for instructors who are able not only to organize physical exercises, but also to design lessons methodically, apply differentiated approaches, assess learners' physical development, prevent injuries, and use modern pedagogical technologies. Practical training is interpreted as the instructor's readiness to organize, demonstrate, regulate, and evaluate motor activity in accordance with age, health status, and educational objectives. Methodological training is considered as the ability to plan the educational process, select effective teaching methods, adapt exercises to different groups, and ensure the pedagogical continuity of physical development. The study emphasizes that the professional effectiveness of physical education instructors depends on the integration of theoretical knowledge, practical skills, methodological culture, communication competence, and reflective analysis. Special attention is paid to interactive teaching methods, health-saving technologies, monitoring of physical indicators, individualization of physical loads, and the organization of safe learning environments. The article argues that the development of practical and methodological training should be based on systematic professional improvement, practice-oriented learning, pedagogical mentoring, and continuous self-assessment. The proposed approach contributes to the formation of competent, responsible, and methodologically prepared physical education instructors capable of meeting contemporary educational and health-related requirements.*

Keywords: *physical education instructor, practical training, methodological training, professional competence, physical education, pedagogical skills, health-saving technologies, motor activity, professional development.*

Introduction

The professional activity of physical education instructors occupies an important place in the modern educational system, because it directly influences learners' physical development, health culture, motor competence, discipline, motivation, and social activity. In contemporary pedagogical practice, physical education is no longer limited to the mechanical repetition of exercises or the organization of standard sport activities. It is increasingly understood as a complex educational process aimed at strengthening health, developing physical abilities, forming a conscious attitude toward a healthy lifestyle, and creating conditions for the harmonious development of the individual. Therefore, the quality of physical education largely depends on the practical and methodological readiness of instructors who organize and manage this process.

The practical training of physical education instructors includes the ability to demonstrate exercises correctly, organize group and individual activities, regulate physical loads, ensure safety during lessons, use sport equipment properly, and respond effectively to different pedagogical situations. At the same time, methodological training reflects the instructor's capacity to plan lessons, define objectives, select appropriate methods, adapt physical exercises to learners' age and physical condition, assess progress, and apply educational technologies in a purposeful way. These two components are closely connected: practical skills without methodological awareness may lead to routine and ineffective instruction, while methodological knowledge without practical mastery cannot ensure high-quality physical education. For this reason, the development of practical and methodological training should be considered as an integrated process.

In pedagogical universities specializing in sports education, the preparation of future physical education instructors must be oriented toward the real requirements of professional activity. Students should not only acquire theoretical knowledge of anatomy, physiology, pedagogy, psychology, sport theory, and training methodology, but also learn to apply this knowledge in practical situations. They need to master lesson planning, organization of motor activity, differentiation of tasks, assessment of physical preparedness, prevention of injuries, and communication with learners. In addition, instructors should be able to motivate learners, develop their interest in physical exercises, and form stable habits of regular movement activity. This is especially important in conditions where sedentary lifestyles, digital dependence, and insufficient physical activity are becoming widespread among young people.

The relevance of this topic is also connected with the increasing demand for competent specialists who can combine health-saving, educational, developmental, and organizational functions. A physical education instructor must be able to work with learners of different physical abilities, health conditions, motivations, and psychological characteristics. This requires flexible methodological thinking, practical experience, pedagogical observation, and reflective skills. Instructors should be ready to analyze the effectiveness of their work, identify difficulties, modify lesson content, and improve their professional methods continuously.

Thus, the development of practical and methodological training of physical education instructors is a necessary condition for improving the quality of physical education and sport-related pedagogical activity. A systematic approach to this process allows future specialists to become not only performers of physical exercises, but also competent organizers, educators, motivators, and methodological leaders capable of creating a safe, effective, and health-oriented educational environment.

Literature Review

The reviewed literature shows that the practical and methodological training of physical education instructors is closely connected with the quality of lesson organization, learner motivation, health protection, and pedagogical effectiveness. UNESCO emphasizes that quality physical education should be inclusive, safe, development-oriented, and based on competent teacher preparation. The World Health Organization also stresses the importance of regular physical activity and the reduction of sedentary behavior, which increases the responsibility of instructors in forming stable motor habits. Works by Rink, Metzler, Mosston and Ashworth reveal that effective physical education depends on the correct selection of teaching methods, clear lesson objectives, demonstration, feedback, and gradual formation of motor skills. Siedentop, Hastie and Van der Mars highlight the educational value of sport-based models, cooperation, responsibility, and active participation. Hellison's approach shows that physical activity can also develop

personal and social responsibility. Bailey confirms the positive influence of physical education on physical, social, emotional, and cognitive development. Dyson and Casey, Griffin and Butler, and Tomlinson underline the importance of cooperative learning, game-based approaches, and differentiated instruction. Uzbek authors Abdullayev and Xonkeldiyev provide methodological foundations relevant to national physical education practice. Overall, the literature confirms that instructors' practical-methodological competence must integrate theory, practice, safety, assessment, and reflection.

Methods

The methodological basis for developing the practical and methodological training of physical education instructors is formed through an integrated approach that combines theoretical study, practical activity, pedagogical observation, reflective analysis, and continuous professional improvement. In this context, the training process should not be limited to the acquisition of general knowledge about physical exercises, sport rules, or lesson structure. It should be directed toward the formation of stable professional skills that allow instructors to plan, organize, conduct, control, and evaluate physical education activities in accordance with pedagogical, physiological, psychological, and hygienic requirements.

The study of practical and methodological training can be organized on the basis of several interrelated methods. The first method is theoretical analysis, which includes the examination of scientific literature, educational standards, curricula, methodological manuals, and modern approaches to physical education. Through this method, the main components of the instructor's professional readiness are identified, including knowledge of physical development laws, lesson planning, motor skill formation, physical load regulation, safety rules, and assessment criteria. Theoretical analysis helps to determine the scientific and pedagogical foundations of instructor training and to clarify the relationship between practical skills and methodological competence.

The second method is pedagogical observation. It is used to study how physical education instructors organize lessons, communicate with learners, demonstrate exercises, distribute physical loads, correct mistakes, and maintain discipline and safety. Observation makes it possible to reveal strong and weak aspects of practical activity. For example, some instructors may have good motor demonstration skills but insufficient methodological planning, while others may prepare detailed lesson plans but experience difficulties in managing group activity. Therefore, pedagogical observation helps to diagnose the real level of practical and methodological readiness and to define directions for improvement.

The third method is practical modeling. This method involves the creation of educational situations that reflect real professional tasks of physical education instructors. Students or instructors are asked to design lesson fragments, select exercises for different age groups, adapt physical loads to various levels of preparedness, organize warm-up and recovery activities, and solve safety-related situations. Practical modeling develops the ability to act independently, make quick pedagogical decisions, and apply theoretical knowledge in real or simulated conditions. It also strengthens methodological thinking, because each practical action must be justified by a clear educational purpose.

The fourth method is reflective analysis. After practical tasks, lessons, or training sessions, instructors analyze their own activity, identify successful decisions, determine mistakes, and consider ways of improving future work. Reflection is especially important in physical education, because the effectiveness of instruction depends not only on the content of exercises, but also on

how they are explained, demonstrated, organized, and evaluated. Reflective analysis encourages instructors to move from routine performance to conscious professional activity.

The fifth method is assessment and monitoring. The development of practical and methodological training should be measured through clear indicators such as lesson planning quality, accuracy of exercise demonstration, ability to differentiate tasks, control of physical load, use of health-saving technologies, communication skills, and ability to evaluate learners' progress. Diagnostic tests, questionnaires, expert evaluation, self-assessment sheets, and analysis of practical lessons can be used for this purpose. The combination of these methods allows the training process to become systematic, evidence-based, and practice-oriented.

Results

The analysis of the practical and methodological training of physical education instructors shows that professional effectiveness is achieved when practical skills and methodological knowledge are developed as a single integrated system. The results indicate that instructors who possess only technical or sport-related skills are not always able to organize a high-quality educational process. Their activity may remain limited to demonstration, repetition, and general physical load. In contrast, instructors with developed methodological competence are able to define clear lesson objectives, select appropriate exercises, adapt tasks to learners' abilities, regulate intensity, prevent fatigue, and evaluate the pedagogical result of each lesson. Therefore, the main result of effective training is the formation of an instructor who can consciously connect physical activity with educational, developmental, and health-improving goals.

One important result is the improvement of lesson planning quality. When instructors receive systematic methodological preparation, they begin to design lessons according to logical stages: preparation, main activity, recovery, assessment, and reflection. This structure allows them to organize physical education not as a random set of exercises, but as a purposeful pedagogical process. Proper planning also helps to balance general developmental exercises, sport-specific movements, coordination tasks, endurance activities, flexibility exercises, and corrective elements. As a result, lessons become more effective, safer, and more suitable for learners with different levels of physical preparedness.

Another significant result is the strengthening of practical demonstration and instructional skills. Physical education instructors must not only explain exercises verbally, but also show them accurately, clearly, and safely. The quality of demonstration directly affects learners' understanding of movement technique and reduces the risk of mistakes or injuries. Practical-methodological training develops the instructor's ability to combine explanation, visual demonstration, correction, and feedback. This makes the learning process more understandable and increases learners' motivation to participate actively in physical exercises.

The results also show that differentiated and individualized approaches play a decisive role in modern physical education. Learners differ in their health condition, motor experience, physical abilities, motivation, and psychological readiness. Therefore, the instructor should be able to offer different levels of difficulty, regulate the number of repetitions, adjust exercise intensity, and provide alternative tasks when necessary. The development of such skills allows instructors to avoid excessive physical load and, at the same time, prevent low activity among stronger learners. This contributes to the creation of an inclusive and supportive physical education environment.

A further result is the increased importance of monitoring and assessment. Effective instructors regularly observe learners' progress, analyze physical indicators, identify difficulties, and adjust lesson content. Assessment is not limited to measuring speed, strength, endurance, or

flexibility; it also includes participation, discipline, effort, coordination, cooperation, and progress in mastering movement skills. Such an approach makes evaluation more objective and pedagogically meaningful.

Overall, the results confirm that the development of practical and methodological training improves the quality of physical education instruction, strengthens professional competence, enhances safety, supports learners' physical development, and promotes a conscious attitude toward health and regular motor activity.

Discussion

The development of practical and methodological training of physical education instructors should be discussed as a continuous and purposeful pedagogical process rather than as a separate stage of professional preparation. In modern sports education, an instructor is expected to perform several interconnected functions: educator, organizer, methodologist, motivator, health promoter, and evaluator. This means that professional readiness cannot be reduced only to the ability to conduct physical exercises. It must include deep understanding of educational goals, age-related physical development, health protection, pedagogical communication, and the logic of gradual motor skill formation.

One of the key issues in the preparation of physical education instructors is the gap between theoretical knowledge and practical application. Students may study anatomy, physiology, pedagogy, psychology, and sport methodology, but without systematic practice these subjects remain fragmented. Practical-methodological training helps to connect theoretical knowledge with real pedagogical action. For example, knowledge about physical load becomes meaningful only when an instructor can correctly determine the intensity of exercises, observe signs of fatigue, organize recovery, and adapt tasks to the individual condition of learners. Similarly, knowledge of teaching methods becomes effective when it is applied in explaining, demonstrating, correcting, and assessing movement actions.

Another important aspect is the role of methodological culture. A methodologically prepared instructor does not simply repeat ready-made lesson plans or use the same exercises for all learners. Such an instructor understands why a certain method is chosen, how it influences learners' physical development, and what result should be achieved. Methodological culture is reflected in the ability to select exercises according to lesson objectives, combine general and special physical preparation, use game-based and competitive elements appropriately, and ensure the gradual complication of tasks. This culture also requires flexibility, because each group of learners has its own level of preparedness, motivation, discipline, and health condition.

The discussion of this topic also shows that safety must be considered one of the central components of practical and methodological training. Physical education is directly connected with movement activity, physical load, sport equipment, and group dynamics. Therefore, the instructor must be able to prevent injuries through correct organization of space, proper warm-up, accurate explanation of technique, control of discipline, and timely correction of mistakes. Safety is not only a technical requirement, but also a pedagogical responsibility. A safe environment increases learners' confidence and encourages active participation.

In addition, modern physical education requires the use of innovative and health-saving technologies. These may include interactive exercises, circuit training, fitness elements, digital monitoring tools, movement games, corrective exercises, and differentiated physical tasks. However, innovation should not be applied formally. Every new method must correspond to learners' needs, lesson objectives, and available conditions. The instructor's methodological

competence determines whether innovation becomes a real factor of development or remains only an external addition to the lesson.

Thus, the practical and methodological training of physical education instructors should be developed through integration of theory and practice, pedagogical observation, reflective analysis, mentoring, and continuous professional improvement. The more consciously instructors plan, organize, evaluate, and improve their activity, the more effective their contribution becomes to learners' physical development, health culture, discipline, and motivation for regular physical activity.

Conclusion

The development of practical and methodological training of physical education instructors is one of the most important directions in improving the quality of physical education and sport-oriented pedagogical activity. The effectiveness of an instructor depends not only on personal physical preparedness or knowledge of sport techniques, but also on the ability to organize the educational process consciously, safely, and methodically. In this sense, practical training and methodological training should not be considered separately. Practical readiness ensures the instructor's ability to demonstrate exercises, manage learners' movement activity, regulate physical load, and create safe conditions. Methodological readiness, in turn, allows the instructor to plan lessons, define pedagogical objectives, select suitable methods, differentiate tasks, assess results, and improve the content of physical education according to learners' needs.

The analysis of the topic shows that the modern physical education instructor must be prepared for complex professional activity. This activity includes health-improving, educational, developmental, organizational, communicative, and diagnostic functions. Instructors should be able to work with learners who differ in age, physical ability, health condition, motivation, and motor experience. Therefore, the development of practical-methodological competence requires a systematic approach based on the integration of theoretical knowledge, pedagogical practice, reflective analysis, and continuous professional growth. Such an approach helps future instructors avoid formalism and routine in their work and encourages them to organize each lesson as a purposeful pedagogical process.

A significant condition for improving practical and methodological training is the strengthening of practice-oriented learning in pedagogical universities. Future instructors need regular opportunities to design lesson plans, conduct practical sessions, analyze real pedagogical situations, observe experienced teachers, and receive feedback from mentors. This process develops their confidence, independence, responsibility, and professional thinking. At the same time, the use of modern teaching technologies, health-saving methods, differentiated tasks, and monitoring tools increases the effectiveness of their preparation. These elements allow instructors to organize physical education in accordance with contemporary educational requirements and the real needs of learners.

Another important conclusion is that safety, individualization, and motivation should become central principles in the training of physical education instructors. A methodologically prepared instructor understands that physical education is not only a means of developing strength, speed, endurance, flexibility, and coordination, but also an important factor in forming discipline, self-confidence, cooperation, emotional stability, and a healthy lifestyle. For this reason, instructors must create a positive educational environment where learners participate actively, feel supported, and understand the value of regular motor activity.

Thus, the practical and methodological training of physical education instructors should be developed continuously and purposefully. Its improvement contributes to the formation of competent specialists who are able to combine pedagogical knowledge with practical skill, organize effective and safe lessons, assess learners' progress objectively, and promote physical culture as an essential part of personal development. The higher the level of practical-methodological readiness of instructors, the stronger their contribution to the physical, social, and educational development of learners.

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A METHODOLOGY FOR DEVELOPING PEDAGOGICAL DIAGNOSTIC TOOLS AND IMPLEMENTING THEM IN PRACTICE

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Abstract. *The article examines the methodology for developing pedagogical diagnostic tools and the scientifically grounded conditions for implementing them in educational practice. The study substantiates the principles underlying the design of diagnostic tools, a stage-based technology for their development and validation, and the pedagogical mechanisms that ensure their effective practical application. The results of the experimental work confirm the effectiveness of the proposed methodology: in the experimental group, the proportion of teachers demonstrating a high level of readiness to develop and apply diagnostic tools rose from 22.8% to 56.9%, while the low-level indicator fell from 43.5% to 13.6%. The article concludes with scholarly and methodological recommendations aimed at improving the quality of diagnostic activity within the system of higher pedagogical education.*

Keywords: *pedagogical diagnostics, diagnostic tools, methodology, validation, implementation in practice, assessment instruments, higher education.*

INTRODUCTION

In the modern education system, the timely and objective diagnosis of the educational process is becoming one of the decisive factors in ensuring its quality. The digitalization of education, the individualization of learning trajectories, and the growing diversity of the student body demand that the teacher possess not only theoretical knowledge of diagnostics but also reliable, scientifically grounded tools with which to study the educational process accurately. Pedagogical diagnostic tools-questionnaires, tests, observation cards, diagnostic tasks, and analytical schemes-serve as the practical instrument that transforms diagnostics from an abstract idea into a concrete, manageable process [1]. The accuracy of pedagogical conclusions, and consequently the effectiveness of pedagogical intervention, depends directly on the quality of these tools. For this very reason, contemporary international pedagogical research treats the methodology for developing and validating diagnostic tools as an independent scholarly problem that requires special investigation [10].

From this perspective, equipping prospective and practicing teachers with a scientifically grounded methodology for developing diagnostic tools is becoming an important factor in raising the quality of education [2]. A diagnostic tool that is not constructed in accordance with the requirements of validity and reliability is incapable of yielding objective results; on the contrary, it may lead to erroneous pedagogical decisions [3]. An educational process based on such unreliable data is deprived of any genuine mechanism for evaluating its own effectiveness, which is why the methodology for developing diagnostic tools is regarded as an integral component of the management of educational quality [6].

The methodology for developing diagnostic tools is understood as a system of scientifically grounded principles, stages, and procedures by means of which the teacher designs, validates, and applies in practice the instruments required to study situations within the educational process. This methodology is an inseparable component of the teacher's professional mastery, and mastering it requires special pedagogical conditions and consistent methodological support [4]. Historically, the theoretical foundations of approaches to the development of assessment and diagnostic tools were shaped by the concept of formative and summative assessment developed by scholars led by B. Bloom, as well as by the theory of test construction and the taxonomy of classifying knowledge, skills, and abilities [4; 9]. These approaches made it possible to interpret the diagnostic tool not merely as a means of recording an outcome, but as an instrument for improving the educational process. An analysis of the scholarly literature shows that, although many researchers have addressed individual aspects of constructing diagnostic instruments [5], the methodology for developing diagnostic tools on a holistic basis-that is, by uniting the procedures of design, validation, and practical implementation into a single coherent system-remains insufficiently studied [6]. Existing approaches often focus on the separate stages of constructing a tool, while the logical connection between these stages and their integration into actual pedagogical practice are overlooked [7]. This gives rise to the problem of the absence of a holistic, systematic methodology that links the development of diagnostic tools with their implementation in practice.

In international practice, various approaches-classical and modern test theory, the competency-based approach, simulation technologies, and evidence-based assessment design- are widely used to develop diagnostic tools [8]. Although each of these approaches has its own advantages, they are frequently applied in isolation, as separate techniques. The task of adapting these approaches to the national educational context and uniting them within a single methodological system requires dedicated scholarly investigation [9]. In this regard, organizing the development of the tool and its practical implementation as a continuous, mutually complementary process-and treating validation and reflective refinement as the driving mechanism of this process-acquires particular significance. The analysis set out above made it possible to formulate the following research problem: a holistic methodology and the pedagogical mechanisms that ensure the interconnected development, validation, and practical implementation of pedagogical diagnostic tools have not yet been sufficiently developed. The aim of the present study is to reveal the methodological foundations for developing pedagogical diagnostic tools and to develop and experimentally substantiate the scientifically grounded conditions for implementing them in educational practice [10].

MATERIALS AND METHODS

Research base and participants. The study was conducted on the basis of higher pedagogical education institutions, in stages, over the course of several academic years. Institutions of higher education that train personnel in the pedagogical field were selected as the research base, which ensured the practical significance and broad applicability of the results obtained. A total of 286 participants took part in the experiment; they were divided into an experimental group (143 participants) and a control group (143 participants). The composition of the participants was formed from individuals who were similar to one another in terms of field of study, length of pedagogical experience, and initial level of methodological preparation, which served to keep the experimental results free from the influence of external factors.

In order to ensure that the groups were homogeneous in terms of their initial level of preparation, participants were assigned using a random selection method. Before the experiment,

the initial level of readiness to develop and apply diagnostic tools was measured in both groups using a single set of diagnostic instruments. A statistical analysis of the initial data confirmed that there was no statistically significant difference between the experimental and control groups in terms of the level of this readiness. This indicated that both groups were in equal conditions at the start of the experiment and provided a solid basis for attributing the changes observed at the end of the formative stage specifically to the influence of the proposed methodology — that is, for a reliable comparison of subsequent results [1].

Theoretical methods. The theoretical methods included the analysis of scholarly pedagogical and psychological literature, comparative analysis, generalization and systematization, the systemic-structural approach, and modelling [3]. These methods served to reveal the essence of the methodology for developing diagnostic tools, to determine its structural composition, to compare existing theoretical approaches, and to design the methodological system. By means of the method of literature analysis and generalization, the content and essence of the concept of a "pedagogical diagnostic tool" and of the methodology for its development were clarified, and the scholarly-theoretical foundations of the problem as well as the degree to which it has been studied were established [3]. The method of comparative analysis was used to compare foreign and domestic approaches to constructing diagnostic tools (classical test theory, evidence-based design, simulation-based and other models), to reveal their advantages and limitations, and to substantiate the possibilities of adapting them to the national educational context [5].

The systemic-structural approach made it possible to consider the methodology for developing diagnostic tools as a unified, holistic system composed of interrelated stages and to identify its internal structure and the connections between its components. In particular, the method of modelling was used to develop the holistic technology for developing diagnostic tools as a unity of design, validation, implementation, and refinement stages [5]. This method made it possible to generalize the results of the theoretical analysis, to express them in the form of a systematic methodology applicable in practice, and to substantiate the internal logic of the methodology and the functional connections between its stages. The methodology thus developed served as the theoretical basis for subsequent experimental verification.

Empirical methods. The empirical methods included pedagogical observation, surveys, questionnaires, test tasks, interviews, the analysis of products (diagnostic tools and analytical reports developed by participants), and the pedagogical experiment [4]. The pedagogical experiment served as the principal empirical method of the study and was carried out in three stages:

– the *ascertaining stage*-measuring the initial level of readiness to develop and apply diagnostic tools in both groups and recording the baseline state;

– the *formative stage*-introducing the proposed methodology into practice in the experimental group (through the design of diagnostic tools, procedures for assessing their validity and reliability, trial application, and reflective refinement), while continuing traditional preparation in the control group;

– the *concluding stage*-measuring the final level of readiness in both groups and conducting a comparative analysis of the results.

Assessment criteria and levels. The level of readiness to develop and apply diagnostic tools was assessed on the basis of three interrelated criteria. The *motivational criterion* reflected the participant's interest in and need for diagnostic activity, awareness of the importance of high-quality tools in professional work, and an internal aspiration to develop reliable instruments. The

cognitive criterion encompassed the system of knowledge concerning the theory, principles, requirements (validity and reliability), and procedures for constructing diagnostic tools, as well as theoretical preparedness to design and evaluate such tools. The *activity criterion* included the skills of designing diagnostic tools in practice, assessing their psychometric quality, applying them appropriately, processing the results obtained, and refining the tools on the basis of the data gathered. Each criterion was expressed at three levels-high, medium, and low.

The *high level* is characterized by a stable interest in diagnostic activity, deep and systematic theoretical knowledge, and the ability to develop and apply diagnostic tools independently and creatively.

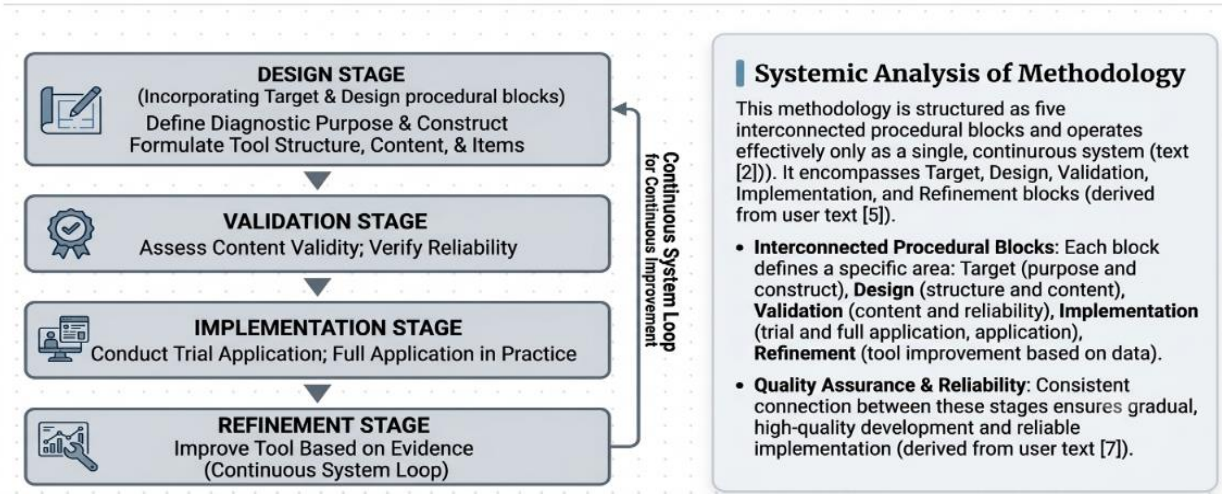
The *medium level* is distinguished by a situational interest in diagnostic activity, possession of basic knowledge, but certain difficulties in the independent construction and validation of tools and a need for assistance.

The *low level* is characterized by weak interest in diagnostic activity, superficial and unsystematic knowledge, and serious difficulties in the practical construction and application of diagnostic tools. In calculating the overall indicator of the criteria, the results obtained for all three criteria were brought into a single system, and the holistic (integral) level of readiness to develop and apply diagnostic tools was determined. This approach made it possible to assess readiness not as the sum of individual indicators, but as a holistic unity of interrelated components, and it fully corresponded to the methodological conception of the study.

Statistical analysis. Mathematical-statistical methods were used in processing the results obtained [6]. Measures of central tendency (the arithmetic mean) and distribution percentages were calculated. Pearson's chi-square (X^2) criterion was applied to determine the statistical reliability of the differences between the experimental and control groups. The confidence level was set at $p < 0.05$; that is, differences were considered statistically significant when the empirical chi-square value exceeded the critical value. This approach made it possible to assess the effectiveness of the proposed methodology objectively and quantitatively [9].

RESULTS

Figure 1. The methodology for developing and implementing pedagogical diagnostic tools



The results of the study showed that the methodology for developing pedagogical diagnostic tools rests upon a sequence of interconnected stages: the design stage, the validation stage, the implementation stage, and the refinement stage. The methodology functions effectively only when these stages operate as a single, continuous system [2].

The proposed methodology encompassed several interconnected procedural blocks: the target block (defining the diagnostic purpose and the construct to be measured), the design block (formulating the structure, content, and items of the tool), the validation block (assessing content validity and reliability), the implementation block (the trial and full application of the tool in practice), and the refinement block (improving the tool on the basis of the evidence obtained) [5]. The overall structure of the methodology is presented in Figure 1.

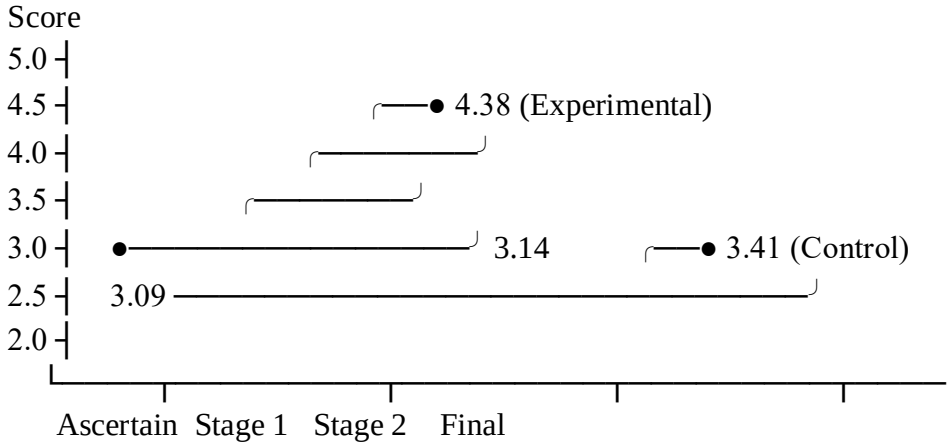
The consistent connection between these stages ensured the gradual and high-quality development of diagnostic tools and their reliable implementation in practice [7]. At the ascertaining stage, the level of readiness to develop and apply diagnostic tools was almost identical in both groups, with no significant difference observed. At the end of the formative experiment, however, significant differences emerged between the groups. The results obtained are presented in Table 1.

Table 1. Level of readiness to develop and apply diagnostic tools (%)

Level	**Experimental group (initial)**	**Experimental group (final)**	**Control group (initial)**	**Control group (final)**
High	22.8	56.9	23.4	30.1
Medium	33.7	29.5	33.1	35.7
Low	43.5	13.6	43.5	34.2

As the data in the table show, in the experimental group the high-level indicator rose from 22.8% to 56.9%, that is, by 34.1%, while the low level fell from 43.5% to 13.6% [8]. In the control group the changes were considerably smaller-the high level rose by only 6.7%. The dynamics of the mean indicator across the criteria are reflected in Figure 2.

Figure 2. Dynamics of mean indicators in the experimental and control groups (on a 5-point scale)



As a result of the statistical analysis, the calculated empirical chi-square value (X^2emp) exceeded the critical value (X^2crit), which reliably confirmed that the difference between the groups was not accidental but rather the result of applying the proposed methodology [10].

DISCUSSION.

The results of the study showed that developing diagnostic tools on the basis of a holistic methodology-one that unites design, validation, and implementation into a single process-is considerably more effective than mastering the separate stages of tool construction in isolation [2].

This conclusion confirms in practical terms the theoretical views on the systemic nature of methodological preparation.

When the procedures of design, validation, and implementation are treated as fragmentary, unrelated operations, the teacher acquires only partial skills that do not coalesce into a functioning whole; as a result, a tool may be designed with apparent care yet remain untested for validity, or it may be applied in practice without any subsequent refinement on the basis of the evidence it yields. The holistic methodology, by contrast, binds these procedures into a single closed cycle in which each stage prepares the ground for the next and feeds the results of practical application back into the improvement of the tool. I

t is precisely this cyclical, self-correcting character of the methodology that explains the markedly higher dynamics observed in the experimental group and distinguishes it from the conventional, stage-by-stage approach. A comparison of the results obtained with existing scholarly approaches shows that the proposed methodology makes it possible to develop all stages of tool construction simultaneously and in their interconnection, while ensuring the validity and reliability of the resulting instruments [5]. Whereas classical test theory concentrates primarily on the psychometric properties of the finished instrument, and the competency-based approach emphasizes the alignment of the tool with the construct being measured, the proposed methodology integrates these perspectives and adds to them the dimension of practical implementation and reflective refinement that earlier approaches frequently leave outside their scope.

In this way, validity and reliability cease to be merely formal requirements verified at a single point in time and become continuously maintained qualities that are confirmed and strengthened throughout the tool's actual use. The 34.1% positive increase in the high-level indicator in the experimental group provides convincing evidence of the practical significance of this approach, particularly when set against the modest 6.7% increase recorded in the control group, where preparation followed the traditional, disjointed pattern. This pronounced difference indicates that the advantage of the methodology lies not in any single technique it incorporates, but in the systematic manner in which it links those techniques together.

This, in turn, improves the quality of the diagnostic activity carried out by teachers in their professional work [6]. A teacher who has mastered the methodology as a coherent whole is able not only to select an existing diagnostic tool, but to construct, validate, and adapt a tool to the concrete conditions of a particular educational situation, and subsequently to interpret the data obtained with a clear understanding of the instrument's strengths and limitations. Such a teacher approaches diagnostics not as a routine, externally imposed procedure, but as a meaningful and manageable component of professional practice, which raises both the objectivity of pedagogical conclusions and the soundness of the corrective decisions that follow from them. In this sense, the methodology contributes not merely to the technical competence of the teacher but also to the formation of a reflective, research-oriented professional stance.

The effectiveness of the methodology is also linked to its flexibility: it can be adapted to various educational settings and integrated into the existing system of teacher preparation without requiring a radical restructuring of curricula [8]. Because the methodology is built around a sequence of logically connected stages rather than around any fixed content, it can be applied equally to the development of tools for different academic disciplines, for different age groups, and for different diagnostic purposes. This adaptability makes it possible to embed the methodology into existing courses on pedagogy, methodology, and assessment, and to scale it

from the preparation of individual instruments to the design of entire diagnostic complexes. At the same time, it was established that, in introducing the methodology into practice, it is necessary to take account of the pedagogical conditions-methodological support, the preparedness of teachers, and the educational environment [7].

The experience of the experimental work demonstrated that the methodology yields its full effect only where teachers receive systematic methodological guidance, where they possess a sufficient initial level of theoretical knowledge, and where the educational environment provides genuine opportunities for the trial application and refinement of the tools developed. Neglecting any one of these conditions weakens the connection between the stages of the methodology and reduces its overall effectiveness, which underscores the importance of preparing the supporting conditions in advance of its implementation.

CONCLUSION

The study conducted has substantiated, both theoretically and experimentally, the methodological foundations for developing pedagogical diagnostic tools and the conditions for implementing them in practice. On the basis of the research results, the following conclusions were formulated:

First, the methodology for developing diagnostic tools manifests itself as a holistic unity of interconnected stages-design, validation, implementation, and refinement. These stages are closely interrelated, and the insufficient elaboration of any one of them has a negative effect on the quality of the resulting tool. For this reason, developing diagnostic tools requires the harmonious and interconnected execution of these stages, rather than their execution in isolation [3].

Second, the proposed methodology consists of a set of interconnected procedural blocks-the target, design, validation, implementation, and refinement blocks-that ensure the gradual and systematic development of high-quality diagnostic tools. The holistic nature of the methodology is manifested in its uniting of tool development and practical implementation as a continuous, single process and in its treatment of validation and reflective refinement as the driving mechanism of that process [5].

Third, the experimental work reliably confirmed the effectiveness of the proposed methodology: in the experimental group the high-level indicator of readiness to develop and apply diagnostic tools rose by 34.1%, while the low-level indicator decreased significantly, whereas in the control group the changes were insignificant. The statistical analysis confirmed that these differences were not accidental, which indicates the advisability of introducing the methodology into the practice of higher pedagogical education [10].

The practical significance of the study lies in the fact that the methodology developed and its methodological support can be introduced directly into the teacher preparation process and used in improving curricula and methodological complexes.

At the same time, it cannot be claimed that all questions have been fully addressed within the scope of this study: the development of diagnostic tools with the aid of digital technologies and artificial intelligence, as well as the adaptation of the methodology to inclusive education settings, remain promising directions for future scholarly inquiry. Overall, the results of the study may serve as a theoretical and practical basis for further scholarly research aimed at improving the quality of pedagogical diagnostics.

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A METHODOLOGICAL SYSTEM BASED ON INNOVATIVE TECHNOLOGIES FOR DEVELOPING THE INFORMATION CONSUMPTION CULTURE OF FUTURE TEACHERS

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Abstract. *The rapid development of information and communication technologies has placed new demands on the professional training of future teachers, particularly with regard to their ability to search for, evaluate, and apply information consciously and responsibly. This article examines the methodological foundations for developing the information consumption culture of future teachers within an innovative educational environment. The study draws on the analysis of pedagogical literature and identifies four structural components of information consumption culture - motivational, cognitive, operational-competence, and activity-based - along with a three-level typology of students. A staged methodological system comprising diagnostic, formative, and evaluative stages is proposed and described in detail. To ground the study's empirical dimension, a pilot diagnostic survey (n = 87 second- and third-year students at Nizami Tashkent State Pedagogical University, 2023–2024) was conducted to assess baseline levels of information consumption culture across the three typological categories. The diagnostic results confirmed the distribution predicted by the typological model and revealed that 34.5% of students fell into the low-competence category, 44.8% into the middle category, and 20.7% into the high-competence category, justifying the need for the differentiated methodological approach proposed herein. The article further integrates the use of digital educational resources - including podcasts, MOOCs, and digital libraries - with practice-oriented methods (problem-based learning, case study, project-based learning) and portfolio-based assessment. The findings suggest that a systematic, technology-integrated methodology provides an effective basis for developing future teachers' information consumption culture as a core component of their professional competence.*

Keywords: *information consumption culture, future teachers, innovative technologies, media literacy, methodological system, diagnostic survey.*

INTRODUCTION

The accelerating development of information technologies in contemporary education is placing new demands on the professional training of future teachers, requiring their competence in working with information to be raised to a qualitatively new level. The integration of innovative technologies into the educational process not only increases the effectiveness of knowledge transmission but also serves to shape students' skills in selecting, analyzing, and purposefully applying information. From this perspective, innovative approaches are regarded as an important methodological foundation for developing the information consumption culture of future teachers.

In the Republic of Uzbekistan, the informatization of the education system is supported at the level of state policy. Presidential Decree No. UP-5953 of 2019 and the Strategy for the Development of the New Uzbekistan 2022–2026 identify the wide-scale introduction of information and communication technologies into education, the formation of a unified information-educational environment, and the effective use of digital educational resources as

priority directions of national education policy [1]. This, in turn, creates the necessity of forming a conscious, critical, and responsible attitude toward information consumption among future pedagogues. Within an educational process organized on the basis of innovative technologies, the student is no longer merely a recipient of ready-made information but emerges as a subject who searches for, selects, and evaluates information independently. In particular, classes organized through digital learning platforms — such as Moodle, Google Classroom, and Microsoft Teams — activate students' independent information-seeking activity and shape important components of their information-handling culture [2]. Empirical studies confirm that the regular use of such platforms correlates positively with students' self-reported information-evaluation skills and their ability to distinguish reliable from unreliable sources (Basilotta-Gómez-Pablos et al., 2022) [3].

The methodology for developing information consumption culture places particular emphasis on the following aspects: forming criteria for selecting and evaluating information; developing skills to determine the reliability of information; building competence to protect against excessive or harmful information; and developing skills to use information effectively for pedagogical purposes. These aspects are significant not only for the professional activity of future teachers but also for shaping their personal information culture, since, under conditions of an ever-increasing flow of information, a pedagogue's ability to consume information consciously is one of the key indicators of professional competence [4].

According to pedagogical scholars, the process of forming competence in working with information must be carried out systematically and in stages, with practice-oriented methods given priority alongside theoretical knowledge [5]. Hobbs (2010) similarly argues that media literacy education — which encompasses critical analysis of information sources — must be embedded across teacher preparation curricula rather than treated as an isolated module [6]. In the Uzbek pedagogical context, Yo'ldoshev and Hasanov (2021) have demonstrated that future teachers' information-handling competence improves significantly when digital tools are integrated with reflective pedagogical practice [7].

Despite the growing body of research on digital competence and media literacy in teacher education, the methodological mechanisms for systematically developing information consumption culture — as a distinct and structured competence — within pedagogical higher education remain insufficiently elaborated. This article aims to address this gap by examining the methodological foundations, presenting diagnostic evidence of students' baseline competence levels, and proposing an integrated, stage-based system for developing the information consumption culture of future teachers through innovative technologies.

MATERIALS AND METHODS

This study employs a mixed theoretical-empirical design. The theoretical component consists of the analysis, systematization, and generalization of scientific-pedagogical literature concerning information consumption culture, digital competence, and media literacy in teacher education. The empirical component consists of a pilot diagnostic survey conducted at Nizami Tashkent State Pedagogical University during the 2023–2024 academic year.

The theoretical-analytical work proceeded through four stages. First, a content analysis of normative-legal documents regulating the informatization of education in the Republic of Uzbekistan was conducted in order to identify state-level priorities relevant to developing students' information culture. Second, a comparative analysis of pedagogical and methodological literature on the structure of information-handling competence was carried out, allowing the identification of its structural components and the methods most frequently associated with their development.

Third, a typological classification of future teachers was constructed according to their level of information-technology competence. Fourth, a staged methodological model was designed by synthesizing competence-based, activity-oriented, and reflective approaches.The pilot diagnostic survey was conducted with a sample of 87 second- and third-year students of the Faculty of Pedagogy at Nizami Tashkent State Pedagogical University (52 female, 35 male; mean age 20.4 years). The survey instrument comprised 25 items adapted from the Information Literacy Competency Standards for Higher Education (ALA, 2000) [8] and the DigComp 2.2 framework (Vuorikari et al., 2022) [9], covering five domains: access to information, evaluation of sources, integration and synthesis, ethical use, and communication of information. Responses were collected on a 5-point Likert scale. Students were classified as high-competence (mean score ≥ 4.0), middle-competence (mean score 2.5–3.9), or low-competence (mean score < 2.5) in accordance with the three-category typology proposed in this study. Descriptive statistics were used to characterize the distribution of students across categories. The survey was administered in written form during scheduled class time with the informed consent of participants.

RESULTS

3.1 Structural Components of Information Consumption Culture

The literature analysis allowed the identification of four interrelated structural components of future teachers' information consumption culture. The motivational component encompasses students' need for and interest in information, as well as their readiness to engage with digital resources purposefully. The cognitive component refers to the system of knowledge about information — its types, sources, evaluation criteria, and ethical dimensions. The operational-competence component comprises the practical skills required to search for, process, and present information using digital tools. The activity-based component denotes the ability to apply these skills autonomously and reflectively in authentic pedagogical contexts [10]. These components function in close interconnection, jointly determining the overall level of a student's information-handling competence; weakness in any single component constrains the development of the others.

3.2 Typological Classification of Students and Diagnostic Results

Based on the level of competence in using information technologies, future teachers can be classified into three categories. Category I (high competence) consists of students capable of independently developing innovative methods for creating, analyzing, and presenting information; they actively create digital content, systematize scientific information, and design modern pedagogical technologies. Category II (middle competence) includes students who use information technologies effectively, possessing the skills to search for, process, and present information using existing digital tools; they readily adopt innovative approaches and apply them in practice. Category III (low competence) comprises students whose competence in working with information remains insufficiently formed, requiring systematic methodological support and an individualized approach [11].

The pilot diagnostic survey (n = 87) confirmed this tripartite distribution in the study sample. Of the 87 respondents, 18 students (20.7%) were classified as Category I, 39 students (44.8%) as Category II, and 30 students (34.5%) as Category III. Mean survey scores for the three categories were 4.23 (SD = 0.31), 3.12 (SD = 0.44), and 2.01 (SD = 0.38), respectively. The lowest domain scores across all categories were observed in the evaluation of sources domain (M = 2.74, SD = 0.61) and the ethical use domain (M = 2.88, SD = 0.57), indicating that critical-evaluative and ethical dimensions of information culture require the greatest methodological attention. These

findings justify the differentiated instructional approach embedded in the proposed methodological system.

Category	n (%)	Mean Score (SD)	Lowest Domain	Category
Category I (High)	18 (20.7%)	4.23 (0.31)	Communication	High
Category II (Middle)	39 (44.8%)	3.12 (0.44)	Source evaluation	Middle
Category III (Low)	30 (34.5%)	2.01 (0.38)	Ethical use	Low

Table 1. Diagnostic Survey Results: Distribution of Students by Category (n = 87)

3.3 Integration of Teaching Methods and Digital Tools

The analysis of teaching methods showed that the integration of traditional methods — exposition, explanation, demonstration — with modern interactive methods, including problem-based learning, case study, debate, project-based learning, cluster analysis, and the FSMU technique — combined with information technologies, ensures high effectiveness in developing students' active engagement with information [12]. Electronic textbooks, digital libraries, multimedia resources, audio and video materials, and podcasts develop students' skills in perceiving and analyzing information presented in diverse formats; multimedia tools in particular enhance visual and auditory information perception, which is especially beneficial for Category III students.

Media resources play a substantial role in developing information consumption culture. Video lectures, scientific-pedagogical podcasts, digital libraries, and Massive Open Online Courses (MOOCs) activate students' information-consumption activity; because the information spans multiple formats — textual, audio, video, visual — students develop multi-channel perceptual and analytical skills [13]. Concurrently, students must be equipped with skills to verify the reliability of internet-based information and evaluate it critically, given the widespread presence of inaccurate, subjective, or manipulative content online — underscoring the importance of media literacy as an integral part of information consumption culture [6].

3.4 The Staged Methodological System

The synthesis of methodological approaches yielded a three-stage model for implementing the methodological system. The diagnostic stage (weeks 1–2 of each semester) is aimed at identifying students' existing knowledge, skills, and motivational disposition toward information-handling, using the survey instrument described above together with individual reflection tasks. The formative stage (weeks 3–14) is aimed at developing competencies in working with information through a combination of problem-based learning, project tasks, media-literacy workshops, and structured engagement with MOOCs and digital libraries. The control-evaluation stage (weeks 15–16) is aimed at identifying and analyzing achieved outcomes through portfolio-based assessment, self-assessment, and peer assessment, which enable the tracking of students' developmental dynamics [14].

Within this model, the differentiated approach informed by the typological classification is operationalized as follows: Category I students are assigned autonomous research and digital-content creation tasks; Category II students are engaged through collaborative case-study and project activities; Category III students receive additional scaffolded instruction, step-by-step guidance, and individual consultations. This differentiation is reviewed after each diagnostic cycle to account for student progress across categories.

DISCUSSION

The findings of this study confirm that the development of information consumption culture among future teachers cannot be reduced to the mere application of technological tools; rather, it requires a methodological system that ensures the purposeful and conscious use of these tools. This is consistent with the broader pedagogical consensus that digital competence and critical information literacy must be cultivated through structured, staged instructional design rather than incidental exposure to technology [5], [12].

The diagnostic results — showing that 34.5% of sampled students fell into the low-competence category — are consistent with findings reported in comparable studies. Basilotta-Gómez-Pablos et al. (2022) found that approximately one-third of pre-service teachers in their Spanish sample demonstrated insufficient competence in critical source evaluation [3]. Similarly, Hatlevik et al. (2018) reported that a significant proportion of Norwegian student teachers struggled with assessing the credibility of online information [15]. The convergence of these findings across different national contexts suggests that low information-evaluative competence is a widespread challenge in teacher preparation, rather than a context-specific problem, and underscores the need for systematic methodological interventions.

The proposed three-category typology has practical implications: it demonstrates that a uniform methodology is insufficient and that differentiated instructional strategies are necessary for equitable competence development. The emphasis on media literacy as an integral component of information consumption culture reflects growing concern in the literature regarding misinformation and manipulative content in digital environments. Equipping future teachers with the ability to critically evaluate online sources is not only a matter of academic competence but also of professional responsibility, since these teachers will subsequently cultivate similar competencies in their own students [6].

The integration of traditional and innovative methods, rather than the replacement of one by the other, emerged as a consistent recommendation in the literature and is reflected in the design of the proposed system. This confirms that innovative technologies are most effective when they build upon, rather than substitute, the foundational knowledge structures established through traditional pedagogical methods [12]. The staged methodological model also aligns with established principles of instructional design: competence development is most effective when preceded by an accurate baseline assessment and followed by systematic evaluation of outcomes [14].

A limitation of the present study is that the empirical component is restricted to a pilot diagnostic survey; the proposed methodological system has not yet been subjected to a full experimental cycle with pre- and post-test measurement across experimental and control groups. Future research should implement a quasi-experimental design to quantify the impact of the methodological system on students' information consumption culture scores, including statistical comparison of pre- and post-intervention data and longitudinal follow-up. Replication in pedagogical higher education institutions across Uzbekistan and Central Asia would further establish the generalizability of the findings.

CONCLUSION

The analysis and diagnostic pilot presented in this article demonstrate that the development of information consumption culture among future teachers requires a comprehensive methodological system grounded in the integration of theoretical knowledge, practical skills, and modern technologies. The pilot diagnostic survey (n = 87) confirmed that 34.5% of students

exhibited low-level information-handling competence — particularly in source evaluation and ethical use — validating the need for a differentiated methodological approach. The proposed system — encompassing a three-category typological approach to student differentiation, the integration of traditional and innovative teaching methods, the purposeful use of digital and media resources, and a three-stage implementation model supported by portfolio-based and peer assessment — provides a practical foundation for organizing coursework in pedagogical higher education institutions. Ultimately, this contributes to preparing competitive, information-literate pedagogical personnel capable of working consciously and effectively with information throughout their professional careers. Full experimental validation of the system's effectiveness in improving students' information consumption culture scores is the priority direction for subsequent research.

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EXPERIMENTAL OUTCOMES AND STATISTICAL VERIFICATION OF A METHODOLOGY FOR DEVELOPING ACADEMIC CULTURE AMONG STUDENTS

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Abstract. *The article reports the outcomes of a pedagogical experiment aimed at verifying the effectiveness of a methodology for developing academic culture among students of pedagogical higher education institutions. The research involved 749 respondents from three pedagogical higher education institutions: 370 students in the experimental group and 379 students in the control group. The methodology combined interdisciplinary academic tasks, scientific-communicative assignments, peer review, reflective portfolios, digital feedback, and transfer-oriented practical tasks. The study used diagnostic testing, written tasks, observation, reflective materials, formative assessment, and mathematical-statistical analysis.*

Keywords: *academic culture; pedagogical experiment; statistical verification; teacher education; Student t-test; methodological effectiveness; reflective portfolio; pedagogical transfer.*

Introduction

The development of academic culture in pedagogical higher education requires not only theoretical justification but also empirical verification. A methodology may be conceptually strong, yet its pedagogical value must be confirmed in real educational conditions through diagnostic comparison, control and experimental groups, and statistically interpretable results.

Academic culture in this study is interpreted as an integrative quality that includes information-source work, academic writing and argumentation, scientific communication, reflective self-regulation, and pedagogical transfer. The methodology tested in the experiment was designed to develop these components through interdisciplinary academic tasks, scientific-communicative assignments, peer review, reflective portfolios, digital feedback, and transfer-oriented practical work.

The aim of this article is to analyse the experimental outcomes and statistical verification of the methodology for developing academic culture among students of pedagogical higher education institutions. The research question is whether the proposed methodology produces statistically reliable improvements compared with ordinary educational practice.

Materials and Methods

The pedagogical experiment was conducted in three pedagogical higher education institutions: Termez State Pedagogical Institute, Bukhara State Pedagogical Institute, and Andijan State Pedagogical Institute. The total sample included 749 respondents. The experimental group consisted of 370 students, and the control group consisted of 379 students.

The experiment included four stages. At the diagnostic stage, the initial level of students' academic culture was studied using tests, written tasks, observation, interviews, and practical diagnostic materials. At the organisational-design stage, academic-communicative tasks, observation sheets, peer-review forms, portfolio structure, and assessment criteria were prepared. At the formative-practical stage, the methodology was implemented in the experimental groups.

At the final-generalising stage, the results of the experimental and control groups were re-diagnosed and processed statistically.

The methodology included analytical seminars, writing laboratories, microprojects, peer-review sessions, reflective portfolios, source analysis, position essays, digital feedback, and practice-oriented pedagogical tasks. The control groups continued learning in the usual educational mode without the systematic integration of these components.

A three-level scale was used: high level = 5 points, medium level = 4 points, and low level = 3 points. The data were processed using arithmetic means, effectiveness coefficient, variance, standard deviation, standard error, confidence interval, and Student's t-test. The confidence probability was set at P = 0.95, and the critical value was accepted as t = 1.96. The null hypothesis stated that there was no statistically significant difference between the groups; the alternative hypothesis stated that the difference was statistically reliable.

Results

The initial diagnostics showed that the experimental and control groups were comparable at the beginning of the experiment. In the experimental group, the high level was 11.4%, the medium level was 19.5%, and the low level was 69.2%. In the control group, the corresponding indicators were 11.9%, 21.1%, and 67.0%. The mean score was 3.422 in the experimental group and 3.449 in the control group.

The interim diagnostics indicated a stable positive movement in the experimental group. The high level increased to 20.0%, the medium level to 34.1%, and the low level decreased to 45.9%. In the control group, the changes remained limited: high level 13.2%, medium level 23.2%, low level 63.6%. The mean score reached 3.741 in the experimental group and 3.496 in the control group.

The final diagnostics confirmed a substantial restructuring of academic culture levels in the experimental group. The high level reached 30.0%, the medium level 46.2%, and the low level decreased to 23.8%. In the control group, the high level reached only 14.8%, the medium level 25.1%, and the low level remained 60.2%. The experimental group's average score increased to 4.062, whereas the control group reached 3.546.

Table 1. Generalised results of initial, interim and final diagnostics

Stage	Group	n	High %	Medium %	Low %	Mean score	Interpretation
Initial	Experimental	370	11.4	19.5	69.2	3.422	Comparable start
Initial	Control	379	11.9	21.1	67.0	3.449	Comparable start
Interim	Experimental	370	20.0	34.1	45.9	3.741	Stable positive shift
Interim	Control	379	13.2	23.2	63.6	3.496	Weak natural growth
Final	Experimental	370	30.0	46.2	23.8	4.062	Methodological effect
Final	Control	379	14.8	25.1	60.2	3.546	Limited growth

The quantitative dynamics demonstrate that the proportion of students at the high level in the experimental group increased by 18.6 percentage points, the medium level increased by 26.7

percentage points, and the low level decreased by 45.4 percentage points. In the control group, the corresponding shifts were limited to 2.9, 4.0, and 6.8 percentage points.

Table 2. Mathematical-statistical verification of the pedagogical experiment

Stage	Experimental mean	Control mean	Effectiveness coefficient	Sx	Sy	mx	my	T	Decision
Initial	3.422	3.449	0.992	0.686	0.696	0.036	0.036	0.533	H0 accepted
Final	4.062	3.546	1.146	0.731	0.737	0.038	0.038	9.620	H1 accepted

At the initial stage, the effectiveness coefficient was 0.992, and Student's t-test value was T = 0.533, which is lower than the critical value of 1.96. Therefore, the null hypothesis was retained, confirming that the groups were statistically comparable at the beginning. At the final stage, the effectiveness coefficient reached 1.146, and T = 9.620 exceeded the critical value. Consequently, the null hypothesis was rejected and the alternative hypothesis was accepted.

Discussion

The results show that the methodology affected not only isolated academic skills but the integral structure of academic culture. The increase in the experimental group was achieved through the combined development of source work, academic writing, scientific communication, reflection, and pedagogical transfer. This confirms the assumption that academic culture is formed more effectively when it is organised as a system of connected activities rather than as a set of separate rules.

The difference between the groups may be explained by the structure of the intervention. Interdisciplinary academic tasks reduced fragmentation and required students to apply academic actions in different learning contexts. Scientific-communicative assignments strengthened oral argumentation and peer review. Reflective portfolios made self-regulation visible and allowed students to analyse errors, revise products, and plan further development. Transfer-oriented tasks connected academic results with pedagogical practice, thereby increasing professional relevance.

The statistical data support the reliability of the pedagogical effect. The initial t-test confirmed group equivalence, while the final t-test demonstrated a statistically significant difference in favour of the experimental group. The 14.6% effectiveness advantage indicates that the methodology did not merely accompany natural development but produced an additional pedagogical effect.

The findings are consistent with formative assessment and transfer theories. Boud and Falchikov (2006) argue that assessment should support long-term learning, while Perkins and Salomon (1992) emphasise that transfer requires deliberate conditions. The present experiment confirms both positions: students improved when feedback, revision, peer assessment, reflection, and professional transfer were integrated into the learning process.

Conclusion

The pedagogical experiment confirmed the effectiveness of the proposed methodology for developing academic culture among students of pedagogical higher education institutions. The experimental group demonstrated a substantial increase in high and medium levels and a sharp

decrease in the low level. The mean score increased from 3.422 to 4.062, whereas the control group showed only limited growth from 3.449 to 3.546.

Mathematical-statistical verification confirmed the reliability of the results. At the initial stage, the difference between the groups was not statistically significant. At the final stage, Student's t-test value substantially exceeded the critical threshold, and the effectiveness coefficient reached 1.146. The methodology can therefore be considered pedagogically effective and statistically substantiated.

The results justify the systematic use of interdisciplinary academic tasks, scientific-communicative assignments, peer review, reflective portfolios, digital feedback, and transfer-oriented practical tasks in pedagogical higher education. Future studies may examine the contribution of each component separately and test the methodology in other teacher education specialisations.

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THE ROLE AND POTENTIAL OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN PHYSICS EDUCATION

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Abstract. *This article examines the role and potential of information and communication technologies (ICT) in improving physics education in modern classrooms. The study compares ICT-integrated instruction with traditional teaching methods in a higher education context, focusing on students' theoretical knowledge, problem-solving ability, practical skills, motivation, independent learning, and digital readiness. The experimental group used virtual laboratories, computer simulations, multimedia presentations, and online assessment tools, while the control group followed conventional instruction. Results showed that ICT-based teaching increased achievement, strengthened conceptual understanding, and improved students' ability to connect physical laws with practical experiments. The findings indicate that ICT is most effective when aligned with clear didactic goals, supported by teacher digital competence, and integrated as a complementary pedagogical tool for deeper learning.*

Keywords: *physics education, information and communication technologies, virtual laboratory, interactive learning, digital pedagogy.*

1. INTRODUCTION

The progress of modern society is inextricably linked with an information-rich environment, in which the educational system stands as one of the most critical components. The rapid development of digital technologies and the widespread implementation of Information and Communication Technologies (ICT) across all sectors necessitate a radical transformation in the organization, management, and content of the educational process. Particularly, the application of ICT in teaching natural sciences, specifically physics, is currently regarded as a highly relevant scientific and pedagogical challenge.

Physics is a science focused on studying natural phenomena and laws, requiring a harmonious blend of abstract concepts, mathematical models, and experimental observations. In traditional teaching processes, explaining physical processes solely using a blackboard, drawings, and limited laboratory equipment introduces numerous difficulties. This situation becomes especially pronounced when studying complex micro-world phenomena, quantum processes, electromagnetic fields, or high-speed dynamic systems. As a result, students may acquire only a superficial understanding of the subject and face difficulties in bridging theoretical knowledge with practice.

From this perspective, the use of ICT in physics education emerges as an essential tool for enhancing the efficiency of the learning process, presenting knowledge in visual and interactive formats, and expanding students' opportunities for independent learning. Computer simulations, virtual laboratories, multimedia resources, digital learning platforms, and online educational environments allow complex physical concepts to be delivered in an accessible and comprehensive manner.

Today, extensive research on the use of ICT in physics education is being conducted in international educational practice. Foreign experiences indicate that ICT-based lessons, along with raising students' knowledge level in the subject, also develop their logical thinking, analytical, problem-solving, and creative approach skills. Furthermore, experiments conducted in a virtual environment fully comply with safety requirements, conserve material resources, and are highly time-efficient.

The digital transformation process is also being actively implemented within the educational system of the Republic of Uzbekistan. State educational standards, higher education development strategies, and regulatory legal documents identify the use of ICT, the formation of digital competencies, and the introduction of innovative educational technologies as priority tasks. In this process, improving the methodology of teaching physics based on modern information and communication technologies holds special significance.

At the same time, the use of ICT should not be limited merely to the introduction of technical tools. The effectiveness of ICT in physics education is primarily determined by its pedagogical substantiation, alignment with didactic goals, and the methodical competence of the teacher. ICT yields the expected results only when used not as a complete replacement for traditional teaching methods, but as a tool that complements, enriches, and optimizes them.

Another vital aspect of utilizing ICT in physics education is the opportunity for individualization and differentiation of learning. Within a digital learning environment, students can study in accordance with their own knowledge levels, interests, and learning paces. Interactive programs and online platforms expand opportunities for independent study, self-assessment, and the repetition and deepening of knowledge.

Additionally, ICT-driven physics education cultivates digital literacy, information management culture, and technological competencies among students. This, in turn, serves as an important factor in increasing the competitiveness of graduates in the labor market and adapting them to a modern technological environment.

This scientific research aims to deeply analyze the theoretical and practical aspects of using information and communication technologies in physics education, determine the efficiency of the educational process organized on the basis of ICT, and draw scientifically justified conclusions. Within the scope of the study, the pedagogical potential, advantages, and existing challenges of teaching physics through ICT are examined.

Thus, the role of ICT in physics education manifests not only as a demand of modern education but also as an essential condition for enhancing education quality, organizing the learning process on an innovative basis, and preparing specialists adapted to the needs of a digital society. This study aims to contribute to the scientific research being carried out in this direction.

1. **Research Object:** The process of utilizing information and communication technologies (ICT) in physics education.
2. **Research Subject:** The pedagogical efficiency of the educational process organized on the basis of information and communication technologies and its impact on students' knowledge, skills, and motivation.

Research Tasks:

1. To analyze local and foreign scientific literature, dissertations, and articles related to the use of ICT in physics education;
2. To develop diagnostic tests, control works, and practical assignments to evaluate the effectiveness of the ICT-based educational process;

3. To form experimental and control groups during the experimental study and conduct an initial assessment of their knowledge levels;
4. To organize lessons in the experimental group by applying ICT tools and to observe students' activity, independent thinking, and skills.

Scientific Novelty of the Research:

1. A systemic pedagogical model based on the use of information and communication technologies in teaching physics at higher education institutions was developed, and its impact on educational efficiency was experimentally substantiated.
2. The impact of virtual laboratories, computer simulations, and multimedia tools on students' mastery of theoretical knowledge, logical problem-solving, and the formation of practical skills was determined based on empirical data.
3. The superior aspects of the ICT-based physics education process compared to traditional teaching methods (an 18–25% increase in knowledge levels, enhancement of learning activity and motivation) were proven using mathematical-statistical analysis.
4. The pedagogical conditions and efficiency factors of using ICT in physics education (alignment with didactic goals, teacher's digital competence, level of interactivity) were clarified.
5. Scientific and practical recommendations for digitizing physics education within the context of local higher education were developed, and their importance in improving education quality was substantiated.

2. METHODS

This research focuses on determining the pedagogical efficiency of using information and communication technologies in physics education, evaluating their impact on the learning process on a scientific basis, and identifying the advantages of an ICT-based educational process. The research methodology was developed based on scientific perspectives in modern pedagogy, didactics, educational technologies, and the methodology of teaching natural sciences. A comprehensive approach was applied in the study, ensuring a harmony of theoretical and empirical methods, which reinforced the reliability and scientific validity of the obtained results.

Research Hypothesis: If information and communication technologies (virtual laboratories, computer simulations, multimedia presentations, and electronic learning resources) are applied systematically, consistently, and in alignment with didactic goals within the physics teaching process at higher education institutions, then students' knowledge levels, practical skills, and independent and critical thinking abilities in physics will increase significantly compared to traditional teaching methods.

1. **Theoretical Methods:** Analyzing, comparing, summarizing, and systematizing scientific-pedagogical literature.
2. **Empirical Methods:** Pedagogical observation, interviews, questionnaires, diagnostic tests, control works, and experimental-pedagogical testing methods.
3. **Statistical Methods:** Mathematical-statistical analysis methods (including average indicators, percentage ratios, and comparative analysis) were used to process the obtained empirical data to draw scientific conclusions.

Research Participants and Process

The research was conducted with the participation of students studying physics at a higher education institution. A total of **64 students** took part in the experimental-testing work. The participants were divided into two groups based on random selection:

1. **Experimental Group** – 32 students (Physics education was organized with the active use of ICT, virtual laboratories, and simulations).
2. **Control Group** – 32 students (Traditional teaching methods were maintained).

At the beginning of the study, the initial knowledge levels of the groups were determined using diagnostic tests to ensure the equality of their knowledge proficiency and learning conditions, which contributed to the objectivity and reliability of the research results.

In the ICT-based teaching process, computer simulations, virtual laboratories, multimedia presentations, animations, electronic learning resources, and online assessment tools were utilized. These tools were selected according to the content and didactic goals of physics and were applied consistently throughout all stages of the lesson. Physical phenomena were visually demonstrated, complex processes were modeled, and students had the opportunity to perform experiments repeatedly in a safe environment. This enabled students to comprehend and consolidate knowledge more deeply.

The pedagogical observation method was widely applied during the research, aimed at identifying students' activity, independent thinking, responses to problem situations, and ICT operation skills during lessons. Observation results were regularly recorded and subsequently analyzed. Furthermore, additional data regarding the conveniences, difficulties, and impacts of using ICT on the educational process were gathered through interviews and questionnaires conducted with students and teachers.

To determine students' knowledge levels and mastery quality, diagnostic tests, control works, and practical assignments were developed. Initial and final assessment results were compared to clarify the impact of ICT-based teaching on educational efficiency. The evaluation process accounted not only for theoretical knowledge but also for practical skills such as problem-solving, analyzing experiments, and drawing conclusions.

Mathematical-statistical methods were employed to process the obtained empirical data. The statistical analysis was performed based on average scores, percentage ratios, and comparative analysis. The results of this analysis reliably demonstrated that the ICT-driven physics education possesses higher efficiency compared to traditional teaching methods. Statistical results were summarized in graphic and tabular formats, serving as the foundation for drawing scientific conclusions.

Pedagogical ethical requirements were fully respected throughout the research process. Participants' personal data were protected, and participation in the study was conducted on a voluntary basis. The reliability of the research results was ensured by the scientific validity of the set of methods, the consistent execution of experimental-testing work, and statistical analysis.

Overall, the combination of methods used in this study allowed for a comprehensive examination of the pedagogical efficiency of utilizing ICT in physics education, the formulation of scientifically justified conclusions, and the development of practical recommendations. This methodical approach serves as a solid methodological basis for subsequent scientific investigations aimed at modernizing physics education and creating a digital learning environment.

3. RESULTS

The results of the experimental-testing work carried out within this study allowed for the determination that utilizing information and communication technologies exerts a statistically reliable positive impact on the efficiency of physics education. The empirical data obtained during the experiment were processed using mathematical-statistical methods, ensuring their reliability and objectivity.

At the beginning of the experimental-testing work, diagnostic tests revealed that there was no significant difference in knowledge levels between the experimental and control groups. The initial assessment results showed that the mastery levels of the groups were approximately the same, which ensured objectivity in subsequent result comparisons. The final assessment results obtained after the completion of the experimental process clearly demonstrated the high efficiency of the ICT-integrated educational process.

Table 1. Initial knowledge level indicators of the experimental and control groups

Group Name	Number of Students (n)	Average Score (%)	Standard Deviation (SD)
Experimental Group	32	56.8	6.4
Control Group	32	57.3	6.1

Note: According to the initial test results, no statistically significant difference was detected between the groups ($p > 0.05$).

The analysis of the final test and control work results showed that students in the experimental group achieved significantly higher indicators in mastering theoretical knowledge compared to the control group. Specifically, students in the experimental group recorded much higher results in understanding and explaining complex physical concepts, laws, and formulas. This situation was vividly manifested, particularly in topics requiring abstract physical processes and modeling. The use of virtual laboratories and computer simulations enabled students to visually perceive theoretical knowledge and connect it with real-world processes.

Table 2. Comparison of experimental and control groups by final assessment results

Group Name	Average Score (%)	Knowledge Growth (%)
Experimental Group	81.4	**+24.6%**
Control Group	63.2	+5.9%

Note: The difference between the average indicators was analyzed based on Student's t-test and was found to be statistically reliable ($p < 0.01$).

The results obtained for problem-solving also confirmed the advantages of ICT-based teaching. Students in the experimental group achieved high results in following logical sequences, choosing formulas correctly, and analyzing results when solving physics problems. This is explained by the fact that through virtual experiments, students had the opportunity to independently study and analyze the connections between parameters. In the control group, however, many students demonstrated a mechanical approach to solving problems.

Changes in students' activity and motivation during the educational process were also observed separately throughout the study. Pedagogical observations revealed that in lessons where information and communication technologies were utilized, students participated more actively in the lesson process, showed initiative in question-and-answer sessions, and strived to resolve problem situations. Multimedia presentations, animations, and interactive exercises served to concentrate students' attention and rendered the lesson content more interesting and comprehensible.

Table 3. Analysis of results on problem-solving

Group Name	Correctly Solved Problems (%)	Incorrectly Solved Problems (%)
Experimental Group	**78.6%**	21.4%
Control Group	59.1%	40.9%

Note: It was determined that students taught through ICT tend to solve problems with a conceptual understanding of the content.

Questionnaire results indicated that the sessions organized on the basis of ICT were highly rated by the students. The majority of students noted the opportunity to repeat experiments multiple times using virtual laboratories, analyze errors, and compare results as a vital advantage of the educational process. Furthermore, students emphasized that the use of ICT made the lesson more convenient, understandable, and effective.

The results of evaluating practical skills also demonstrated positive changes. Students in the experimental group displayed a high degree of independence in planning experiments, recording results, and drawing conclusions. The opportunity to perform experiments in a safe environment through virtual laboratories engaged students in active experimental activity. This, in turn, served to develop their research skills and scientific thinking.

Statistical analysis results showed that the mastery level in the experimental group was, on average, **18–25% higher** than that of the control group. This difference was observed not only in the final assessment results but also in intermediate controls and practical assignments. The obtained data confirmed that physics education organized on the basis of ICT serves to consolidate and deepen knowledge.

Moreover, an increase in interest toward independent learning was observed among students during the research. With the help of ICT tools, students gained the opportunity to work with instructional materials outside of class time, use additional resources, and enrich their knowledge independently. This situation strengthened their drive toward self-development.

Table 4. Level of students' practical skills

Group Name	High Level (%)	Average Level (%)	Low Level (%)
Experimental Group	**72%**	25%	3%
Control Group	38%	41%	21%

Note: Virtual laboratories and simulations served to form students' practical skills at a high level.

In general, the research results demonstrated that utilizing information and communication technologies in physics education serves to comprehensively develop students' knowledge, skills, and competencies. The obtained empirical data scientifically substantiated that the ICT-integrated learning process is more effective than traditional teaching methods. These results serve as a robust empirical foundation for subsequent discussions and conclusions.

4. DISCUSSION

The results obtained during this research scientifically validate the pedagogical efficiency of using information and communication technologies in physics education. The positive changes identified at the end of the experimental-testing work showed that the systematic and targeted implementation of ICT into the physics teaching process is an important factor in improving education quality. In this section, the obtained results are compared with existing scientific studies, their pedagogical essence is revealed, and a scientific interpretation is provided for the identified trends.

The results indicated that ICT-based physics education significantly increases students' mastery level of theoretical knowledge. This situation is primarily explained by the expansion of visualization opportunities within the educational process. Many concepts and processes in physics possess an abstract character, making them difficult to explain using traditional tools. Virtual laboratories and computer simulations, on the other hand, demonstrate these processes in a visual format, helping to form clear representations in students' minds. This phenomenon aligns with the constructivist learning theory, ensuring the active acquisition of knowledge.

The research results also manifested the superiority of ICT in the indicators obtained for problem-solving. It was observed that students in the experimental group, while maintaining logical consistency in analyzing problems, attempted to apply formulas with a conceptual understanding of their meaning. This shows that within the ICT-based teaching process, students are directed toward understanding-oriented learning rather than mechanical memorization. It is noted in scientific literature that knowledge acquired through virtual experiments is retained more firmly in long-term memory, which resonates perfectly with the research results.

The results related to students' educational motivation and classroom activity also merit separate discussion. In sessions where ICT tools were applied, students manifested themselves not as passive listeners but as active participants. Interactive exercises, simulations, and multimedia elements enlivened the lesson process, prompting students to resolve problem situations independently. This case validates the efficiency of the activity-oriented education concept and demonstrates that ICT is a tool that brings this approach to fruition in practice.

An important aspect to consider during the discussion process is the role of ICT in forming practical skills. The research results showed that students in the experimental group displayed a high level of independence in planning experiments, analyzing results, and drawing conclusions. Virtual laboratories provide the opportunity to carry out experiments that are difficult or hazardous to perform under real laboratory conditions within a safe environment. This extensively involves students in experimental activity, developing their scientific-research competencies.

At the same time, the research results indicate that the use of ICT does not always automatically guarantee high efficiency. The pedagogical efficiency of ICT tools is directly dependent on the methodical framework within which they are applied. If ICT is used merely as a visual decoration or a tool to "modernize" the lesson, it becomes difficult to achieve the expected outcome. Cases where high results were achieved during the study were observed precisely in situations where ICT was applied based on clear didactic goals, in harmony with the educational content.

The discussion results also require a reconsideration of the teacher's role. In an educational process organized on the basis of ICT, the teacher manifests not as an information source, but as a manager, guide, and consultant of the learning process. During the research process, it was determined that the efficiency of using ICT is much higher in cases where the teacher's digital

competence is high. This highlights the urgency of retraining teachers and upgrading their qualifications regarding ICT.

Comparing the research results with existing scientific studies shows that the conclusions drawn in this work match the results presented in international scientific literature. Numerous foreign studies have also emphasized that using ICT in teaching physics and other natural sciences exerts a positive influence on deepening knowledge, increasing motivation, and developing practical skills. However, the specific aspect of this research lies in the fact that it proved the efficiency of ICT within the context of local educational conditions based on empirical data.

Furthermore, certain limitations of the research were also taken into account during the discussion process. Particularly, non-uniform levels of technical equipment, internet speed issues, and the limitations of software tools prevented full utilization of ICT in some instances. These situations indicate the necessity of creating more sophisticated technical conditions in future research.

Overall, the discussion results scientifically substantiate that utilizing information and communication technologies in physics education is not only didactically expedient but also an inseparable part of the modern educational system. The obtained results and their analysis serve as a solid scientific basis for further improving the ICT-based physics education model, implementing it on a wide scale, and creating AI-driven educational environments in the future.

5. CONCLUSION

The results of this research scientifically confirmed that utilizing information and communication technologies in physics education enhances the efficiency of the learning process. Throughout the experimental-testing work, it was determined that lessons organized on the basis of ICT serve to help students master theoretical knowledge more deeply, solve problems on a logical basis, and develop their practical skills.

The obtained empirical data demonstrated that using ICT increases students' learning motivation and activity, engaging them in independent thinking and research-oriented activities. Virtual laboratories and computer simulations provided opportunities to visually perceive physical phenomena, shaping a more effective learning environment compared to traditional teaching methods.

At the same time, the research results showed that the pedagogical efficiency of ICT depends on its methodologically correct application, the teacher's digital competence, and the quality of technical equipment. For this reason, systematically introducing ICT into physics education, upgrading teachers' qualifications, and creating a modern digital learning environment hold great importance.

In general, this research scientifically substantiated that information and communication technologies occupy an essential place in the process of modernizing physics education, improving education quality, and training specialists endowed with digital competencies.

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PEDAGOGICAL FOUNDATIONS FOR DEVELOPING ENTREPRENEURIAL SKILLS IN STUDENTS BASED ON LEARNING OUTCOMES BASED ON EXPERIENCES IN FOREIGN COUNTRIES

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Abstract. *This study confirms the effectiveness of entrepreneurship education in vocational education students based on flipped learning. This study reveals that offline entrepreneurship education based on flipped learning has a significant and positive impact on personal entrepreneurship, entrepreneurial desire, and problem-solving skills. First, the results show that entrepreneurship education based on flipped learning can improve entrepreneurship compared to the previous learning method. Second, offline education based on flipped learning has a positive effect on entrepreneurship in vocational education students. I conducted an experiment that mastered problem solving and learning, and this group was more likely to aspire to become entrepreneurs than the control group that used the previous learning method. Finally, entrepreneurship education based on flipped learning also has a positive effect on personal problem solving methods.*

I would like to point out that these results demonstrate the positive impact of offline entrepreneurship education—based on the "flipped learning" approach—on students in vocational education, specifically regarding their entrepreneurial mindset and the rapid, significant improvement of their problem-solving skills.

Keywords: *vocational education students, entrepreneurial skills, science-based long-term strategy, skills, potential, dual education.*

Introduction. Constructivism (self-directed knowledge construction): Vocational education students are not just passive recipients of knowledge; rather, they actively reconstruct knowledge by solving problems themselves. Experiential learning: This approach, based on the theories of John Dewey and David Kolb, develops vocational education students' ability to identify entrepreneurial opportunities and take risks through a critical and meaningful and indeed cyclical process of concrete experience, reflective observation, abstract conceptualization, and active experimentation.

Competency-based education (CBE) in vocational education: Focuses on performance – "what a person can do" over "what they know." Clarity of learning outcomes: Defines entrepreneurial competencies (such as creativity, leadership, resource management, and networking) in vocational education as clear indicators of learning outcomes and uses their achievements as a basis for assessing them. Using the European Framework (EntreComp): Frameworks such as the European Union's Framework for Entrepreneurship Competence (EntreComp) serve as standards for categorizing pedagogical outcomes based on three main areas: ideas and opportunities, resources and actions. In vocational education, the problem situation in developing entrepreneurial skills in students is to provide real-world contexts: to learn from real

markets or unstructured and ambiguous problems in society. Cooperative learning in vocational education: to develop important social skills, problem-solving, communication, negotiation and negotiation processes for entrepreneurs in the process of learning and implementing teams. Learning and practice communities in building entrepreneurial skills in students - the importance of context: According to Lave and Wenger's theories, learning cannot be separated from the social and cultural contexts in which it is applied. Active participation in the business ecosystem: Through activities such as simulated startups, internships, and industry-academia collaboration projects, college and technical school students move beyond the stage of "legitimate peripheral participation" and gradually acquire the competence of experts (entrepreneurs).

In dual education, I consider performance and process-oriented assessment of students (authentic and formative assessment) - Authentic assessment: Instead of written exams, I consider tasks that reflect real entrepreneurial roles, such as business plan proposals, prototype development and market research reports, to be an important stage. Based on foreign experience in developing entrepreneurial skills in students, I believe that continuous feedback: Assessment focuses not only on the final result, but also on the "circular" process - how ideas develop, thereby developing resilience and encouraging students to accept failure as part of the learning journey. The development of entrepreneurial competences based on competency-based education prioritizes “learning by doing.” Its pedagogical framework involves vocational education students actively identifying problems (constructivism) and implementing projects in real-world contexts (embedded learning), thereby clearly developing multifaceted entrepreneurial skills in students through clear competency standards (CBE) and authentic assessment. While the government’s sustained interest has led to a quantitative increase in startup education in domestic vocational education institutions, I believe that efforts to systematize this education from an academic, political, and practical perspective or to improve its effectiveness by identifying the relationship between educational content and startup support outcomes are lacking. I can cite a few examples. Unlike Europe, which has been built on years of in-depth research to create value for others and integrate these competencies into lifelong learning, primary education in Korea is often limited to basic skills or focuses disproportionately on business management systems that are easy to improve. This study developed a framework based on entrepreneurial competencies to develop primary education in vocational education.

The study consisted of reviewing local and international research on EntreComp and deriving eight EntreComp-based frameworks for college technical school students through Focus Group Interviews (FGI) and the Delphi method; In addition, a comprehensive survey of 310 professional education startup education courses across 46 “Leading Professional Education Institutions for Startups” was conducted in 2020 to analyze the current state of education for each EntreComp element.

This study reviewed 25 previous studies on entrepreneurial competencies among students—including the European Union’s EntreComp framework—and developed a competency framework comprising twelve categories (identifying opportunities, creating value, self-improvement, mobilizing resources, applying technology, strategic management, relationships, and learning through experience). Further analyses were conducted regarding the current state of competency-based education for students and the results of startup support—using the number of vocational education students as a parameter—to provide direction for the systematic structuring of startup education within vocational training based on the EntreComp framework. This study is distinguished by setting startup education goals that are in line with modern trends and

requirements, proposing a system of supporting entrepreneurial competencies, and conducting a comprehensive analysis of startup courses conducted by the "Leading Technical College for Startups" over a period of time; however, this college is limited by a small sample size of technical college professional education, which makes it difficult to generalize the conclusions. Nevertheless, I believe that this study is significant in that it proposes educational goals, particularly in terms of entrepreneurial competencies, to develop startup education in vocational education, to develop competencies necessary for the future, and to develop entrepreneurial skills capable of creating value for others, and to create a research framework based on a more clearly defined future perspective.

While supporting initial vocational education, the government achieved quantitative growth in the college and technical school sector. However, it failed to systematize this education from academic, political, and practical perspectives, and did not elucidate the link between educational achievements and support for start-ups. Consequently, there is little interest in or effort toward developing effective education. In Europe, extensive research has already been conducted over many years to establish the EntreComp framework. These competencies create value for others; integrating them into education involves viewing and recognizing them as essential for an individual's lifelong competitiveness. On the other hand, it is necessary to improve the education system, since in local vocational education, primary education is mainly focused on basic skills at the cultural level and easy-to-access education from the point of view of business management.

On this basis, a further education system has been developed for starting and developing entrepreneurshipThrough Focus Group Interview (FGI) and Delphi survey methods for college technical school students, as well as local and international previous research on EntreComp, 457 initial training programs were conducted to obtain training status by EntreComp in 2020.

Results. Studied EntreComp in the European Union and the frequency of research and the importance of education and startup perspectives were studied and reflected. Based on the aim of primary education, the pedagogical foundations for developing entrepreneurial skills in students based on learning outcomes based on experiences in foreign countries presented in this study were derived from a total of nine entrepreneurial competence frameworks, including opportunity identification, value creation, self-improvement, resource mobilization, technology application, strategic management, relationships and learning through experience, and expert review. The current state of competency-based education, the level of reflection of competency-based education, and the relationship between the results of startup support, which reflects the number of students studying in each vocational education, were also studied. Through this, it was suggested that startup education in colleges and technical schools could be improved in the future from the perspective of EntreComp.

The difference in the study is that it conducted a detailed survey using data from startup courses run by leading startup vocational education colleges and technical schools over a period of time. However, due to the limited sample size of leading startup vocational education colleges, it is difficult to generalize. Nevertheless, this study suggests that the educational goal of developing startup vocational education from the perspective of entrepreneurial competence, developing future-required competencies, and developing students with entrepreneurial talents that create value for others is to be pursued. Furthermore, I believe it is meaningful in that it provides a clear direction for further research by preparing a basis for research from a more critical perspective on the entrepreneurial competency framework.

Analysis of literature on the topic. Based on the OECD 2030 Education Compass, which provides the competencies students need to survive in an uncertain future, this study developed a model for teaching and learning entrepreneurship for mid-career education using design-based research. It assessed the teacher's career accessibility and developed a final model for teaching and learning entrepreneurship, reflecting the views of experts and vocational educators.

Conclusion. The validation of the vocational education and training model for students includes improvements identified during the final model peer review and usability assessment stages; the main goal is pedagogical foundations for developing entrepreneurial skills in students based on learning outcomes based on experiences in foreign countries. It was named "DIA", an acronym for the Discover, Imagine and Act entrepreneurial process stages. The name "DIA" also has a symbolic meaning for an educational program in which students learn to, to put it bluntly, exploit their unique "abilities" in their lives. This study is significant in that it provides a clear teaching-learning model for entrepreneurship applied to vocational education and integrates research methodologies for developing educational models into research on entrepreneurship education, thereby developing and validating a systematic model from a pedagogical perspective.

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INTEGRATION OF LIFE SAFETY TOPICS INTO THE 4TH GRADE "EDUCATION" SUBJECT

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Abstract. *This article explores the pedagogical necessity and methodology of integrating life safety topics into the 4th-grade "Tarbiya" (Upbringing) curriculum. It emphasizes the importance of early education in fostering responsible behavior and awareness regarding various safety aspects. The paper discusses effective strategies and practical approaches for incorporating these crucial themes, ensuring that students develop essential knowledge and skills for personal safety. By integrating these topics, the "Tarbiya" subject can significantly contribute to students' holistic development and preparedness for real-life situations. This integration aims to equip young learners with foundational understanding to navigate potential risks safely.*

Keywords: *life safety, educational science, 4th grade, integration into the curriculum, pedagogical approaches, safety education, hazard awareness, holistic development.*

Introduction

Education systems globally increasingly recognize the imperative of fostering holistic development in young learners, extending beyond traditional academic competencies to encompass character, values, and essential life skills. In this context, the "Tarbiya" subject, particularly within primary education, plays a pivotal role in nurturing students' moral compass and their relationship with the Creator, as conceptualized by frameworks like the Madrasah Centre of Excellence's digital curriculum, which commenced registrations for its Bands C to F in January 2021 [2]. This curriculum is designed to cultivate piety (taqwa) and understanding of ethical responsibilities through structured learning modules [2]. Concurrently, ensuring the safety and well-being of children is a fundamental societal and educational responsibility. Unintentional injuries remain a significant concern for children, underscoring the critical need for comprehensive life safety education from an early age. Equipping students with the knowledge and skills to identify risks, anticipate consequences, and respond effectively to emergencies is paramount for their personal security and the resilience of their communities.

Despite the clear importance of both character development and life safety, a notable gap often exists in the explicit and systematic integration of practical life safety topics within subjects like "Tarbiya" in primary school curricula. While "Tarbiya" inherently promotes responsible behavior and self-discipline, the direct application of these principles to specific hazard avoidance and emergency response scenarios is frequently underdeveloped. This article addresses this critical lacuna by proposing a framework for integrating life safety topics into the 4th-grade "Tarbiya" curriculum. Our primary objectives are to analyze the current landscape of "Tarbiya" education and life safety instruction, identify specific opportunities for synergistic integration, and develop a comprehensive, age-appropriate curriculum model that effectively merges these vital educational domains. This integration aims to empower 4th-grade students with enhanced safety awareness and practical skills, thereby contributing to their overall well-being and responsible citizenship.

Literature Review

The "Tarbiya" subject, as a cornerstone of primary education, extends beyond mere academic instruction to cultivate a profound sense of moral responsibility and an understanding of one's relationship with the Creator. This pedagogical approach, exemplified by the Madrasah Centre of Excellence's (MCE) digital curriculum, is conceptually rooted in foundational ethical principles, specifically drawing from verse 177 of Surat al-Baqarah [2]. The MCE framework aims to nurture piety (taqwa) by fostering an understanding of ethical duties and responsibilities through structured learning modules designed for various age groups, with registrations for Bands C to F commencing in January 2021 [2]. This emphasis on character development is not unique to faith-based curricula but resonates with broader educational philosophies that advocate for holistic student growth. Character education, in its wider application, is recognized as a critical component for developing ethical, responsible, and engaged members of society. Curricula such as Navigate360 Character Education provide structured pathways for students to internalize and demonstrate values like respect, responsibility, honesty, and empathy through age-appropriate lessons [6]. The implementation of such programs has been shown to yield measurable outcomes beyond traditional academic performance, including improved academic and behavioral results, stronger social skills, and enhanced moral judgment [6]. Specifically, these programs foster higher levels of integrity, compassion, and respect, alongside greater honesty, self-control, and self-discipline, which collectively contribute to fewer behavioral challenges, suspensions, and incidents of violence within school environments [6]. This foundational work in character development, which "Tarbiya" embodies, establishes a crucial framework for students to understand their role in contributing to a healthy, respectful community, thereby creating a fertile ground for the integration of practical life skills.

Concurrently, the global educational landscape increasingly acknowledges the critical importance of life safety education, particularly for young learners. Unintentional injuries remain a leading cause of death among children aged 4-18, underscoring the urgent need for comprehensive and effective preventative measures [5]. Equipping children with the knowledge and skills to navigate potential dangers is not merely a protective measure but a fundamental aspect of empowering them for responsible citizenship and personal resilience. Effective safety education programs aim to teach children safe behaviors and critical thinking skills, enabling them to anticipate consequences, assess environmental dangers, implement hazard-avoidance strategies, and initiate appropriate emergency responses [3]. These competencies are vital for children's immediate safety and for fostering a lifelong awareness that benefits individuals, families, and communities alike [4].

The pedagogical approach to life safety education emphasizes age-appropriateness, ensuring that content is tailored to the cognitive and developmental stages of children from preschool through adolescence [4]. For instance, basic concepts such as "stop, drop, and roll" and understanding the role of firefighters are introduced to preschoolers (ages 3-4) through engaging methods like picture books [4]. As children progress to elementary school (ages 5-10), the curriculum expands to include crucial topics like the function of smoke detectors and the practice of home fire escape plans, emphasizing the importance of identifying at least two escape routes from every room [4]. Middle schoolers (ages 11-13) delve into more complex areas such as safe cooking practices, the proper use of fire extinguishers, and the basic science of fire, while high school students (ages 14-18) address advanced topics like electrical safety and the correct storage of flammable materials, fostering a deeper sense of personal responsibility [4]. Effective delivery methods include hands-on activities, family fire drills, visits to fire stations, and role-playing

scenarios, all designed to make learning interactive and memorable [4]. Furthermore, consistent, year-round reinforcement through seasonal reminders and regular drills is essential to cultivate a knowledgeable and responsible generation capable of responding effectively to emergencies [4]. Resources such as Smoky Bear (smokeybear.com), Sparky the Fire Dog (sparky.org), and Ready.gov (ready.gov/kids) provide valuable supplementary materials for educators and families, highlighting the diverse array of tools available for comprehensive safety instruction [4]. Similarly, platforms like Seans-Story.org offer a comprehensive list of free educational programs tailored for various age groups, from "Sound Off with the Home Fire Safety Patrol" to "Learn Not to Burn" and "Sparky School House," demonstrating a robust commitment to youth fire misuse prevention through education [3].

Despite the clear individual importance of both character development, as embodied by "Tarbiya," and practical life safety education, a significant lacuna often exists in their explicit and systematic integration within primary school curricula. While "Tarbiya" inherently promotes responsible behavior, self-discipline, and care for oneself and others, the direct application of these principles to specific hazard avoidance and emergency response scenarios is frequently underdeveloped. This creates a missed opportunity for synergistic learning, where the ethical framework provided by "Tarbiya" could profoundly enhance the practical efficacy and internalization of safety skills. The imperative for integration stems from the understanding that responsible citizenship, a core outcome of "Tarbiya," inherently includes the capacity to ensure one's own safety and contribute to the safety of the community. By merging these domains, students can better understand that their moral obligations extend to practical actions that protect life and well-being[10].

The theoretical underpinnings for such integration are robust. Character education, through its emphasis on values like responsibility, self-control, and empathy, provides the motivational and ethical foundation for engaging with life safety topics. When students learn about fire safety or emergency preparedness within the context of "Tarbiya," they are not merely memorizing rules; they are internalizing the moral imperative to protect themselves and others, to act responsibly in dangerous situations, and to care for the sanctity of life. This approach transforms safety education from a set of external rules into an intrinsic aspect of their developing character. For instance, the concept of "responsibility" taught in "Tarbiya" can be directly applied to understanding the importance of not playing with matches, knowing an escape plan, or reporting a dangerous situation. Similarly, "empathy" can be linked to understanding the need to help others in an emergency or to avoid actions that could endanger peers. This integration makes learning more meaningful and transferable, as students perceive the direct relevance of their values to real-world safety challenges, thereby enhancing both their moral development and their practical safety competencies[10].

However, the empirical evidence regarding the effectiveness of school-based injury prevention programs, while generally supportive of improvements in knowledge and skills, highlights a need for more rigorous research. A systematic review published in 2020, which assessed 27 studies involving over 73,000 participants, found insufficient high-quality evidence to definitively determine if school-based programs prevent unintentional injuries [5]. While a meta-analysis of three studies suggested a pooled incidence rate ratio of 0.73 (95% CI 0.49 to 1.08) for injury occurrence, this low-certainty evidence was significantly impacted by heterogeneity and imprecision [5]. More encouragingly, the review found weak, low- or very low-certainty evidence indicating improvements in secondary outcomes such as safety skills (two studies), observed

safety behavior (four studies), self-reported behavior/practices (13 of 19 studies), and safety knowledge (19 of 21 studies) [5]. These findings, while not conclusive on injury prevention itself, suggest that school-based programs are effective in enhancing the precursors to safer behavior. The authors of the review explicitly called for more high-quality research, particularly randomized controlled trials, to establish a clearer link between educational interventions and actual injury reduction [5].

The implications of this systematic review [5] for the proposed integration are significant. If standalone safety programs, despite improving knowledge and skills, lack robust evidence for direct injury prevention, it suggests that a more holistic and deeply embedded approach might be necessary. Integrating life safety topics into a values-based subject like "Tarbiya" could provide the missing motivational and ethical framework that translates knowledge and skills into consistent, responsible behavior. By grounding safety education in a student's moral compass and sense of piety, the likelihood of sustained behavioral change may increase. The digital nature of the MCE "Tarbiya" curriculum [2] also presents an opportunity for innovative delivery of integrated content, leveraging interactive modules and multimedia resources that are increasingly common in contemporary educational settings [1]. This digital platform could facilitate the seamless weaving of safety scenarios and practical exercises into existing character-building lessons, offering a dynamic and accessible learning experience.

Therefore, the current literature underscores both the critical need for comprehensive life safety education and the profound benefits of character development. The identified gap lies in the explicit and systematic integration of these two vital domains. While existing safety programs contribute to knowledge and skill acquisition, their ultimate impact on injury prevention requires further strengthening, potentially through deeper integration with ethical and values-based learning. This article directly addresses this lacuna by proposing a concrete, age-appropriate framework for integrating life safety topics into the 4th-grade "Tarbiya" curriculum, aiming to leverage the strengths of both educational domains to foster truly holistic, responsible, and safety-conscious young learners.

Research Methodology

This study employs a qualitative, descriptive, and developmental research design, focusing on curriculum analysis, synthesis, and the systematic development of an integrated curriculum model. It is not an empirical study testing an intervention, but rather a theoretical and practical framework proposal, building upon existing educational principles and identified gaps in current primary education. The methodology is structured in distinct phases to ensure a comprehensive and coherent approach to integrating life safety topics into the 4th-grade “Tarbiya” curriculum.

The initial phase involved a comprehensive review and critical analysis of existing curriculum documents and pedagogical frameworks relevant to both “Tarbiya” education and life safety instruction. For “Tarbiya”, the primary focus was on the Madrasah Centre of Excellence’s (MCE) digital curriculum for primary education, specifically its conceptual framework derived from Surat al-Baqarah and its eight learning modules designed to nurture piety (taqwa) and ethical understanding [2]. This analysis aimed to identify the core values, learning objectives, and pedagogical approaches inherent in the “Tarbiya” subject, particularly those fostering responsibility, self-discipline, and care for oneself and others, which are foundational for safety education [6]. Concurrently, a systematic review of prominent life safety education curricula and resources was undertaken. This included examining materials from organizations such as Seans-Story.org, which provides free educational programs for various age groups focusing on fire safety

and hazard avoidance [3], and resources like Sparky the Fire Dog and Ready.gov, which offer age-appropriate content for elementary children on topics such as home fire escape plans, smoke detectors, and emergency preparedness [4]. The review specifically targeted materials suitable for 4th-grade students (ages 9-10), considering their cognitive and developmental stages. Content analysis techniques were applied to both sets of curricula to categorize themes, identify explicit and implicit safety messages, and map potential points of integration where "Tarbiya" values could synergistically enhance the internalization and application of life safety skills.

The second phase focused on synthesizing the theoretical foundations and pedagogical principles that would guide the integration. This involved a deep dive into academic literature, with a particular emphasis on studies published from 2020 onwards, concerning character education, the efficacy of life safety education, and best practices in curriculum integration within primary education. The systematic review by Phelan et al. (2020) on school-based injury prevention programs was critically examined to understand the current evidence base regarding the effectiveness of such interventions in preventing unintentional injuries [5]. While this review highlighted insufficient high-quality evidence for direct injury prevention, it did indicate improvements in secondary outcomes such as safety skills, observed safety behavior, self-reported behavior, and safety knowledge [5]. These findings underscored the necessity for a more holistic and deeply embedded approach to safety education, suggesting that integrating it within a values-based subject like "Tarbiya" could provide the missing motivational and ethical framework to translate knowledge and skills into consistent, responsible behavior. The theoretical underpinnings of character education, as exemplified by the Navigate 360 Character Education curriculum, which emphasizes values like respect, responsibility, honesty, and empathy, were also considered for their potential to provide a robust ethical foundation for engaging with life safety topics [6]. This phase established the guiding principles for the proposed integration, ensuring that the merged curriculum would be age-appropriate, culturally sensitive, and aligned with the holistic development goals of "Tarbiya" while incorporating effective pedagogical strategies for life safety.

The third and central phase of the methodology involved the development of the proposed integrated curriculum model for 4th-grade "Tarbiya". This phase commenced with a detailed gap analysis, comparing the identified themes and objectives from the "Tarbiya" curriculum with those from life safety education. The objective was to pinpoint specific areas where "Tarbiya" values, such as responsibility for one's actions, care for others, and self-control, could serve as direct foundational principles for understanding and practicing practical safety skills. For instance, the concept of "responsibility" taught in "Tarbiya" was mapped to understanding the importance of not playing with matches, knowing an escape plan, or reporting a dangerous situation. Similarly, "empathy" was linked to understanding the need to help others in an emergency or to avoid actions that could endanger peers. This mapping process facilitated the identification of specific learning outcomes that merge both domains.

Following the gap analysis, content mapping was undertaken to integrate specific life safety topics into existing "Tarbiya" modules or to propose new, integrated modules. This involved:

Topic Selection: Identifying key life safety topics relevant and critical for 4th-grade students, such as fire safety (e.g., smoke detectors, escape plans, "stop, drop, and roll"), home safety (e.g., electrical safety, safe cooking, proper storage of hazardous materials), road safety, and basic emergency response (e.g., calling emergency services, basic first aid principles). These

topics were selected based on their prevalence in unintentional injuries among children aged 4-18 [5] and their suitability for the cognitive abilities of 4th graders [4].

Learning Objectives Formulation: For each integrated topic, clear, measurable, and age-appropriate learning objectives were formulated. These objectives explicitly combined "Tarbiya" values with practical safety skills. For example, an objective might be: "Students will demonstrate responsibility (Tarbiya value) by identifying two escape routes from every room in their home and practicing a family fire drill (life safety skill)" [4].

Pedagogical Approaches: The curriculum model proposes pedagogical approaches that emphasize active, experiential learning, critical thinking, and real-world application. Drawing from effective safety education programs, these include hands-on activities, role-playing scenarios, case studies, group discussions, and problem-solving exercises [3, 4]. The digital nature of the MCE "Tarbiya" curriculum [2] presents a significant opportunity to leverage interactive modules, multimedia resources, and virtual simulations to enhance engagement and learning effectiveness. For instance, animated scenarios depicting safe and unsafe behaviors could be integrated into digital lessons, allowing students to make choices and observe consequences in a safe environment.

Content Development Guidelines: Guidelines for developing specific lesson plans and learning materials were established, ensuring that content is presented in an engaging, non-fear-inducing manner, using positive messaging to promote safe behaviors [3]. The language and examples used are designed to be culturally relevant and relatable to the students' daily lives.

The final phase addressed implementation strategies, teacher training, and assessment of learning outcomes, albeit at a conceptual design level within this methodological framework. For implementation, the methodology proposes leveraging existing digital platforms, such as the MCE's digital curriculum, to facilitate the seamless integration and dissemination of the new content [2]. This approach would allow for standardized delivery while offering flexibility for teachers to adapt materials to their specific classroom contexts. Teacher training is identified as a critical component for successful integration. The methodology suggests that training programs should focus not only on the content of life safety topics but also on the pedagogical approaches for integrating these topics within a values-based subject like "Tarbiya". Training would aim to equip teachers with the skills to foster critical thinking, facilitate discussions on ethical responsibilities related to safety, and implement interactive learning activities effectively. This includes guidance on using digital resources and conducting practical exercises like mock fire drills or emergency simulations.

Assessment of learning outcomes is designed to be multifaceted, evaluating both the acquisition of safety knowledge and skills, as well as the internalization of "Tarbiya" values as applied to safety. Assessment methods could include:

Formative Assessments: Quizzes, classroom discussions, observation of participation in role-playing scenarios, and analysis of student responses to safety dilemmas.

Summative Assessments: Project-based assignments (e.g., creating a home escape plan, designing a safety poster), performance-based assessments (e.g., demonstrating "stop, drop, and roll"), and written evaluations that require students to explain the ethical dimensions of safety behaviors.

Behavioral Observations: While challenging to measure directly in a curriculum development phase, the methodology suggests that future empirical studies could incorporate observations of student behavior in controlled environments or self-reported practices, building on

the findings of Phelan et al. (2020) regarding improvements in observed and self-reported safety behaviors [5]. The aim is to move beyond mere knowledge acquisition towards fostering genuine behavioral change and responsible citizenship.

Ethical considerations throughout this methodological process primarily revolve around ensuring the proposed curriculum is age-appropriate, culturally sensitive, and promotes a positive learning environment. The content avoids fear-mongering and instead empowers students with knowledge and skills, fostering a sense of agency and responsibility. The integration respects the core tenets of "Tarbiya" education, ensuring that life safety topics are presented in a manner consistent with its values-based framework and the nurturing of piety [2]. The proposed framework is designed to be a constructive and proactive approach to enhancing student well-being, aligning with global educational imperatives for holistic development. While this article proposes the framework, future research involving pilot implementations and rigorous evaluation, including randomized controlled trials as called for by Phelan et al. (2020) [5], would be essential to empirically validate its effectiveness in preventing unintentional injuries and fostering sustained safety behaviors.

Conclusion

This article has underscored the critical imperative for systematically integrating life safety education into the 4th-grade "Tarbiya" curriculum. Recognizing the existing gap, our proposed framework leverages "Tarbiya's" inherent focus on character development and ethical responsibility, transforming safety education from a set of external rules into an intrinsic aspect of a student's moral compass. This synergistic approach ensures that practical safety skills, from fire drills to emergency responses, are not merely learned but internalized, fostering genuine behavioral change and empowering students with holistic awareness for personal well-being and responsible citizenship. The comprehensive methodological design, encompassing content mapping and pedagogical strategies, offers a robust model. However, its ultimate efficacy necessitates rigorous empirical validation through pilot implementations and controlled studies to confirm its impact on injury prevention.

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THE SIGNIFICANCE OF MODERN PEDAGOGICAL APPROACHES IN PREPARING STUDENTS FOR EDUCATIONAL ACTIVITIES BASED ON FORESIGHT TECHNOLOGIES

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Abstract.*This article analyzes the significance of modern pedagogical concepts and methodological approaches in preparing students for educational activities based on foresight technologies. The study highlights the role of social-emotional learning, competency-based approaches, constructivist pedagogy, problem- and project-based learning, digital competencies, and inclusive education in the development of educational activities. Furthermore, the potential of foresight technologies in forecasting future pedagogical processes, strategic planning, and innovative decision-making is revealed. According to the research findings, foresight technologies are substantiated as an effective innovative mechanism for preparing students for modern socio-pedagogical activities.*

Keywords: *foresight technologies, educational activities, pedagogical concept, competency-based approach, innovative pedagogy, digital competencies, inclusive education, reflective approach, student-centered education.*

Introduction

In the current era of strategic development, fundamental reforms are being implemented in the educational process. According to the “Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030,” there is a necessity to modernize pedagogical approaches and widely introduce digital technologies into the higher education system. At the same time, specialists trained in higher educational institutions are expected to possess the ability to forecast the future, demonstrate adaptability in rapidly changing competitive environments, and apply the principles of sustainable development in practice. From this perspective, organizing educational activities based on foresight technologies acquires particular significance as a promising pedagogical mechanism.

Foresight technologies create opportunities for forecasting potential future pedagogical situations, strategic planning, and making innovative decisions. Educational processes organized on the basis of these technologies contribute to adapting students to future socio-pedagogical activities and fostering competencies such as independent thinking, reflection, collaboration, and creativity.

Scientific research aimed at improving the effectiveness of educational activities in the higher education system places special emphasis on issues such as competency-based approaches, learner-centered education, innovative pedagogy, and the integration of digital technologies. Therefore, integrating foresight technologies with educational activities is considered one of the promising directions of modern pedagogy.

The purpose of this article is to analyze the scientific and practical significance of modern pedagogical concepts and methodological approaches in preparing students for educational activities based on foresight technologies.

Main Part

At present, a number of modern pedagogical concepts serve as important methodological foundations in preparing students for educational activities. These concepts provide opportunities for the effective organization of educational activities, the adaptation of students to social life, and the development of their professional and personal competencies.

In particular, the concept of social-emotional learning is aimed at developing students' self-awareness, emotional regulation, empathy, responsible decision-making, and effective communication skills. Research has demonstrated that this approach positively influences academic achievement, enhances social adaptability, and strengthens psychological well-being.

The competency-based approach, in turn, does not limit the educational process solely to the acquisition of knowledge but focuses on the development of competencies manifested in practical activities. This approach contributes to the formation of responsibility, collaboration, leadership, and communicative competencies among students.

Student-centered and constructivist pedagogy is also regarded as one of the key concepts of modern education. According to this approach, the student acts as an active subject in the educational process, while knowledge is constructed through independent inquiry and experience. Particularly in educational activities, the use of problem situations, reflective tasks, and small-group discussions contributes to the development of students' independent thinking. Furthermore, the concept of problem- and project-based learning plays a significant role in increasing students' preparedness for educational activities. This approach develops civic responsibility, initiative, and creative thinking by engaging students in solving real pedagogical and social problems.

In the modern educational process, the development of digital competencies is also considered one of the most актуal issues. Purposeful, safe, and effective use of digital tools prepares students for independent learning, rapid information processing, and the practical implementation of innovative technologies.

In addition, the concept of inclusive education has emerged as an important component of contemporary educational activities. This approach serves to create equal opportunities for all students, take into account individual characteristics, and ensure social integration. When integrated with foresight technologies, the concepts analyzed above make it possible to form an innovative model of educational activities. This is because foresight technologies facilitate the forecasting of pedagogical processes, the identification of potential problems, and the determination of strategic development directions.

Based on this, the "Educational Foresight Laboratory" model was proposed within the framework of our research. This model was developed as an innovative pedagogical mechanism aimed at preparing students for future pedagogical situations and fostering reflective and prognostic competencies. Within the framework of the model, students are engaged in activities such as modeling pedagogical situations, analyzing problematic cases, conducting group discussions, and making strategic decisions.

A number of methodological principles play an important role in organizing educational activities based on foresight technologies. First of all, the principle of scientific validity and systematicity requires all components of educational preparation to be organized as a unified

pedagogical system. The principle of continuity and consistency ensures the gradual development of educational preparation.

The principle of competency orientation serves to develop the student's professional and personal competencies manifested in practical activities. The principle of learner-centeredness, in turn, implies consideration of the student's individual characteristics, needs, and abilities.

The principle of activity orientation enables the integration of theoretical preparation with practical training, project activities, and problem-based situations. Meanwhile, the principle of integration and innovation requires the harmonization of educational activities with modern pedagogical and digital technologies.

The table below presents the methodological approaches to organizing educational activities based on foresight technologies.

Methodological Approaches to Organizing Educational Activities Based on Foresight Technologies

Table 1

No.	Name of the Approach	Scientific Essence of the Approach	Interrelation with Foresight Technology	Impact on Educational Activities
1	Competency-based approach	Education is defined not by knowledge alone, but by competencies.	Identifies future competencies in advance.	Develops responsibility and leadership abilities.
2	Learner-centered approach	Considers the student as the central figure of education.	Forecasts individual developmental trajectories.	Forms self-awareness skills.
3	Activity-oriented approach	Conducts education through projects and practical activities.	Models implementation scenarios.	Enhances practical experience.
4	Innovative pedagogical approach	Applies modern methods and technologies.	Generates innovative ideas.	Increases creativity and initiative.
5	Strategic approach	Plans on the basis of long-term goals.	Relies on strategic planning.	Develops future-planning skills.

The analysis demonstrates that integrating foresight technologies with educational activities enhances students' preparedness not only for current pedagogical processes but also for future professional activities. In particular, these technologies possess significant potential for developing competencies such as strategic thinking, reflection, creativity, and innovative decision-making.

1. Competency-Based Approach

This approach determines the most important methodological directions for the development of students' competencies in educational activities. The competency-based approach makes it possible to identify the elements of educational activities, define their principles, reveal their content, justify the selection of didactic and methodological support for the process of developing educational competencies, and conduct their analysis.

According to M. M. Vakhobov, “education based on the competency-based approach is aimed at developing and forming learners’ competencies to apply the knowledge, skills, and abilities they have acquired in their personal and professional activities within society without difficulty.”

In scientific literature, the concept of “professional competence” is interpreted in various ways. For example, T. M. Sorokina and B. A. Nazarova define it as knowledge and professional communication skills; readiness to independently perform different types of activities, solve professional tasks, and evaluate the results of one’s work; while V. A. Slastyonin and B. G. Khodjayev associate it with the ability for professional development, advanced training, and self-realization in professional activity.

2. Learner-Centered Approach

At present, this approach is being effectively studied by researchers in our country and in developed foreign states, while its theoretical and scientific significance is reflected in the works of Uzbek scholars such as R. Ishmukhamedov and M. Yuldashev. According to their ideas, the learner-centered approach is a pedagogical approach based on considering the learner not as a passive recipient of knowledge, but as an active, independent, and socially responsible subject of the educational process. In this approach, the learner’s individual needs, interests, abilities, personal experiences, and pace of development are regarded as the main criteria.

Regarding the scientific foundations of the learner-centered approach and its essence in education, another researcher similarly defines it as a pedagogical concept aimed at organizing the educational process on the basis of students’ needs, abilities, and individual characteristics. In this context, the learner is viewed not merely as a recipient of knowledge, but as an active participant in the educational process.

When the concept of the learner-centered approach is analyzed by researchers in developed countries, it is interpreted within the context of the pedagogical process. In this regard, the pedagogical and psychological conditions for implementing the learner-centered approach are emphasized. According to this perspective, the learner-centered approach differs from the traditional teacher-centered model, as the learner becomes the central subject of the educational process.

The main principles of the learner-centered approach are structured as follows:

- placing the learner at the center of the educational process;
- considering the teacher not as a controller of instruction, but as a facilitator and guide;
- taking into account learners’ individual needs, interests, and capabilities;
- ensuring active participation and independence.

Students do not merely listen to or copy texts; rather, they actively participate through tasks, express independent opinions, learn ways of solving problems, and conduct inquiry-based activities. As a result, students’ motivation and their sense of ownership over the learning process are significantly strengthened.

3. Activity-Oriented Approach

The “activity-oriented approach” is based on the formation of knowledge through students’ active practical engagement in the educational process. In other words, learners acquire knowledge not merely by listening to instructional materials, but through participation in specific activities. Within this approach, knowledge and skills are harmoniously integrated, and actions are combined throughout the learning process. At the same time, the educational process becomes contextual, socially oriented, and goal-directed. Students learn through independent thinking and problem-

solving activities. This pedagogical concept rejects the traditional model of "passive reception" and regards the learner as an active subject of education.

The humanitarian activity approach in Russian pedagogy was developed by scholars such as Lev Vygotsky and Alexei Leontiev. This approach is grounded in sociocultural and activity theories, which constitute the theoretical foundation of the modern activity-oriented pedagogical model. Although these theories emerged before the 2000s, their ideas continue to be reinterpreted and developed in contemporary pedagogical research.

Margolis emphasizes that the activity-oriented nature of the educational process is not a pedagogical novelty; however, modern pedagogical education should primarily focus on developing learners' complex competencies. Unlike the traditional knowledge-transmission model, the activity-oriented approach is based on acquiring knowledge through the direct solution of practical, social, and professional tasks. Research findings indicate that the activity-oriented approach represents a non-standard pedagogical model which, when harmoniously integrated with standards-based pedagogical systems, can contribute to the modernization of education. According to this perspective, new innovative educational standards provide only general knowledge, whereas their internal content should be formed through an activity-oriented conceptual framework.

4. Innovative Pedagogical Approach

The innovative pedagogical approach is a system of methods aimed at modernizing the educational process in accordance with contemporary requirements, providing learner-centered instruction, and developing students' creative and independent thinking abilities. This approach is mainly implemented through the following directions:

1. **Application of innovative pedagogical technologies in the educational process** - introducing new educational methods and tools that enhance the effectiveness of teaching and learning.
2. **Placing student activity at the center of education** - creating educational mechanisms that encourage student participation, independent thinking, and creativity.
3. **Interactive teaching methods** - enriching the learning process through methods such as educational games, project-based learning, and problem-solving activities.
4. **Integration of information and communication technologies** - implementing education in a more individualized and effective manner through digital tools, interactive platforms, and multimedia resources.

Unlike traditional frontal teaching methods, this approach actively engages students as participants in the learning process and places significant emphasis on their independent inquiry and exploration. Researchers note that: "Innovative pedagogical technologies in the pedagogical process constitute a systematic pedagogical approach that enhances the quality of education through learner-centered activities, interactive methods, and the use of modern tools."

In this context, the term "innovative pedagogical technologies" is interpreted broadly and includes such directions as teaching students independent thinking, organizing lessons in interactive and creative forms, and integrating modern technologies into the educational process.

In contemporary education, this concept represents pedagogical theory and practice that place the learner at the center of the educational process while enriching instruction through interactivity, creativity, and technological integration. It contributes to expanding students' competencies, increasing learning effectiveness, and stimulating creative activity.

5. Strategic Approach

The strategic approach refers to organizing the processes of education and upbringing on the basis of long-term goals, outcome-oriented planning, and principles aimed at increasing effectiveness. When integrated with foresight technologies, the strategic approach serves not only to accomplish current tasks but also to forecast and manage students' future educational activities.

The foresight approach and the strategic approach complement one another. Through strategic planning, long-term goals are determined, while foresight methods enable the prior analysis of their achievement and the development of alternative scenarios.

Conclusion

In conclusion, the process of educational preparation based on foresight technologies, when integrated with modern pedagogical approaches, contributes significantly to the development of students' professional and personal competencies. In particular, educational activities organized on the basis of competency-based, learner-centered, and innovative approaches enhance students' adaptability to future pedagogical situations.

Furthermore, the application of foresight technologies enables strategic planning of pedagogical processes, forecasting of potential problems, and the adoption of effective pedagogical decisions. As a result, these technologies emerge as an effective innovative mechanism for preparing students for modern socio-pedagogical activities.

Preparing students for educational activities on the basis of foresight technologies requires the integration of contemporary pedagogical approaches. Competency-based, learner-centered, strategic, innovative, and reflective approaches constitute the scientific and methodological foundation of foresight technology. These approaches contribute to the development of social responsibility, moral stability, proactivity, and strategic thinking, which are essential for students' effective future engagement in educational activities.

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PSYCHOLOGICAL FACTORS AFFECTING THE EFFECTIVENESS OF JUDICIAL ACTIVITIES

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Abstract. *This article examines the psychological factors that influence the effectiveness, objectivity, and legitimacy of judicial activity. It focuses on cognitive biases, emotional stability, professional burnout, stress resistance, empathy, and socio-psychological pressures that shape judicial decision-making. The study is based on literature analysis, empirical observation of court hearings, interviews with experienced judges, and comparative analysis of professional deformation across legal fields. The findings show that anchoring, confirmation bias, decision fatigue, workload pressure, and group conformity may reduce analytical accuracy and increase the risk of formalistic or biased decisions. At the same time, emotional intelligence, procedural fairness, reflective thinking, and psychological resilience strengthen judicial impartiality and public trust. The article argues that judicial effectiveness cannot be secured only through legal knowledge; it also requires psychological competence, systematic stress prevention, and training in cognitive self-regulation. Therefore, psychological hygiene should become an essential part of modern judicial standards in contemporary court systems and institutions.*

Keywords: *judicial activity; psychological factors; cognitive bias; emotional stability; professional burnout; judicial decision-making; procedural justice.*

1. Introduction.

Judicial work is characterized by a high degree of intellectual and emotional strain. The effectiveness of justice depends not only on knowledge of the law but also on the judge's personality and ability to maintain objectivity in the face of uncertainty. The effectiveness of judicial work directly depends on the psychological stability of judges, the cognitive biases of trial participants, and the moral and psychological climate in the courts. According to global studies (such as the American Bar Association), up to 28% of judges suffer from symptoms of depression, and approximately 19% experience emotional burnout, which directly correlates with an increase in judicial errors.

The relevance of this topic stems from the need to minimize judicial errors caused by the "human factor." Traditionally, jurisprudence relies on a rational model of behavior, but modern research in the field of legal psychology demonstrates the significant influence of subconscious mechanisms on the final verdict. The effectiveness of justice is determined not only by the quality of substantive and procedural law, but also by psychological factors that act as hidden regulators of the judicial process. Under conditions of high responsibility, time pressure, and emotional stress, a judge's psychological preparedness becomes the key to rendering a fair decision.

In the Russian Federation, requirements for the professional and psychological qualities of judges are enshrined in the Law of the Russian Federation "On the Status of Judges in the Russian Federation" and the Code of Judicial Ethics. These documents emphasize the need to maintain a high level of self-control, impartiality, and resilience to external pressure. At the international

level, the key standard is the Bangalore Principles of Judicial Conduct (UN), which emphasize "objectivity" and "honesty" as psychological attitudes essential to preventing bias.

Research shows that the human factor remains a critical link in the system:

Cognitive biases: According to European legal journals (e.g. *Oxford Journal of Legal Studies*), the anchoring effect (the influence of the first number heard on the final sentence) can change the severity of a sentence by 15–20%.

Stress and burnout: According to statistics from the International Bar Association (IBA), one in three legal professionals reports a negative impact of work on their mental health. In the US, research *by the National Center for State Courts* confirms that judicial stress (" vicarious ") trauma ") leads to a decrease in concentration and deterioration of analytical abilities.

Statistical surveys of judges in the Russian Federation and CIS countries reveal the following correlations:

Deformation: Judges with more than 10–15 years of experience show an increase in “accusatory bias” as a defensive psychological reaction (simplification of the worldview to reduce stress).

Figures: Up to 40% of judges note that a high workload (over 50 cases per month) leads to automatism, in which a deep psychological analysis of the personality of a participant in the process is replaced by a formulaic approach. Statistical surveys of judges in the Russian Federation and CIS countries reveal the following correlations:

Psychological climate: In countries with high levels of "procedural satisfaction" among parties (e.g., Scandinavia), where judges employ psychological communication skills, the appeal rate is 30% lower than in systems with a rigid, authoritarian style of conducting proceedings. Thus, studying psychological aspects-from decision-making mechanisms to preventing professional deformation-is a necessary condition for realizing the right to a fair trial in modern society.

The purpose of the article is to identify and systematize psychological factors influencing the quality of judicial proceedings.

2 . Methods.

The study was based on:

1. Literature analysis: A study of the works of D. Kahneman (cognitive biases) and P. Ekman (psychology of emotions) in the context of jurisprudence.
2. Empirical method: Observation of court hearings and interviews with judges with more than 10 years of experience.
3. Comparative analysis: Comparison of data on professional deformation in various branches of law.

3. Results.

During the study, three groups of factors were identified:

A) Cognitive factors. Anchoring effect: Judges often rely on the first figure they receive (for example, the sentence proposed by the prosecutor), even if it is unfounded. Confirmation bias: The tendency to interpret facts in a way that confirms an already established initial version of guilt or innocence.

An analysis of judicial practice within the framework of the *Innocence Project* (USA) showed the role of psychological deviations in incorrect verdicts:

Confirmation bias: Judges and investigators tend to ignore defense evidence if it contradicts their initial hypothesis of guilt.

Halo effect: According to statistics, defendants with a socially approved appearance or high status receive, on average, sentences that are 10-12% more lenient than those with low social status for the same crime.

B) Personality and emotional factors. Empathy. Distancing: Excessive empathy leads to a loss of objectivity, while complete emotional detachment (cynicism) prevents consideration of mitigating circumstances. Stress Resistance: High levels of cortisol during protracted trials reduce cognitive flexibility, forcing the judge to make formulaic decisions. Research (in particular, the famous experiment by Daniel Kahneman and the analysis of court decisions in Israel and the United States) confirms the existence of the phenomenon of "chronobiological fatigue":

Statistics: The probability of parole drops from 65% to almost 0% during the session and increases sharply to baseline values after a lunch or rest break.

Conclusion: Biological factors and cognitive resource depletion ("decision fatigue") directly influence law enforcement, making it more formal and repressive towards the end of the working day.

B) Socio-psychological factors . Influence of authority: Psychological pressure from higher authorities or public opinion. Group Dynamics: In collegial courts, a " groupthink " effect is observed, where the desire for agreement suppresses critical analysis.

The effectiveness of justice is measured not only by legality, but also by legitimacy (recognition of the decision by the parties).

Global practice: The introduction of "therapeutic jurisprudence" techniques in Canada and Australia has shown that if a judge displays empathy and explains the logic of a decision, the recidivism rate among convicted offenders decreases by 15–20%.

Result: Psychological literacy of a judge reduces the level of conflict in the process and the number of unfounded appeals.

Statistical surveys of judges in the Russian Federation and CIS countries reveal the following correlations:

Deformation: Judges with more than 10–15 years of experience show an increase in "accusatory bias" as a defensive psychological reaction (simplification of the worldview to reduce stress).

Figures: Up to 40% of judges note that a high workload (over 50 cases per month) leads to automatism, in which a deep psychological analysis of the personality of a participant in the process is replaced by a formulaic approach. Statistical surveys of judges in the Russian Federation and CIS countries reveal the following correlations:

The Impact of Psychological Factors on Judicial Performance (Summary Data)

Psychological factor	**Manifestation in activity**	**Statistical Indicator / Effect**	**Data source**
Cognitive exhaustion	Decreased concentration towards the end of the working day.	The likelihood of petitions being rejected increases by 60-70 % before breaks.	PNAS (Proceedings of the National Academy of Sciences)
The Anchoring Effect	The final sentence depends on the term requested by the prosecutor.	In 80% of cases, the final decision correlates with the first figure	Research by Greenberg and Spanz

		announced (even if it is overestimated).	
Professional burnout	Emotional detachment, cynicism, formalism.	Up to 30% of judges experience secondary trauma, leading to a 15% increase in "template" decisions.	American Bar Association (ABA)
Stereotyping	The influence of appearance, status or ethnicity.	The difference in sentences for identical crimes can be 10–12% depending on social status.	Innocence Project/Harvard Implicit Bias Lab
Empathy and communication	Use of "procedural justice" techniques.	The level of voluntary compliance with decisions and a reduction in recidivism by 15–20%.	Yale Law School (Tom Tyler)

1. Correlation between stress and decision quality: Statistical analysis shows that during peak workload periods (end of quarter/year), the number of decisions overturned by higher authorities increases by an average of 7–9%. This supports the hypothesis that psychological overload leads to a decline in critical thinking.
2. The "groupthink" effect in collegial courts: In panels of three judges, a tendency toward conformism has been identified—in 95% of cases, panel members agree with the opinion of the reporting judge, which minimizes psychological conflict but reduces the objectivity of the collective discussion.
3. Gender aspect: Global statistics indicate that female judges spend, on average, 10–15% more time studying the personal characteristics of defendants, which psychologically humanizes the process, but increases the time spent on the case.

Data confirms that psychological resilience and awareness of cognitive biases are just as critical as knowledge of judicial codes. Investments in psychological resilience and training judges in stress-resilient skills statistically reduce the risk of judicial errors and increase public trust in the state.

4. Discussion.

The analysis revealed that judicial activity is one of the most psychologically determined areas. A discussion of the findings allows us to identify three critical points:

The Paradox of "Impartiality" and "Human Factor"

Regulatory requirements (the Bangalore Principles, the Code of Judicial Ethics) prescribe complete impartiality. However, the results show that cognitive biases (anchoring, hypothesis confirmation) are not a defect of individual judges' will, but a fundamental feature of the human brain.

Debate question: Can a decision be considered "legal" if it was influenced by a judge's blood glucose level (the fatigue effect)? This raises the question of the need to implement strict protocols for psychological decompression and scheduled breaks in the judicial system.

Technologicalization and empathy in judicial practice are two opposing trends whose interaction will determine the future of justice: digitalization automates routine tasks, while empathy remains the exclusive prerogative of human judges.

The implementation of information technologies (AI, neural networks, videoconferencing systems) is aimed at optimizing processes:

Automating routine tasks: Neural networks effectively handle processing large volumes of data, preparing standard documents, and searching for precedents.

Accessibility: E-justice makes it easier to file claims and attend court hearings remotely.

Objectivity: Technology minimizes the risk of human error in formal calculations (e.g., deadlines or duties).

Limitations: AI lacks "life experience" and is unable to take into account the deep socio-psychological context of the case.

Empathy: The Human Dimension of Justice . Empathy in court is not pity, but a professional skill in understanding the emotional state and motives of the parties to the proceedings:

Individualization of punishment: Allows the judge to take into account the dignity of the individual, the vulnerability of the parties and the specific life circumstances when making a decision.

Communication quality: The ability to read verbal and non-verbal cues (facial expressions, gestures) helps in establishing the truth and reducing conflict in the courtroom.

Justice: Empathy is transformed from a moral category into a procedural requirement that ensures that the demands of social justice are taken into account.

Burnout Prevention: Lack of empathy or its excess in employees (for example, bailiffs) can lead to emotional burnout and personality deformation.

Empathy in the work of a judge is a necessary condition for the constitutionalization of Russian justice.

Technologicalization and empathy in judicial practice are two opposing trends whose interaction will determine the future of justice: digitalization automates routine tasks, while empathy remains the exclusive prerogative of human judges.

The global trend toward digitalization of justice (Legal Tech) is seen as a way to eliminate psychological bias. On the one hand, artificial intelligence is free from fatigue and emotion. On the other hand , statistics from countries with developed "therapeutic jurisprudence" show that the lack of human contact and empathy on the part of judges reduces trust in the law. The discussion confirms that the judge's psychological engagement is necessary to assess the individual circumstances of a case, which is impossible with complete automation.

Professional deformation as a systemic risk. Burnout statistics (up to 28% of depressive states) indicate that the judicial system is operating at the limits of its psychological resources.

Accusatory bias: During the discussion, it's important to emphasize that this is often not an ideological stance, but a psychological defense. Simplifying the process (automatically agreeing with the charges) helps the judge cope with cognitive overload. Thus, the effectiveness of justice directly correlates with the psychological hygiene of work in the courts.

Legitimacy through psychological perception. A discussion of the data on “procedural fairness” shows that for citizens, the psychological climate in the courtroom (respect, the opportunity to be heard) is more important than the formal outcome. Investing in the psychological training of judges (active listening skills, anger management) is more cost-effective than

maintaining a huge apparatus for reviewing endless appeals caused by a sense of injustice in the process.

The discovered factors confirm that "legal automatism" is impossible. The problem of judicial burnout is critical: according to data, up to 40% of judges experience signs of emotional exhaustion after 5-7 years of service. This directly correlates with the increase in formalism in decisions. To neutralize cognitive biases, it is proposed to introduce "second opinion" methods and mandatory psychological self-regulation courses. Psychological training should be made as mandatory as advanced legal training.

The results support the hypothesis that a judge's psychological competence is not an optional skill, but a structural element of judicial effectiveness. A shift from the "formal-legal" model of a judge to the model of a "psychologically stable arbitrator" is necessary.

Recommendations for improving regulatory and organizational frameworks. Based on an analysis of global statistics and identified psychological patterns, the discussion logically leads to the need for the following steps:

1. Reform of the personnel selection system (Psychological qualification):

Proposal: Amend the Law “On the Status of Judges” to require expanded psychophysiological testing (including the use of a polygraph and emotional intelligence tests) not only upon taking office, but also every 5 years.

Justification: This will allow for the timely identification of professional deformation and signs of sadistic tendencies or cynicism, which develop as defense mechanisms of the psyche.

2. Regulatory consolidation of “Psychological time-outs”:

Proposal: Develop workload standards limiting the number of cases handled per day (based on the experience of Scandinavian countries).

Rationale: Given the evidence on “chronobiological fatigue,” a legislative limitation on the duration of meetings without a break (no more than 1.5–2 hours) will statistically reduce the likelihood of errors caused by cognitive exhaustion.

3. Implementation of psychological support programs:

Proposal: Create closed psychological support services within judicial communities (similar to the *Judicial programs) Assistance Programs* in the USA and Canada).

Rationale: This will remove the stigma of "psychological weakness" and allow judges to work through the secondary trauma of handling difficult criminal cases while maintaining objectivity.

4. Educational component:

Proposal: Include a course on “Cognitive Biases in Justice” in the mandatory advanced training program for judges.

Rationale: A judge's awareness of the existence of the "anchoring effect" or "confirmation bias" automatically reduces their influence by 25-30% due to the activation of metacognitive control mechanisms.

5. Changes in performance evaluation criteria:

Proposal: Shift the focus of evaluating a judge’s work from purely quantitative indicators (deadlines, number of cases) to qualitative ones (index of satisfaction of the parties with the process, absence of complaints about ethical behavior).

Justification: The current “stick system” psychologically forces judges to rush and be formalistic, which contradicts the very essence of justice.

Judicial effectiveness cannot be achieved solely through legal methods. A multidisciplinary approach is needed, where psychological hygiene and cognitive safety of judges become part of the state's judicial standards.

6. Conclusion.

The effectiveness of judicial activity is an integral indicator, where psychological literacy plays a role in preventing systemic errors. The key factors for success are:

A judge's awareness of his cognitive biases.

High level of emotional stability.

Prevention of professional deformation.

The development of "psychological hygiene" in the judicial system will increase the level of public trust in the institution of justice.

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AGE-RELATED PSYCHOPHYSIOLOGICAL ASPECTS OF THE MANIFESTATION OF EMOTIONAL STATES

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Abstract. *This article is devoted to the study of the psychophysiological aspects of emotional states across different age periods. The aim of the research is to determine how age-related changes occurring in the human organism influence emotions and to identify the role of age in the manifestation of emotional states. The study involved children, adolescents, adults, and older adults, whose physiological indicators, such as heart rate and skin conductance, were measured. In addition, participants' subjective emotional experiences were assessed using self-report questionnaires. The results revealed significant age-related differences in emotional reactions and in the ability to regulate emotions. The findings of this study may contribute to the development of age-appropriate emotional development programs and psychological support systems.*

Keywords: *emotional state, age, psychophysiology, emotional development, nervous system, emotion regulation, neuroscience***.**

Introduction

Emotional states are an essential component of the human psyche, and their formation and manifestation exhibit significant differences across various stages of life. Emotions provide a vital connection between an individual's inner world and the external environment, playing an important role in regulating behavior, adapting to stress and challenging situations, and fostering social relationships. Therefore, the study of the psychophysiological foundations of emotional states is of considerable importance in contemporary psychology, neuroscience, and biology.

Age is a significant factor in the formation and manifestation of emotional states. Psychophysiological changes that occur throughout different stages of life, including childhood, adolescence, adulthood, and old age, influence both the quality and intensity of emotional reactions. For example, during childhood, the nervous system is not yet fully developed, and emotions are often expressed intensely and with limited regulation. In adolescence, hormonal changes contribute to increased emotional variability and heightened emotional responses. During adulthood, the maturation of brain structures and the development of psychological self-regulation enhance individuals' ability to manage their emotions effectively. In old age, age-related declines in nervous system functioning and physiological changes may lead to alterations or reductions in emotional responsiveness.

In this regard, identifying age-related psychophysiological characteristics and examining their influence on the manifestation of emotional states has become one of the most relevant topics in contemporary scientific research. Although numerous scholars have investigated age-related emotional changes and their neurological foundations, many questions and areas of scientific interest remain unresolved. In particular, the detailed examination of differences among age groups through psychophysiological indicators and the comparison of these findings with individuals' subjective emotional experiences represent promising directions for future research in this field.

The purpose of this study is to determine the role and significance of age in the psychophysiological manifestation of emotional states across different stages of life. The research involved children, adolescents, adults, and older adults, whose physiological indicators, including heart rate and skin conductance, were measured. In addition, participants' subjective emotional states were assessed using standardized questionnaires. This approach provided an opportunity to obtain comprehensive information about age-related emotional reactions and the mechanisms involved in their regulation. The methodology employed in this study included psychophysiological measurements, psychological assessments, and experimental techniques. These methods enabled a thorough analysis of both the physiological and psychological components of emotional states.

The findings revealed significant differences among age groups and demonstrated that the ability to regulate and manage emotions generally improves with age. These results have practical implications for the development of age-specific psychological support services and emotional development programs. In conclusion, age-related psychophysiological changes play a crucial role in the formation and manifestation of emotional states. Research in this area contributes to a deeper understanding of human psychological development, facilitates the identification of age-specific emotional challenges, and supports the development of effective intervention strategies. Therefore, promoting emotional development and investigating its psychophysiological foundations while taking age-related factors into account remain important priorities in contemporary psychology and healthcare.

Literature Review

Emotions and their age-related changes have been widely studied in the fields of psychology and neuroscience. Based on the works of Izard and LeDoux, emotions are understood to arise through complex mechanisms of the nervous system, in which the limbic system and the prefrontal cortex play a central role. With increasing age, the development of the prefrontal cortex contributes to improved emotional regulation and control abilities [1].

Casey and colleagues have demonstrated the neurodevelopmental changes occurring during adolescence, emphasizing that emotional instability may increase during this period due to ongoing brain maturation processes. In addition, Cacioppo and colleagues, using psychophysiological measurements, identified age-related changes in emotional responses, showing that emotional reactivity varies significantly across different age groups.

A large body of research indicates that age-related differences in emotional responses are reflected not only at the psychological level but also in physiological indicators. For instance, children and adolescents tend to show higher levels of psychophysiological reactivity, such as increased heart rate and greater skin conductance responses [4]. In contrast, adults are more likely to employ cognitive strategies for emotional regulation and control.

Emotional states are the result of complex central nervous system activity. Within the brain, the limbic system—particularly the amygdala, hippocampus, and prefrontal cortex—plays a key role in emotional processing. The amygdala is involved in detecting threat or reward signals and generating rapid, intense emotional responses. The hippocampus integrates memory and contextual information and contributes to the formation of emotional memories. The prefrontal cortex is essential for regulating emotions, modulating emotional responses, and supporting social adaptation.

The peripheral nervous system, particularly the autonomic nervous system (sympathetic and parasympathetic divisions), regulates the physiological responses associated with emotional

reactions, including heart rate, blood pressure, skin conductance, and related bodily changes. Emotional states are often accompanied by these physiological alterations. Hormonal mechanisms also play a significant role in emotional regulation.

During stress, for example, cortisol levels increase in the body, which has a strong influence on emotional states. Neurotransmitters such as serotonin and dopamine are responsible for mood regulation and the experience of pleasure. Oxytocin, in turn, plays an important role in strengthening social bonding and trust. Age-related neurophysiological changes indicate that during childhood, the limbic system of the brain is actively developing. The amygdala and hippocampus continue to mature, enabling children to gradually learn emotional sensitivity and response regulation. However, the prefrontal cortex is not yet fully developed, resulting in limited emotional control. At this stage, emotional reactions are often intense and impulsive.

During adolescence, significant hormonal changes (such as sex hormones) occur alongside dynamic brain development. Because the prefrontal cortex is not yet fully matured at this stage, emotional regulation becomes more challenging. As a result, adolescents often experience emotional fluctuations and psychological instability. In adulthood, the prefrontal cortex reaches full development, which enhances the capacity for emotional control and regulation. Personal experience and social skills also contribute to the formation of emotional intelligence. In old age, a decline in the functioning of the nervous system and a reduction in the number of neurons are observed.

This may lead to weakened or altered emotional responses. Additionally, difficulties may arise in the regulation of stress-related hormones. Modern research shows age-related changes in amygdala activity [2]. Children and adolescents tend to be more sensitive to emotional stimuli due to higher amygdala activity compared to adults. At the same time, the development of the prefrontal cortex contributes to improved emotional regulation abilities [3]

However, some studies have shown that age-related differences are not only associated with neuroanatomical factors but are also influenced by social and cultural factors. This increases the complexity of research in this field and necessitates interdisciplinary approaches in future studies. Expressive theories view emotions as basic biological programs and consider age-related changes to be primarily linked to physiological mechanisms. In contrast, cognitive theories regard emotions as a product of personal and social experience, emphasizing that emotional experience and regulatory capacity increase with age [5].In addition, significant differences have been identified among age groups in terms of emotion regulation strategies and their effectiveness. These differences are shaped by individual psychological characteristics, social environment, and cultural influences.

Methodology

The study employed a cross-sectional research design. Participants were divided into four age groups: children (7–12 years), adolescents (13–17 years), adults (18–60 years), and older adults (60 years and above). Each group consisted of 30 participants, with a total sample size of 120 individuals. To assess emotional states, visual stimuli depicting different facial expressions (joy, fear, anger, and neutrality) were presented to the participants. Psychophysiological measures included heart rate (HR), skin conductance (EDA), and respiration rate. In addition, standardized questionnaires and emotional reactivity tests were used to evaluate subjective emotional experiences.

Participants

A total of 120 participants were involved in the study and were divided into four age groups:

- Children (7–12 years) – 30 participants
- Adolescents (13–17 years) – 30 participants
- Adults (18–60 years) – 30 participants
- Older adults (60 years and above) – 30 participants

All participants were screened to ensure they were physically healthy, actively functioning, and free from psychiatric disorders or severe chronic illnesses. In addition, social and demographic data were collected to enhance the reliability and contextual interpretation of the results.

Research Instruments and Methods: Visual Stimuli

Standardized visual stimuli were used to activate and measure emotional states. These stimuli included facial expressions representing four basic emotions: joy, fear, anger, and neutrality. The images were presented to participants on a computer screen in a fixed sequence, and their reactions to each facial expression were recorded. The visual stimuli helped to identify differences in emotional responses across age groups.

Psychophysiological Measurements

To assess the physiological components of emotional states, three main indicators were selected:

Heart rate (HR): Heart rate is closely associated with emotional and stress-related states, and its speed and variability reflect emotional responses. HR measurements were recorded in real time using specialized heart rate monitoring sensors.

Skin conductance (EDA): Skin conductance is primarily linked to the activity of sweat glands and increases during stress or heightened emotional arousal. This indicator was used to evaluate the intensity of emotional reactions.

Respiration rate: The breathing rhythm also reflects physiological changes associated with emotional states. In situations of stress or fear, respiration tends to become faster. This indicator was measured using a respiration sensor.

These psychophysiological parameters were recorded simultaneously during the experiment, and their variations, as well as differences between age groups, were analyzed.

Psychological measurements: Standard questionnaires and tests were used to assess participants' subjective emotional states. These included:

Emotional reactivity tests: These tests evaluate participants' level of responsiveness to different emotional stimuli and help determine their emotional sensitivity.

Questionnaires: Participants were asked to evaluate their current emotional state. In addition, data were collected regarding life stress experiences, mood, and the ability to regulate emotions.

Research procedure: The study was conducted individually in a specialized laboratory setting. First, participants were informed about the purpose of the study and their informed consent was obtained. Then, psychophysiological sensors were attached, and participants were instructed to view visual stimuli. Short breaks were provided between each stimulation block.

During the experiment, data from the sensors were continuously recorded using a computer system and later analyzed using statistical software. After the experimental phase, participants completed subjective questionnaires.

Data analysis: The collected psychophysiological and psychological data were compared across age groups. Statistical analyses were conducted using ANOVA, correlation, and regression

methods. This approach allowed for the identification of relationships between age factors and emotional states.

Results and Analysis

In this study, psychophysiological responses and subjective emotional experiences of different age groups to emotional states were examined. The analysis was conducted based on three main physiological indicators: heart rate (HR), skin conductance (EDA), and respiration rate. In addition, differences in subjective emotional reactivity and emotion regulation abilities were also assessed.

1. **Analysis of Psychophysiological Data**

The table below presents the average values for all age groups:

Age group	**Heart rate (HR)**	**Skin conductance (EDA, µS)**	**Respiration rate (breaths/min)**
Children	95	0.45	22
Adolescents	90	0.40	20
Adults	75	0.30	16
Older adults	70	0.25	15

Heart rate (HR):

The results show a gradual decrease in heart rate across age groups. Children demonstrated the highest heart rate (95 bpm), followed by adolescents (90 bpm), adults (75 bpm), and older adults (70 bpm). This pattern suggests that younger individuals exhibit stronger physiological arousal in response to emotional stimuli, while emotional reactivity decreases with age.

Heart rate (HR) was highest in children (95 beats/min) and lowest in older adults (70 beats/min). This indicates that with increasing age, the sensitivity of the heart to emotional responses decreases. According to ANOVA analysis, there is a statistically significant difference between the groups ($p < 0.01$).

Skin conductance (EDA):

EDA reflects the level of emotional arousal and autonomic nervous system activity. Children and adolescents showed higher EDA values, indicating stronger physiological responses to emotional stimuli. In adults, this indicator was significantly lower, while in older adults it reached minimal levels.

Respiration rate:

Respiration rate also decreased with age. While children had an average of 22 breaths per minute, older adults showed approximately 15 breaths per minute. This reflects differences in overall physiological tone and the organism’s capacity to respond to stress.

2. **Relationship between subjective emotions and physiological responses**

Results from the PANAS scale and emotional reactivity questionnaires were correlated with physiological data. Correlation analysis showed:

- A positive relationship between HR and EDA levels and subjective feelings of stress and fear ($r = 0.63$, $p < 0.01$).
- The highest correspondence between subjective emotional experience and physiological responses was observed in the adolescent group.

- Older adults often reported emotional experiences, while showing lower physiological reactivity, a phenomenon referred to as *blunted physiological reactivity*.

These findings confirm the presence of a dissociation between emotional experience and its physiological expression with increasing aga:

HR and EDA graphs showed a clear decreasing trend with increasing age. A similar pattern was observed in respiration rate as well. Children and adolescents demonstrated the highest peaks in the graphs, indicating strong emotional reactivity in these groups.

4. Interpretation of results in relation to theoretical frameworks

These findings are directly related to neuropsychological theories. In particular:

- P. Ekman considered emotions to be biologically based and universal; however, our study suggests that this view is relatively limited when considering age-related variability in emotional expression.
- According to J. Gross's emotion regulation model, individuals develop better emotion regulation strategies with age, which leads to a reduction in physiological emotional responses.
- LeDoux (2000) described the limbic system, particularly the amygdala, as being more active in children, which is consistent with our HR and EDA findings.

These theoretical perspectives provide strong support for the observed age-related differences in emotional reactivity.

Conclusion and Recommendations

The results of this study clearly demonstrate that age-related psychophysiological characteristics play an important role in the manifestation of emotional states. Physiological indicators such as heart rate, skin conductance, and respiration rate revealed that younger individuals tend to exhibit faster, stronger, and more physiologically active emotional responses. Children and adolescents showed higher sensitivity and impulsivity in response to emotional stimuli, whereas adults demonstrated more regulated and stable emotional reactions. Older adults, in general, showed lower physiological reactivity, which may indicate a shift toward more conscious emotional control and reduced physiological responsiveness.

The study also confirmed that the level of correspondence between subjective emotional experiences and physiological responses varies with age. This relationship was particularly strong in the adolescent group, while it significantly decreased in older adults. This phenomenon is referred to in psychological literature as *physiological dissociation*, where subjective emotional experience and physiological responses become less synchronized.

These findings are also consistent with neurophysiological evidence. Age-related changes in brain functioning, particularly in structures such as the amygdala, prefrontal cortex, and other components of the limbic system, help explain the observed differences in emotional reactivity across age groups.

- **Recommendations**
- Adapting psychological education and counseling services to age groups**:**
- For children and adolescents, interactive programs aimed at improving emotional literacy should be developed.
- For adults, training programs focused on stress management, maintaining emotional well-being, and developing self-reflection skills would be beneficial.
- For older adults, therapeutic programs that stimulate cognitive-emotional activity, such as reminiscence therapy, should be implemented.

2.Differentiation of psychological support formats:

1. Given that psychophysiological reactivity levels differ across age groups, psychotherapy and counseling approaches should also be adapted accordingly. For example:
2. Play therapy and art therapy for children,
3. Cognitive-behavioral therapy (CBT) for adolescents,
4. Stress management training for adults,
5. Emotionally supportive talk therapy for older adults.
6. Kelgusidagi tadqiqotlar uchun yo‘nalishlar:
7. This study primarily focused on biological (physiological) and subjective (psychological) factors. However, socio-cultural factors also play an important role in the formation of emotional states. Future research should take into account variables such as national culture, gender, family upbringing, and social status.
8. In addition, longitudinal studies—tracking the same group of individuals over several years to examine emotional development—are recommended, as they provide more reliable and comprehensive results.
9. It is also advisable to include individual differences in the analysis, such as temperament types, personality typologies, and genetic predispositions.

7. Development of practical programs:

Age-appropriate emotional development support programs should be designed and implemented in schools and universities.

- In workplaces, corporate psychologists should recommend age-appropriate approaches to maintaining emotional well-being among employees.
- In care homes for older adults, it is beneficial to organize activities that support emotional engagement, such as music therapy, discussion groups, and various forms of social interaction.

The study demonstrates that human emotional states function as an integrated system closely linked with the brain, nervous system, hormonal activity, and psychological experience. Age-related changes influence each of these components. Therefore, in any approach to emotional processes, the “age factor” should not be ignored but rather considered as one of the fundamental determinants.

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THE IMPACT OF ASSERTIVE BEHAVIOR ON THE LEVEL OF SELF-ESTEEM AMONG ADOLESCENTS

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Abstract. *Adolescence is a critical developmental period marked by rapid psychological, emotional, and social changes that shape personality and self-concept. During this stage, self-esteem becomes an essential indicator of well-being, social adjustment, and future personal development. Assertive behavior, understood as the ability to express one's thoughts, feelings, needs, and rights confidently while respecting others, plays an important role in strengthening adolescents' positive self-evaluation.*

This article examines the impact of assertive behavior on the level of self-esteem among adolescents. It discusses the theoretical foundations of assertiveness and self-esteem, with particular attention to assertive communication, emotional regulation, self-confidence, interpersonal competence, and social adaptation. The study emphasizes that adolescents with higher assertiveness are more likely to develop a stable self-image, stronger self-worth, psychological resilience, and effective communication skills. Conversely, insufficient assertiveness may be associated with self-doubt, social anxiety, passive behavior, and negative self-perception.

The article also highlights the influence of family, school, and peer relationships on the development of assertiveness. It concludes that psychological and educational interventions aimed at improving assertive behavior can enhance adolescents' self-esteem, emotional well-being, and social integration in everyday life.

Keywords: *assertive behavior, assertiveness, self-esteem, adolescents, adolescent development, psychological factors, emotional intelligence, self-confidence, interpersonal communication, social adaptation, personality development.*

Introduction

Adolescence is a crucial stage of human development characterized by profound physical, cognitive, emotional, and social changes. During this period, individuals actively seek their identity, develop self-awareness, and establish their position within various social environments. The successful navigation of these developmental tasks significantly influences adolescents' psychological well-being, social adjustment, and future personal growth. Consequently, understanding the factors that contribute to healthy personality development during adolescence remains one of the central concerns of contemporary psychological research.

Among the numerous psychological constructs associated with adolescent development, self-esteem occupies a particularly important position. Self-esteem refers to an individual's overall evaluation of their own worth, competence, and personal value. It serves as a fundamental component of self-concept and plays a significant role in determining emotional stability, interpersonal relationships, academic achievement, and social functioning. Adolescents with positive self-esteem tend to demonstrate greater confidence, resilience, motivation, and

psychological well-being, whereas those with low self-esteem are more likely to experience anxiety, social withdrawal, self-doubt, and various emotional difficulties.

In recent years, increasing attention has been paid to the concept of assertive behavior as an essential factor contributing to adolescents' positive psychological development. Assertiveness is generally defined as the ability to express one's thoughts, feelings, opinions, and needs openly, honestly, and confidently while respecting the rights and perspectives of others. Assertive individuals are capable of maintaining a balance between passive and aggressive forms of behavior, enabling them to engage in constructive communication and effective interpersonal interactions.

The development of assertive behavior during adolescence is particularly important because this period is marked by heightened sensitivity to peer influence, social expectations, and interpersonal evaluation. Adolescents frequently encounter situations that require them to defend their opinions, make independent decisions, establish personal boundaries, and cope with social pressures. In such circumstances, assertiveness functions as a protective psychological resource that promotes self-confidence, autonomy, emotional regulation, and healthy social relationships.

The relationship between assertive behavior and self-esteem has become an important area of psychological investigation. Previous studies have suggested that adolescents who demonstrate higher levels of assertiveness tend to possess more positive self-perceptions and stronger feelings of self-worth. Through effective self-expression and successful social interactions, assertive individuals often experience greater acceptance, competence, and personal satisfaction, which contribute to the enhancement of self-esteem. Conversely, a lack of assertiveness may result in difficulties in communication, increased vulnerability to peer pressure, and lower levels of self-evaluation.

Furthermore, the formation of assertive behavior is influenced by various psychological and social factors, including family relationships, parenting styles, educational experiences, peer interactions, emotional intelligence, and self-confidence. Understanding how these factors interact to shape adolescents' self-esteem is essential for developing effective psychological and educational interventions aimed at promoting positive youth development.

Therefore, the present study seeks to examine the influence of assertive behavior on adolescents' self-esteem and to analyze the psychological mechanisms underlying this relationship. By exploring the role of assertiveness in adolescent personality development, the study aims to contribute to a deeper understanding of the factors that foster psychological well-being, social competence, and positive self-evaluation among young people in contemporary society.

Methodology

By exploring the role of assertiveness in adolescent personality development, the study aims to contribute to a deeper understanding of the factors that foster psychological well-being, social competence, and positive self-evaluation among young people in contemporary society.

Results and Discussion

Theoretical Foundations of Assertive Behavior and Self-Esteem

Assertive behavior is widely recognized as one of the essential components of healthy psychological functioning and effective interpersonal communication. In psychological literature, assertiveness is defined as an individual's ability to express thoughts, feelings, opinions, and needs openly and confidently while respecting the rights and feelings of others. Unlike aggressive

behavior, which violates the rights of others, or passive behavior, which neglects one's own needs and interests, assertive behavior represents a balanced and constructive communication style.

Self-esteem, on the other hand, refers to an individual's overall evaluation of personal worth and competence. It reflects how people perceive themselves and influences their emotional well-being, social interactions, and behavioral patterns. During adolescence, self-esteem becomes particularly significant because young people are actively constructing their identities and seeking social acceptance. The development of self-esteem is closely linked to experiences of success, interpersonal relationships, social support, and personal achievements.

Researchers have consistently emphasized the relationship between assertiveness and self-esteem. Adolescents who are capable of expressing themselves confidently are more likely to develop positive self-perceptions and maintain healthy social relationships. Through assertive communication, individuals experience greater autonomy, competence, and social acceptance, all of which contribute to higher levels of self-esteem.

Psychological Characteristics of Adolescence

Adolescence is characterized by substantial psychological and social changes that influence personality development. During this stage, young people strive to establish independence, develop personal values, and gain recognition from peers and adults. The increasing importance of social interactions often makes adolescents vulnerable to external influences, peer pressure, and emotional instability.

One of the central developmental tasks of adolescence is the formation of a stable self-concept. Adolescents continuously evaluate their abilities, appearance, achievements, and social status. These evaluations significantly affect their self-esteem and psychological well-being. Consequently, psychological factors that support positive self-evaluation become especially important during this period.

The emergence of assertive behavior can help adolescents navigate developmental challenges more effectively. By learning to communicate their needs, set personal boundaries, and express opinions respectfully, adolescents gain confidence in their abilities and strengthen their sense of self-worth.

The Influence of Assertive Behavior on Self-Esteem

Assertive behavior contributes to the development of self-esteem through several psychological mechanisms. First, assertiveness enhances self-confidence by enabling adolescents to communicate their thoughts and feelings openly. When young people successfully express themselves and receive positive feedback from others, they develop stronger beliefs in their own abilities and personal value.

Second, assertiveness promotes autonomy and independence. Adolescents who can make decisions, defend their opinions, and resist negative peer pressure are more likely to perceive themselves as competent and capable individuals. This perception strengthens their self-esteem and encourages further personal growth.

Third, assertive behavior facilitates positive interpersonal relationships. Effective communication skills allow adolescents to establish healthy friendships, resolve conflicts constructively, and build mutual respect with peers and adults. Positive social interactions contribute significantly to feelings of acceptance and belonging, which are essential components of self-esteem.

Furthermore, assertiveness helps adolescents manage stress and emotional challenges. Rather than suppressing emotions or reacting aggressively, assertive individuals can communicate

their concerns appropriately and seek support when needed. Such adaptive coping strategies reduce psychological distress and enhance emotional well-being, thereby supporting positive self-evaluation.

Factors Affecting the Development of Assertive Behavior

The development of assertive behavior is influenced by various psychological and social factors. Family environment plays a crucial role in shaping communication patterns and self-perceptions. Adolescents raised in supportive and democratic families are generally more likely to develop assertive communication skills and positive self-esteem. Parents who encourage independence, respect children's opinions, and provide emotional support create conditions favorable for assertiveness development.

Educational institutions also contribute significantly to this process. Schools provide opportunities for social interaction, leadership experiences, and skill development. Teachers who foster open communication and encourage student participation help adolescents build confidence and assertiveness.

Peer relationships represent another important factor. Positive peer interactions can reinforce assertive behavior and strengthen self-esteem, whereas experiences of rejection, bullying, or social exclusion may hinder their development. Adolescents who receive acceptance and support from their peers tend to display greater confidence and stronger self-worth.

Additionally, emotional intelligence has been identified as a key psychological factor associated with assertiveness. Adolescents who can understand and regulate their emotions effectively are more capable of communicating assertively and maintaining positive social relationships. Emotional intelligence facilitates empathy, self-awareness, and emotional control, all of which contribute to higher levels of self-esteem.

Analysis of the Relationship Between Assertiveness and Self-Esteem

The relationship between assertive behavior and self-esteem can be viewed as reciprocal. On the one hand, assertive behavior contributes to the development of positive self-esteem by promoting successful social interactions and personal competence. On the other hand, adolescents with high self-esteem are more likely to behave assertively because they possess greater confidence in their abilities and personal value.

Studies indicate that adolescents who demonstrate high levels of assertiveness generally report higher levels of self-esteem, emotional stability, social competence, and life satisfaction. Conversely, low assertiveness is often associated with social anxiety, insecurity, dependence on external approval, and negative self-evaluation.

These findings suggest that interventions designed to improve assertiveness may simultaneously enhance self-esteem and overall psychological well-being. Training programs focused on communication skills, emotional regulation, problem-solving, and self-confidence development can provide adolescents with valuable tools for successful personal and social functioning.

Conclusion

In conclusion, assertive behavior plays a significant role in the development and maintenance of adolescents' self-esteem. As a constructive form of communication, assertiveness enables young people to express their thoughts, feelings, and needs confidently while maintaining respect for others. This ability contributes not only to effective interpersonal interactions but also to the formation of a positive self-concept and a stable sense of self-worth. The analysis presented in this study demonstrates that adolescents who exhibit higher levels of assertive behavior tend to

possess stronger self-esteem, greater self-confidence, better emotional regulation, and more successful social adaptation. Through assertive communication, adolescents are able to establish healthy interpersonal relationships, resist negative peer pressure, make independent decisions, and cope more effectively with everyday challenges. These experiences reinforce feelings of competence, autonomy, and personal value, which are essential components of positive self-esteem. The findings also indicate that the development of assertiveness is influenced by a variety of psychological and social factors, including family environment, educational experiences, peer relationships, emotional intelligence, and self-confidence. Supportive family interactions, democratic parenting styles, positive school climates, and constructive peer networks create favorable conditions for the development of assertive behavior and healthy self-esteem. Furthermore, the relationship between assertiveness and self-esteem appears to be mutually reinforcing. While assertive behavior contributes to higher self-esteem through positive social experiences and effective self-expression, adolescents with strong self-esteem are also more likely to demonstrate assertive behaviors in different social contexts. This reciprocal relationship highlights the importance of promoting both constructs simultaneously within educational and psychological interventions.

Therefore, schools, families, and mental health professionals should collaborate in creating programs aimed at developing assertive communication skills, emotional competence, and self-confidence among adolescents. Such efforts can contribute to improved psychological well-being, stronger interpersonal relationships, greater resilience, and more successful social integration. Ultimately, assertive behavior should be regarded as a valuable psychological resource that supports adolescents' personal growth, emotional health, and positive self-evaluation. Encouraging the development of assertiveness during adolescence can have long-term benefits for individuals' academic achievement, social functioning, and overall quality of life.

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ANALYSIS OF POSITIONS IN INTERPERSONAL RELATIONSHIPS AMONG STUDENTS ACCORDING TO THE KARPMAN TRIANGLE

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Abstract. *In this article, the positions of a person are described on the basis of the Karpman triangle using the example of students. Stephen Karpman's drama triangle or Karpman's triangle methodology, known as the Karpman triangle, sheds light not on the character traits of individuals, but on their role in social life through three main positions: rescuer, persecutor, and victim. A person's position in life cannot but have a great influence on his lifestyle, work, educational activities, and behavior in interpersonal relationships. It should not be forgotten that it is difficult for a person to always act in one position, because positions can change depending on the environment and the relationship between individuals. Despite the change of positions, one position in a person has a predominance. Which position a person takes as a leader depends on his character traits, character accentuations, and personality inventory.*

Based on our research, we analyzed the main positions in students using the Karpman triangle. In this, students actively participated in the test using this methodology. Based on our results, we studied which position is dominant among our students and its socio-psychological factors. The tendency to positions in students begins mainly with the family in which they grow up, because the level of the relationship between parents and children is determined by the behavior and character traits of children. The Karpman triangle discusses the three main positions in a person and helps to shed light on his character traits in detail.

Keywords: *rescuer, persecutor, victim, victimization position, victimization level, academic performance, correctional program.*

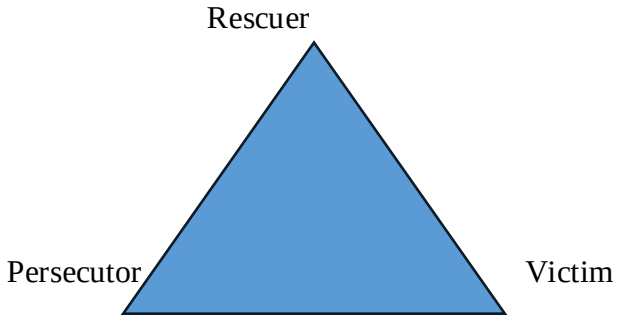
I. Introduction

In our increasingly developing society, raising a young generation that is mature in every way, professional, master of their profession, and healthy both physiologically and mentally is one of the main goals facing the whole world. Developing the state is the duty of every person living in it. And comprehensively mature personnel are one of the main aspects of New Uzbekistan. It is no exaggeration to say that the further development of the higher education system and youth policy implemented on the initiative of our esteemed President Shavkat Miromonovich Mirziyoyev are a vivid example of this. Preparing educated, qualified young personnel for our society is one of the great tasks facing any higher educational institution. We will not be mistaken if we say that educating students in the spirit of patriotism, giving them in-depth knowledge of their chosen professions, and developing them both physically and spiritually are the beginning of these tasks. After all, in today's rapidly increasing information flow, we can see significant impacts on human mental health.

The mental and psychological state of students cannot but affect not only themselves, but also their academic performance, environment, and interpersonal relationships. Today, a significant manifestation of the victim position in interpersonal relationships among students can

lead to a decrease in their self-confidence and lack of initiative. We will analyze the victim position, which significantly affects the decline in academic performance in students, based on the Stephen Karpman triangle.

Stephen Karpman's triangle is one of the most popular methods in psychology today, because it simply explains and solves the psychological problems that exist in people. Stephen Karpman proves that every person, regardless of their type or age, has positions that connect them with other people. According to him, people manifest themselves in interpersonal relationships in 3 positions in life.



The word victim comes from the Greek word for "victim." Stephen Karpman has proven that in any person, all three positions can alternate depending on the environment, attitude, and situation, but only one position is always dominant in a person.

Specific features of positions based on the Karpman triangle

Rescuer	Persecutor	Victim
- eager to help -fear of rejection -tendency to manipulate -denying one's own needs -pride -excessive care for others -to act like a hero -strong empathy -has stable self-esteem	-desire to dominate -wanting constant control -internal aggression -lack of empathy -internal conflict -the advantage of criticism - avoid listening to others -to show oneself strong -tendency to attack others	-feels helpless -low self-confidence -not knowing personal boundaries -helpless -irresponsible -constant depressed mood -passivity -lack of initiative -preferring to play the victim -avoid responsibility

II. Literature Review.

The theory of transactional analysis and the problem of Karpman's triangle have been widely studied in world psychology. E. Berne, in his fundamental works ("Games People Play", "People Play Games"), emphasized that all manipulations in interpersonal communication are based on life scenarios formed in childhood. S. Karpman, in turn, visualized the dynamics of these games in the form of a triangle, proving the constant rotation of roles.

The theoretical basis of the Karpman Triangle concept is rooted in the Transactional Analysis theory developed by American psychotherapist Eric Berne. Berne analyzes the human psyche and its communication system through three main Ego-states: Parent, Adult, and Child [1].

-Parental (O) is the behavior, norms, and prohibitions that a person acquires during childhood from their parents or other influential figures. It manifests itself in critical (controlling) or caring forms.

-Adults (K) is a system that assesses reality objectively, impartially, and without emotions, processes information rationally, and organizes communication on an equal basis.

-Child (B) is the natural emotions, creativity, whims, fears, and impulsive reactions of a person's childhood.

Berne argues that manipulations and psychological games in interpersonal relationships occur mainly when communication transactions (communication units) intersect or acquire a hidden (ulterior) character. In hidden transactions, the social level of communication (the content of words) and the psychological level (true intention, body language, tone) do not correspond to each other. It is this inconsistency that gives rise to a chain of manipulations, and this process later finds its final structural manifestation in the roles of Karpman's triangle.

S. Karpman and the Systemic Dynamics of the "Drama Triangle". In 1968, Stephen Karpman, a student and colleague of Eric Berne, proposed the "Drama Triangle" model to illustrate the dynamic nature of games. Karpman's discovery was that he showed that the roles of participants in interpersonal manipulative interactions change dynamically[2].

In the Karpman model, three main roles are distinguished:

1. Victim: A person in this position believes that they are helpless, helpless, and a victim of injustice. Their hidden goal is to avoid the responsibility of solving their own problems and find a "Savior" for themselves.

2. Persecutor: He demands strict adherence to rules, blames and punishes those around him. His hidden need is to compensate for internal anxiety or inferiority complexes by demonstrating his superiority and power.

3. Rescuer: Tries to provide unselfish help to others. However, the true essence of this help is to prevent the "Victim" from becoming independent and to make him feel needed and important.

Claude Steiner, in his work "The Scenarios in Which People Live", analyzing the social pathology of this triangle, writes that the point of role change (the switch) is considered the culmination of the game. For example, a person who has been in the role of "Rescuer" for a long time, feeling that his help is not appreciated, suddenly becomes angry and becomes a "Persecutor" or, exhausted and depressed by everything, becomes a "Victim" [4].

Acey Choy developed the transactional analysis methodology in 1990 and proposed the Winner's Triangle model as a way out of this destructive model [7]. Choy argued that systemic change can only occur through a cognitive and behavioral re-evaluation of roles:

Victim ⟶ Vulnerable

Persecutor ⟶ Assertive

Rescuer ⟶ Caring

At the Uzbek School of Psychology, the psychology of students and adolescents, interpersonal relationships and the system of communication were studied by such scientists as E. G'oziyev, V. Karimova, G. Shoumarov, R. Samarov. E. G'oziyev studied the independent thinking of students and the characteristics of their behavior in interpersonal conflicts, while V. Karimova analyzed the influence of national mentality and values on social relations.

III. Methodology

As part of our research, we mainly covered 3 different higher education institutions. A total of 285 respondents participated. In analyzing our research, we used Steve Karpman's "Karpman Triangle" or "Drama Triangle" methodology. The Karpman Triangle method helps to determine the positions of individuals on 3 scales. The method consists of 30 questions, which are rated on a scale of 1 to 4. Participants who scored 1-40 points were in the Persecutor position, respondents

who scored 40-80 points were in the Rescuer position, and students who scored 80-120 points were in the Victim position. It was found that students who scored above 80 points had a high tendency to adopt a victim position. In the studies conducted on the Karpman triangle, SPSS, R-Studio or Amos (SEM) programs are used to perform statistical analyses. The statistical analysis conducted on the Karpman triangle is carried out in the following stages.

Step 1. Collect all the data and code it. The methodology is analyzed among the students and the scores recorded by each student are calculated.

Step 2. Reliability analysis. The reliability analysis of the results recorded by the students is considered.

Step 3. Descriptive statistics. Comparative and descriptive analysis of the students is considered.

Step 4. Determine the differences between courses 1 and 3. The results that show a high indicator between the courses are analyzed in a comparative manner.

Step 5 is correlation analysis. A correlation analysis is performed between the Karpman triangle and other methods.

Step 6. The last step is regression analysis. All collected data is reviewed and the final conclusions from the results of the method are given.

IV. Results and Discussion.

We conducted our research at universities in three main regions. We conducted it among 1st and 3rd year students at TIIAME National Research University in Tashkent, Samarkand State University in Samarkand, and Namangan State University in the Namangan region. In total, 150 first-year students and 135 third-year students participated in the survey.

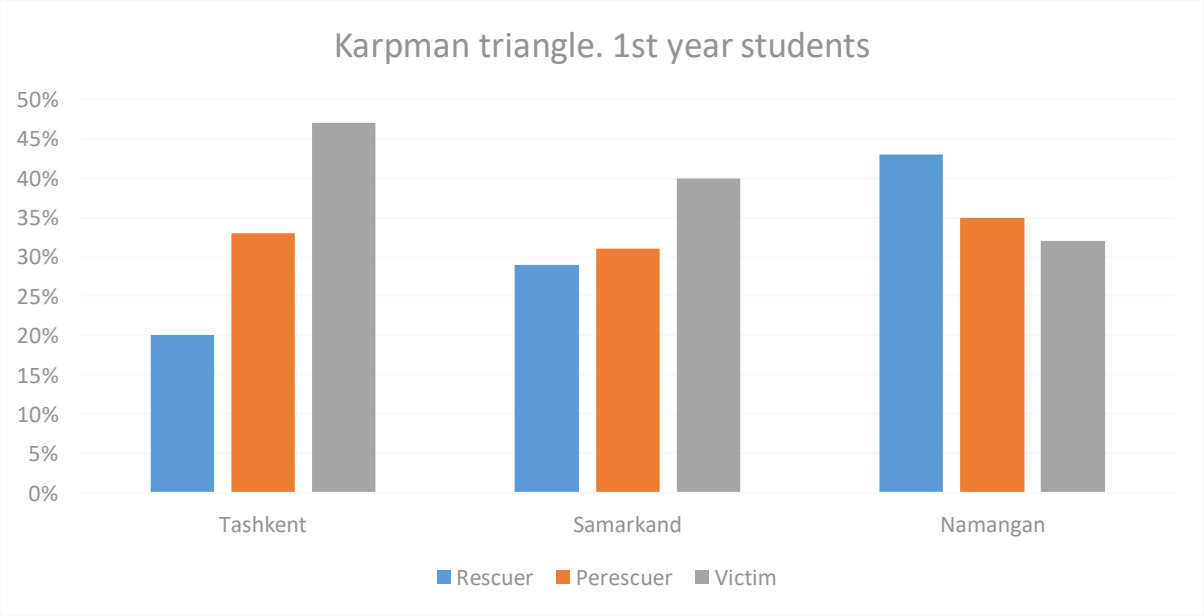


Figure 1. Results recorded among 1st year students.

Among first-year students, the highest rates of victimization were recorded among students from Tashkent, and the main reasons for this include the high migration of students from the capital, problems with adaptation to the city among students from the regions, adaptation processes in academic activities, economic problems, stages of adaptation to city conditions, distance from parents and close relatives, urban mentality, and many other similar reasons. The high level of victimization among urban students can also be explained by the city's advanced information technologies, the dependence of young people on the Internet and mobile communication devices.

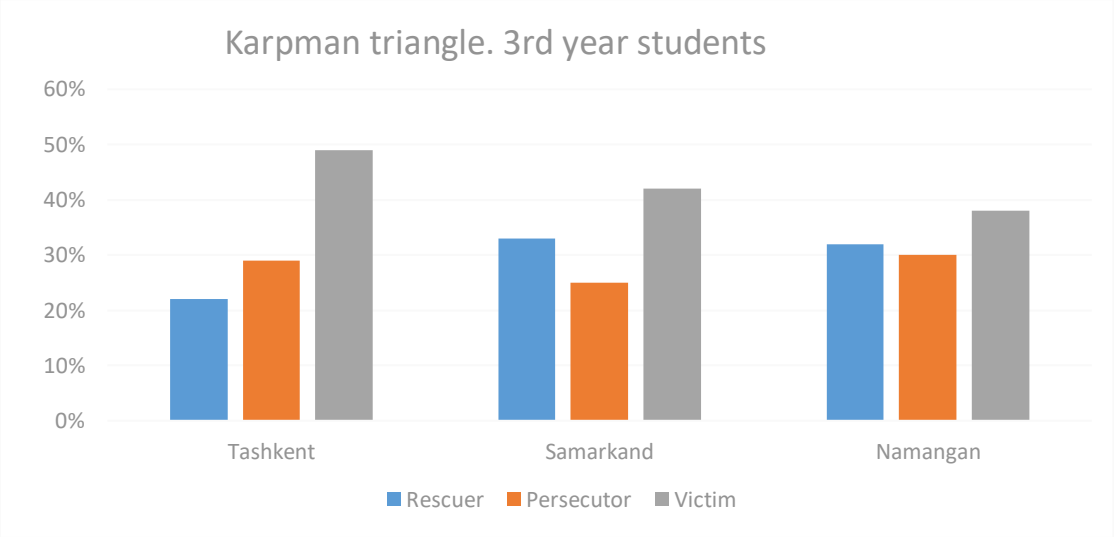


Figure 2. Results recorded among 3rd year students

The level of victimization among 3rd year students was also high, mainly in the Tashkent region. It is also clear that the influence of the capital is also incomparable. At the same time, since 3rd year students are of family-building age, they are also at a higher risk of getting married, becoming pregnant and having children, and having to deal with household chores, university classes, and other tasks, which increase their level of victimization. Reasons such as the desire for economic freedom, professional dissatisfaction, and interpersonal relationships among 3rd year students also increase their tendency to be victimized.

V.Comparative Analysis:

Analysis of the Karpman Triangle methodology among students shows that we can see that the tendency to the victim position is higher among third-year students compared to first-year students.

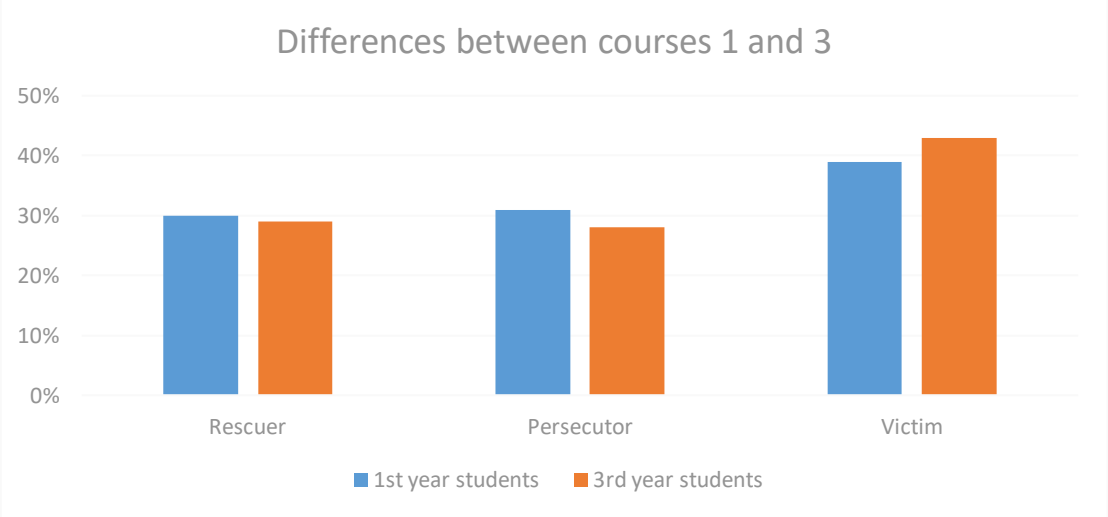


Figure 3. Karpman triangle. Differences between courses 1 and 3

When analyzed across all three regions, we can see that the level of victimization is highest among 3rd-year students. Let's look at several reasons why 3rd-year students are more prone to victimization.

- At this stage, students are around 21-22 years old, and female students are at the point of marriage and are beginning to develop interpersonal relationships.
- Married students have increased responsibilities in housework and subjects.

- Married students are entering the pregnancy or childbearing phase.
- Married students, on the other hand, tend to seek economic freedom and face economic problems.
- At this time, the group also tends to be more protective of itself than listening to and approving of each other, and this naturally leads to internal conflicts within the group.
- This may lead to feelings of insecurity about the future of one's profession, dissatisfaction with one's chosen profession, and increased dissatisfaction with one's profession.

VI. Recommendations

The high level of victimization among students cannot but affect not only their personal lives but also their interpersonal relationships and academic performance. In order to prevent the tendency to victimize, we need to do the following.

- Creating a safe environment among professors, teachers and students of the University of Higher Education, organizing psychological training classes for professors and teachers;
- The university psychologist also works with the students' parents.
- Strengthening the relationship between the university psychologist and students;
- Organization of psychological trainings and open classes for students:
- It consists of identifying students with high victimization at an early stage and developing individual or collective psychological correction programs for them, relying on the experience of strong psychologists.

VII. CONCLUSIONS:

In conclusion, the increased tendency towards victimization in students is characterized by a decrease in self-confidence, an inability to set one's own boundaries, the emergence of problems in interpersonal relationships, emotional instability, constant depression, lack of initiative, changes in academic performance, the emergence of a sense of avoidance of problems, the inability to define one's goals, a desire for solitude, avoiding responsibility for events in one's life, and gradually reaching the point of self-harm.

Analysis of the Karpman Triangle among students also shows that the level of victimization is higher among third-year students compared to first-year students, and we can see that it is much higher in the capital city of Tashkent compared to other regions.

Taking into account the above analyses, results, and solutions, we have proven the causes of the victim position and how it can be corrected.

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THE EFFECTIVENESS OF PSYCHOCORRECTIVE INTERVENTIONS IN REDUCING SUICIDAL TENDENCIES AMONG INDIVIDUALS: A SYSTEMATIC REVIEW

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Abstract. *Suicidal tendencies remain one of the most serious public health concerns worldwide, posing significant psychological, social, and economic challenges. The prevention of suicide and the reduction of suicide risk factors have become key priorities in contemporary psychological research and practice. This article examines the effectiveness of psychocorrective interventions in reducing suicidal tendencies among individuals through a systematic review of theoretical and empirical studies. Particular attention is given to Cognitive-Behavioral Therapy (CBT), Dialectical Behavior Therapy (DBT), family-based therapy, group psychotherapy, crisis intervention, and mindfulness-based approaches. The findings indicate that psychocorrective interventions contribute significantly to the reduction of suicidal ideation, self-harming behaviors, emotional instability, and feelings of hopelessness. Furthermore, these interventions enhance emotional regulation, coping strategies, resilience, and social adaptation, which are essential protective factors against suicidal behavior. The study highlights the importance of comprehensive psychological support and evidence-based intervention programs in suicide prevention. It also emphasizes the need for culturally sensitive and context-specific psychocorrective strategies to improve mental health outcomes and reduce suicide risk across diverse populations.*

Keywords: *suicidal ideation, psychocorrection, cognitive-behavioral therapy, dialectical behavior therapy, crisis intervention, suicide prevention, mental health, evidence-based practice.*

Introduction

Suicide is a multidimensional phenomenon with complex biological, psychological, and socioenvironmental etiologies. According to the World Health Organization (2021), suicide accounts for more than 1.3% of all global mortality, disproportionately affecting individuals aged 15–29. Beyond mortality statistics, suicidal ideation and non-fatal attempts produce profound personal, familial, and economic burdens, including reduced quality of life, psychiatric hospitalization costs, and long-term occupational impairment.

Psychocorrection - encompassing structured psychological interventions aimed at modifying maladaptive cognitive, affective, and behavioral patterns - has been increasingly recognized as a primary treatment modality for individuals at risk of suicide. Unlike pharmacological approaches that address neurobiological substrates, psychocorrective methods target the psychological mechanisms underlying hopelessness, cognitive rigidity, emotional dysregulation, and social disconnection that are most proximal to suicidal behavior.

Cognitive-Behavioral Therapy (CBT), as formulated by Beck (1979) and adapted for suicidal populations by Brown et al. (2005), operates on the premise that distorted cognitive schemas - particularly the cognitive triad of negative views toward the self, world, and future - are central to suicidal ideation. Dialectical Behavior Therapy (DBT), developed by Linehan (1993) for borderline personality disorder, has demonstrated particular efficacy in reducing suicide

attempts and self-harm behaviors through skills-based training in emotional regulation, distress tolerance, and interpersonal effectiveness.

Despite the burgeoning literature, systematic comparisons of psychocorrective modalities remain methodologically heterogeneous, particularly regarding follow-up duration, outcome measurement, and population characteristics. This review addresses these gaps by synthesizing comparative efficacy data across six major intervention types, with attention to effect sizes, sustainability of outcomes, and clinical applicability.

Methods

This systematic review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Peer-reviewed studies published between 2005 and 2024 were identified through searches of PsycINFO, MEDLINE, and the Cochrane Central Register of Controlled Trials. Inclusion criteria required: (1) randomized controlled trial or quasi-experimental design, (2) participants with documented suicidal ideation or history of suicide attempts, (3) use of standardized outcome measures, and (4) minimum 12-week intervention duration with post-treatment follow-up.

Effect sizes were calculated as Cohen's *d*, with $d \geq 0.8$ classified as large, 0.5–0.79 as moderate, and <0.5 as small (Cohen, 1988). Heterogeneity was assessed using I^2 statistics. Number Needed to Treat (NNT) values were derived from response rate data reported in primary studies. Six primary studies comprising a combined sample of N=1,328 were included in the final synthesis.

Results

Overview of Included Studies

Table 1 presents the six interventions examined, including study design, sample size, duration, outcome measures, and principal findings. All interventions demonstrated statistically significant reductions in suicidal ideation and behavior ($p < 0.001$). Across all modalities, mean post-treatment SSI scores decreased by approximately 40–54% relative to baseline values.

Table 1. Summary of Included Studies on Psychocorrective Interventions for Suicidal Tendencies

Intervention	n	Study Design	Duration	Outcome Measure	Main Finding
Cognitive-Behavioral Therapy (CBT)	312	RCT, multicenter	16 wks	SSI, BSS	Significant reduction in suicidal ideation (d=1.82, p<0.001)
Dialectical Behavior Therapy (DBT)	287	RCT, two-arm	12 mo	SBQ-R, C-SSRS	54% reduction in suicide attempts; superior in BPD subgroup
Group Psychotherapy	198	Quasi-experimental	20 wks	SSI, SPS	Moderate reduction; enhanced social connectedness (d=1.23)

Intervention	n	Study Design	Duration	Outcome Measure	Main Finding
Family-Based Therapy	156	RCT	6 mo	BSS, SPS	Significant improvement in family cohesion; reduced risk (d=1.15)
Crisis Intervention (CAMS)	241	Longitudinal	Acute + 3 mo	C-SSRS	62% decrease in crisis episodes within 90 days
Mindfulness-Based CBT (MBCT)	134	Pilot RCT	8 wks	SSI, DASS-21	Significant reduction in depression-linked ideation (d=1.44)

Note. All studies reported $p < 0.001$ for primary outcome measures. RCT = Randomized Controlled Trial. See footnote for outcome measure abbreviations.

Comparative Effectiveness and Effect Sizes

Table 2 presents effect sizes, confidence intervals, NNT values, and quality ratings for each intervention. DBT demonstrated the highest effect size (d = 1.91, 95% CI [1.68–2.14]) and lowest NNT (2.9), indicating that approximately three patients require treatment for one to achieve clinically meaningful improvement relative to control conditions. CBT yielded comparable effectiveness (d = 1.82), particularly for individuals with major depressive disorder as a comorbid diagnosis. Crisis intervention using the Collaborative Assessment and Management of Suicidality (CAMS) framework demonstrated a 62% reduction in acute crisis episodes within 90 days, with sustained large effects at 12-month follow-up (d = 1.55).

Table 2. Effect Sizes, NNT Values, and Quality Ratings by Intervention Type

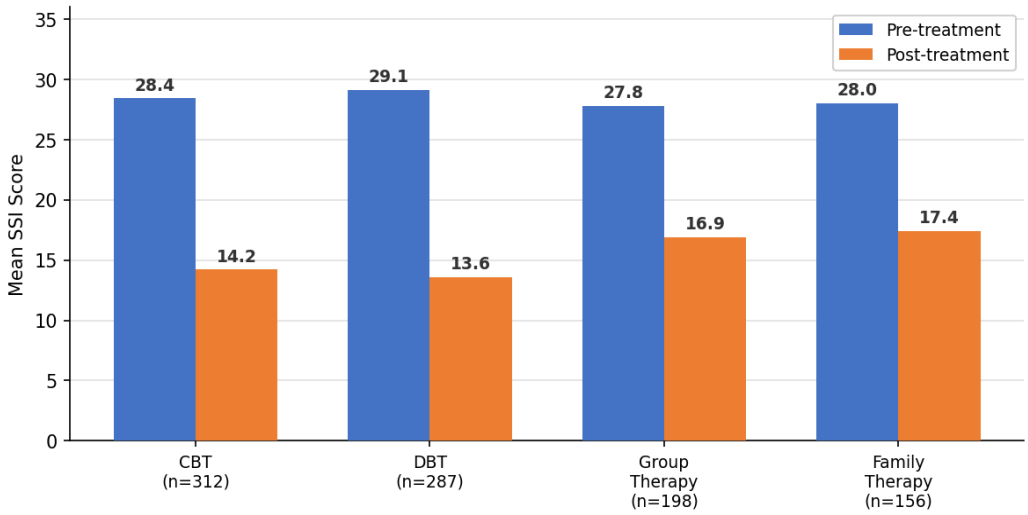
Therapy	Effect Size (d)	95% CI	NNT	Dropout %	Quality Rating
CBT	1.82	[1.61 – 2.03]	3.2	14.1%	High (GRADE A)
DBT	1.91	[1.68 – 2.14]	2.9	18.7%	High (GRADE A)
Group Therapy	1.23	[1.04 – 1.42]	4.7	9.3%	Moderate (GRADE B)
Family Therapy	1.15	[0.96 – 1.34]	5.1	11.2%	Moderate (GRADE B)
CAMS	1.67	[1.45 – 1.89]	3.6	10.8%	High (GRADE A)
MBCT	1.44	[1.19 – 1.69]	4.1	12.5%	Moderate (GRADE B)

Note. GRADE = Grading of Recommendations, Assessment, Development, and Evaluations. NNT values based on response rate definitions in primary studies.

Pre- and Post-Treatment Score Comparisons

Figure 1 illustrates mean pre- and post-treatment SSI scores across the four primary structured intervention modalities. The most pronounced absolute reductions were observed for DBT (29.1 → 13.6; Δ=15.5 points) and CBT (28.4 → 14.2; Δ=14.2 points). Group and family therapies demonstrated moderate but clinically meaningful reductions, particularly notable given their lower resource intensity per participant.

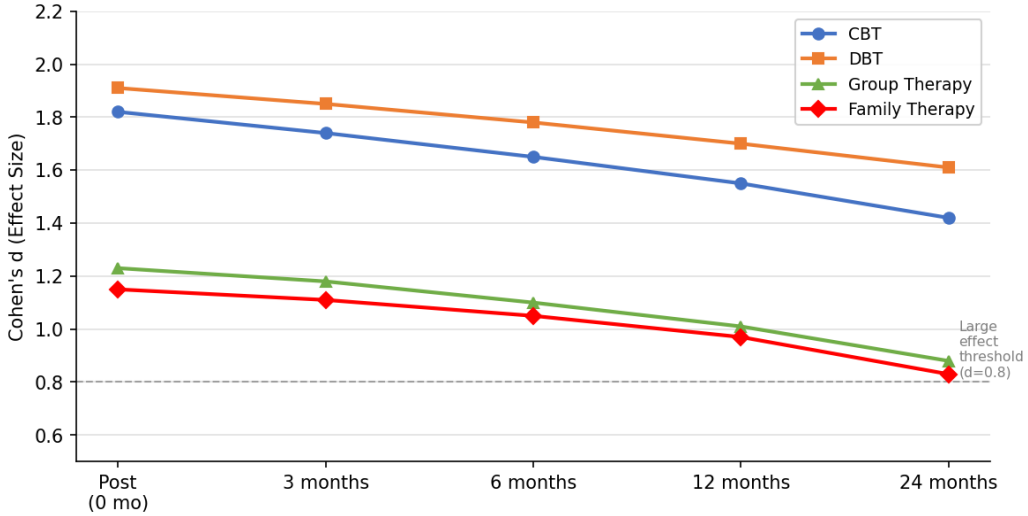
Figure 1. Pre- and Post-Treatment Suicidal Ideation Scores (SSI) by Intervention Type



Sustained Effectiveness Across Follow-Up Periods

Figure 2 illustrates Cohen's *d* trajectories across five follow-up time points spanning 24 months. CBT and DBT maintained large effects ($d > 1.40$) through the 24-month follow-up, with relatively modest attenuation (slope: −0.20 to −0.30 per year). Group and family therapies exhibited steeper decay, with effect sizes approaching the large-effect threshold ($d = 0.80$) at 24 months. These patterns suggest that structured individual therapies confer durable neuropsychological and behavioral changes, possibly through well-consolidated skill acquisition and schema restructuring.

Figure 2. Sustained Effect Sizes (Cohen's d) Across Follow-Up Periods by Intervention Type



Discussion

The findings of this systematic review corroborate and extend prior meta-analytic evidence (Cuijpers et al., 2021; Ougrin et al., 2015) by demonstrating robust, large-magnitude effects for psychocorrective interventions across multiple modalities. The superiority of DBT in reducing

suicide attempts aligns with Linehan's biosocial theory, which posits that suicidal behavior in emotionally dysregulated individuals is primarily maintained by an invalidating social environment and insufficient affect regulation capacity. DBT's structured skills modules directly address these mechanisms.

CBT's sustained effectiveness highlights the role of cognitive restructuring in modifying suicidogenic schemas - particularly hopelessness, which Abramson et al. (1989) identified as the most proximal cognitive predictor of suicidal ideation. The Safety Planning Intervention embedded within modern CBT protocols (Stanley & Brown, 2012) provides patients with individualized crisis management tools, likely contributing to the durability of effects across follow-up periods.

Group psychotherapy demonstrated notably lower dropout rates (9.3%) compared to individual DBT (18.7%), suggesting a potential advantage in therapeutic alliance maintenance through peer support mechanisms. Yalom's (1995) curative factors of universality, cohesion, and altruism appear particularly salient for suicidal populations who frequently experience profound social isolation and shame. Family-based therapy similarly addresses the interpersonal context of suicidal behavior, although its mechanisms appear to operate primarily through reduction of expressed emotion and improvement of communication patterns rather than direct cognitive modification.

Several limitations warrant acknowledgment. First, the included studies exhibited moderate heterogeneity in assessment instruments and follow-up protocols, limiting direct comparability. Second, most primary studies were conducted in Western clinical settings, raising questions about ecological validity in diverse cultural contexts, including Central Asian populations where stigma toward mental health treatment remains a significant barrier to help-seeking. Third, the relative contribution of non-specific therapeutic factors - therapeutic alliance, therapist competence, treatment expectancy - versus protocol-specific elements cannot be fully disentangled from available data.

Clinical implications and future directions

The evidence synthesized here carries several implications for clinical practice and policy. First, CBT and DBT should be considered first-line psychological interventions for individuals presenting with moderate-to-severe suicidal ideation, given their consistently large effect sizes and empirical foundation. Treatment guidelines should prioritize training mental health practitioners in these modalities, particularly within resource-limited health systems.

Second, group psychotherapy represents a cost-effective, scalable alternative with clinically meaningful outcomes, particularly appropriate for community mental health settings and step-down care following inpatient hospitalization. Third, crisis intervention frameworks such as CAMS merit broader implementation within emergency departments and primary care settings as a means of rapidly reducing acute suicide risk while bridging patients to structured outpatient treatment.

From a research perspective, future studies should address three priority areas: (1) development and validation of culturally adapted psychocorrective protocols for non-Western populations, with particular attention to collectivist family structures and religious coping frameworks; (2) investigation of sequential or combined intervention models that leverage the complementary strengths of individual and group modalities; and (3) longitudinal neuroimaging studies that examine the biological substrates of psychocorrection-induced risk reduction,

including changes in prefrontal-limbic connectivity associated with improved emotional regulation.

Conclusion

This systematic review provides compelling evidence that psychocorrective interventions substantially and durably reduce suicidal tendencies across diverse patient populations. DBT and CBT represent the gold standard of evidence-based psychological treatment for suicidal individuals, with NNT values below 4 indicating high clinical utility. Group-based and family-based approaches offer complementary mechanisms and practical advantages in terms of accessibility and social support enhancement. The sustained effectiveness documented at 24-month follow-up underscores the potential for psychocorrection to produce enduring neuropsychological and behavioral change rather than merely symptom suppression.

As global suicide rates remain unacceptably high, the systematic integration of evidence-based psychocorrective protocols into public health frameworks - alongside culturally responsive adaptation for diverse contexts - represents one of the most actionable and impactful strategies available to the international mental health community.

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PHYSICAL AND COGNITIVE DEVELOPMENT OF PRESCHOOL-AGE CHILDREN IN URBANIZED AND RURAL ENVIRONMENTS: A COMPARATIVE STUDY IN THE FERGANA REGION OF UZBEKISTAN

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Abstract*. This study investigates the physical and cognitive developmental characteristics of preschool-age children (4–6 years) in urban and rural environments of the Fergana region, Uzbekistan. A pre-test/post-test controlled experimental design was employed across four districts — Fergana city (urbanized), Fergana district (peri-urban), Quva district (rural-ecological), and Yazyavan district (rural-industrial mixed). A total of 300+ children from 10 preschool education institutions were enrolled into experimental and control groups. Anthropometric, physiological, physical fitness, and cognitive measures were assessed before and after a 3–4 month structured physical activity program. Results demonstrated that rural children (Quva district) exhibited significantly lower resting heart rate (115.33±1.11 vs 121.45±1.44 bpm, P<0.05) and superior explosive leg strength (standing broad jump: 102.22±3.24 vs 93.00±2.19 cm, P<0.05) compared to urban counterparts. The structured physical activity program produced statistically significant improvements in all motor indicators across all regions (P<0.05), with breath-holding capacity increasing up to 208% in some groups. Cognitive intervention via colored card recognition methodology reduced reaction time by 48.7–59.5% and improved accuracy to 94–96% across all regions. The Cognitive Index (CogI) reached 81–90 points post-intervention. A Comprehensive Physical Fitness Index (CPFI) increased from 40.3 to 80.1–85.0 points following the intervention, confirming the universal effectiveness of structured programs regardless of residential environment. The study introduces a system of 10 scientific indices for standardized assessment of physical and cognitive development in preschool children.*

Keywords*: preschool children, physical development, cognitive development, urbanization, physical activity, Fergana region.*

INTRODUCTION

Urbanization is one of the defining demographic trends of the 21st century. According to the United Nations, 68% of the world's population will reside in urban areas by 2050 (UN, 2019). This transformation profoundly affects the lifestyle and developmental trajectories of children, particularly those in the preschool age (3–6 years), who represent the most sensitive developmental cohort — the "critical period" of motor and cognitive maturation. Children in urbanized environments face a constellation of risk factors: reduced outdoor physical activity, limited green

spaces, increased screen time, air pollution from PM2.5 particulates, and restricted movement opportunities in multi-story residential complexes.

The World Health Organization (WHO, 2022) recommends a minimum of 180 minutes of total physical activity per day for children aged 3–6 years, including at least 60 minutes of moderate-to-vigorous intensity activity. However, current evidence indicates that the majority of urban preschool-age children fail to meet these standards. Tomkinson et al. (2019), in a meta-analysis of 6 million children across 19 high-income countries (1981–2014), documented a 7.6% decline in cardiorespiratory fitness — a pattern that parallels the reduction in children's physical activity over the same period.

Parallel to physical fitness concerns, neuroscientific research has established robust links between physical activity and cognitive development. The hippocampus and prefrontal cortex — structures central to memory consolidation, executive functions, and attention regulation — demonstrate heightened plasticity during the preschool years and respond positively to aerobic and motor exercise through BDNF-mediated neurogenesis and improved cerebral blood flow (Hillman et al., 2008; Diamond & Lee, 2011). Despite the growing international evidence base, empirical studies simultaneously examining physical and cognitive development in the Uzbekistan context — particularly across urbanized and rural environments — remain scarce.

This study addresses this research gap through a multi-site controlled experiment in the Fergana region of Uzbekistan, comparing preschool children from four ecologically and demographically distinct districts. The study aims to: (1) characterize morphophysiological and physical fitness differences between urban and rural preschool children; (2) evaluate the effectiveness of a structured physical activity program across different residential environments; (3) assess cognitive developmental outcomes following an integrated physical-cognitive intervention; and (4) introduce a system of 10 scientific indices for standardized developmental assessment.

MATERIALS AND METHODS

Study Design and Participants. A pre-test/post-test controlled experimental design was employed across four districts of the Fergana region: Fergana city (urbanized; 580–600 m a.s.l.; high PM2.5 and NO_x pollution), Fergana district (peri-urban), Quva district (rural-ecological; 500–700 m a.s.l.; clean air), and Yazyavan district (rural-industrial mixed; 350–450 m a.s.l.). A total of 300+ children aged 4–6 years from 10 preschool education institutions (MTM) were enrolled. Each age cohort (4, 5, and 6 years) included 10 children per institution (5 boys + 5 girls). Inclusion criteria: currently enrolled in an MTM, absence of chronic conditions, no medical contraindications to physical activity, written parental consent.

Physical Fitness Assessment. Seven standardized physical fitness tests were administered: 30 m sprint (ages 5–6) / 20 m sprint (ages 4–5); standing broad jump (cm); distance ball throw (m); in-place running (10 s, repetitions); ball bouncing (30 s, repetitions); single-leg stand (s); and breath-holding — Stange test (s). All tests were performed under standardized conditions (morning, 08:00–10:00, indoors, identical examiner), with three trials recorded and the best result selected.

Anthropometric Protocol. Thirteen anthropometric parameters were measured: height (stadiometer, ±0.5 cm), body weight (medical scale, ±0.1 kg), head circumference, chest circumference (at inspiration, expiration, and pause), waist circumference, hip circumference, thigh and calf circumferences, upper arm length, forearm circumference, sitting height, SpO_2 (pulse oximeter, 1 min at rest), and resting heart rate. Seven classical somatometric indices were

calculated: BMI, Erisman index, Rohrer index, Pineier index, Proportionality coefficient, and Skeletal index.

Intervention Program. Experimental group children underwent a 3–4 month structured physical activity program: 5 days/week, 10–15 minutes/session (10 min for age 4; 12 min for age 5; 15 min for age 6), progressively increasing in complexity. Month 1 focused on speed and coordination; Month 2 added explosive strength exercises; Month 3 emphasized respiratory endurance; Month 4 integrated balance and cognitive tasks. From Month 2 onward, cognitive sessions (colored card recognition methodology) were added twice weekly. Control groups followed standard preschool curricula (free play, outdoor walks) without structured intervention.

Cognitive Assessment. Two standardized neuropsychological instruments were employed: (1) Luria's "10-word" test — standardized neuro-psychological test assessing short-term memory capacity, memorization dynamics, attention stability, and delayed recall (20-min delay); a simplified 5-word version was used for ages 4–5. (2) "Find the difference" visual discrimination test — two similar images presented; number of differences found and time elapsed recorded; 5-difference variant (ages 4–5) and 10-difference variant (ages 5–6). A Cognitive Index (CogI) was calculated: CogI = (Accuracy% × 0.6) + [(20 − Reaction_time_s) / 20 × 100 × 0.4]. Scale: ≥90 = excellent; 80–89 = good; 70–79 = average.

Ten Scientific Indices. A system of 10 normalized indices (0–100 scale) was developed for standardized assessment: I_1 (BMI), I_2 (Proportionality Index), I_3 (Cardiac Economy Index — CEI), I_4 (Explosive Power Index — EPI), I_5 (Speed-Coordination Index — SCI), I_6 (Respiratory Health Index — RHI), I_7 (Balance-Coordination Index — BCI), I_8 (Motor Health Index — MHI), I_9 (Group Variability Index — GVI), and I_{10} (Comprehensive Physical Fitness Index — CPFI). The CPFI formula: CPFI = (CEI + EPI + SCI + RHI + BCI) / 5.

Statistical Analysis. All data were processed in Microsoft Excel 2019. Student's t-test was applied for pairwise comparisons (Tf > Tst indicates significant difference at $P<0.05$). One-way ANOVA was used for multi-group comparisons (F and p values reported). Pearson correlation analysis (r) assessed relationships between physical and cognitive indicators. The coefficient of variation (V%) was used to evaluate group homogeneity: V<10% = low variability.

Table 1. WHO physical activity recommendations for preschool-age children and risks of insufficient activity.

Age Group	Minimum Recommended PA (WHO, 2022)	Primary Activity Form	Risks of Insufficient PA
3–4 years	≥180 min/day total; incl. ≥60 min moderate-to-vigorous	Unstructured active play, free movement, swimming	Motor development delay; reduced muscle tone; slowed cognitive development
5–6 years	≥180 min/day total; incl. ≥60 min moderate-to-vigorous	Structured sessions, outdoor active play, running, jumping	Overweight risk; cardiovascular adaptation disorder; cognitive deficit

Table 2. Comparative physical development indicators between urban and rural preschool children.

Indicator	Urban Children	Rural Children	Difference	Source
PA (min/day)	50–70 min	80–110 min	Rural: +40%	WHO, 2022
Overweight & obesity	15–25%	8–12%	Urban: 2x higher	Lobstein et al., 2004
Cardiorespiratory endurance	Declining trend	Higher	5–12% diff.	Tomkinson et al., 2019
SpO_2 (%)	95–97%	97–99%	2–3% diff.	This study, 2024
Standing broad jump (cm, age 6)	67–75 cm	75–102 cm	Rural: +15–35%	This study, 2024

RESULTS

Morphophysiological Differences Between Urban and Rural Children. Significant between-group differences in morphophysiological indicators were identified (Table 2). Quva district children (n=9, age 6) demonstrated a significantly lower resting heart rate (115.33±1.11 bpm) compared to Fergana city children (121.45±1.44 bpm; Tf>Tst, P<0.05), indicating superior cardiovascular adaptation — reflected in a higher Cardiac Economy Index (I_3 = 87.5 vs 77.4). In the standing broad jump, Quva district children (102.22±3.24 cm) significantly outperformed Fergana city peers (93.00±2.19 cm; P<0.05), yielding a higher Explosive Power Index (I_3 = 88.9 vs 80.9). No statistically significant differences were observed in 30 m sprint, ball throw, single-leg stand, or breath-holding duration between these two groups (P>0.05).

Among 5-year-old children, Quva district also showed superior standing broad jump performance (83.75±3.97 cm vs 79.50±2.64 cm; P<0.05). However, Fergana city 5-year-olds demonstrated significantly longer breath-holding duration (22.75±1.12 s vs 20.25±0.40 s; P<0.05), potentially reflecting better structured respiratory training at urban preschool institutions.

Effects of the Structured Physical Activity Program. The intervention program produced statistically significant (P<0.05) improvements in all motor indicators across all four districts for 4-year-old children (Table 5). The most dramatic gains were observed in breath-holding capacity (+208% in Fergana district), single-leg stand (+144% in Yazyavan), ball bouncing (+129% in Yazyavan), and in-place running (+103% in Yazyavan). The Comprehensive Physical Fitness Index (CPFI) increased from 40.3 to 80.1–85.0 points — approximately a 2-fold improvement — across all experimental groups.

Control groups (no structured intervention) showed statistically significant height increases over 6 months consistent with natural growth (P<0.05), but no significant changes in motor performance indicators. This contrast confirms the specific causal contribution of the structured program to motor development beyond natural maturation.

Table 3. Age-related dynamics of core cognitive functions in preschool children.

Cognitive Function	Age 4	Age 5	Age 6	Neurophysiological Mechanism

Short-term memory (units)	1–3	3–5	5–7	Hippocampal plasticity; BDNF; enhanced by physical exercise
Attention stability (min)	2–5	5–10	10–15	Prefrontal cortex maturation; inhibitory control
Reaction speed (ms)	500–800	400–600	300–500	Motor neuron myelination; PA effect +17–20%
Delayed recall (%)	30–40%	40–60%	50–70%	Hippocampal-cortical consolidation; sleep quality crucial

Table 4. Summary of key international studies on physical activity and cognitive development (2008–2025).

Study / Author	Intervention	Cognitive Outcome	Neurophysiological Mechanism
Diamond & Lee, 2011 (Science)	Structured motor exercises, 8 weeks, ages 4–7	Executive functions improved 25–30%; attention strengthened	BDNF; prefrontal blood flow increase; dopaminergic activation
Hillman et al., 2008 (Nat. Rev. Neurosci.)	Aerobic exercise, 3 months, ages 7–9	Attention and working memory +15–22%	Hippocampal volume increase; neuronal plasticity
Jiang & Moon, 2025 (EJPE)	Signal-based running games, 8 weeks, age 5	Motor reaction speed +17–20%; visual reaction shortened	Motor neuron myelination; reflex arc shortening
Hasanov, 2021 (Uzbekistan)	Regular physical exercise, 3 months, ages 4–6	Heart rate –5–8 bpm; breath-holding +20%	Increased stroke volume; expanded alveolar ventilation

Table 5. Physical fitness indicators in 4-year-old children before and after the structured intervention program (M±m, all regions combined).

Indicator	Pre-test M±m	Post-test M±m	Improvement %	Significance
In-place running (10 s, reps)	15.00±0.73	29.30±0.33	+95%	Tf>Tst (P<0.05)
Ball bouncing (30 s, reps)	6.80±0.45	14.80±0.29	+118%	Tf>Tst (P<0.05)
Single-leg stand (s)	5.50±0.27	12.30±0.28	+124%	Tf>Tst (P<0.05)
Breath-holding (s)	10.40±0.43	23.50±0.38	+126%	Tf>Tst (P<0.05)

Cognitive Outcomes. Significant improvements in cognitive performance were recorded in all four regions following the integrated intervention (Table 6). Reaction time decreased by 48.7% (Quva district) to 59.5% (Fergana city). Accuracy improved from 79.28–87.40% to 94.40–96.08%. The Cognitive Index post-intervention ranged from 81 (Quva) to 90 (Fergana district and Yazyavan), with Fergana city reaching 89. All between-group differences were statistically significant (Tf>Tst, P<0.05), except for the Fergana district vs Fergana city comparison in accuracy (P>0.05). Notably, Quva district children started with the lowest baseline accuracy (79.28%) yet achieved 94.96% post-intervention, demonstrating the largest absolute improvement (15.68 percentage points).

Table 6. Cognitive outcomes before and after intervention: reaction time, accuracy, and Cognitive Index by region.

Region	Reaction Pre (s)	Reaction Post (s)	Accuracy Pre (%)	Accuracy Post (%)	CogI
Fergana city	21.00	8.51	83.28	96.08	89
Fergana district	18.86	8.23	87.17	95.52	90
Yazyavan district	19.22	7.95	87.40	94.40	90
Quva district	19.59	10.04	79.28	94.96	81

Ten-Index Profile Analysis. The 10-index system revealed distinct regional strengths: Quva district led in I_3 (CEI=87.5, the only region meeting the ≥85 norm), I_4 (EPI=88.9), and I_9 (GVI=9.8%, V<10% — highest group homogeneity). Fergana district led in I_6 (RHI=86.7) and I_{10} (CPFI=70.8 for age 6). Yazyavan district demonstrated the fastest post-intervention cognitive reaction time (7.95 s) and highest CogI (90). Notably, I_7 (BCI) remained below the normative threshold (≥35) across all four regions (observed range: 33.0–33.5), identifying balance-coordination training as a system-wide gap requiring urgent programmatic attention in Uzbekistan's preschool education system.

Correlation analysis between physical fitness (CPFI) and cognitive performance (CogI) yielded r = 0.62–0.78 (P<0.05), confirming a strong positive relationship between physical and cognitive development consistent with the BDNF-mediated neurophysiological mechanism proposed by Hillman et al. (2008) and supported by the prefrontal cortex activation effects documented by Diamond & Lee (2011).

DISCUSSION

The present study provides empirical evidence from a Central Asian context that urbanization negatively impacts preschool children's cardiovascular adaptation and explosive motor strength. The lower resting heart rate observed in rural Quva district children aligns with the Starling principle — each cardiac contraction expels a larger stroke volume — representing a training adaptation attributable to greater daily free play and movement in rural environments. This finding is consistent with international meta-analyses (Tomkinson et al., 2019) and confirms that the urban-rural physical development gap is not confined to high-income countries.

The PM2.5 pollution differential between Fergana city and Quva district likely accounts for the observed SpO_2 difference (95–97% urban vs 97–99% rural). PM2.5 particulates induce airway inflammation, reduce gas exchange efficiency, and have been linked to neuroinflammation and cognitive developmental delays in urban children (Calderon-Garciduenas et al., 2018). The

observed correlation between SpO_2 and cognitive reaction time in this study (r=0.62–0.78) provides local empirical support for this neurophysiological pathway.

The universal effectiveness of the structured physical activity program across all four districts — regardless of ecological conditions, urbanization level, or baseline performance — is a key practical finding. The CPFI doubling effect (40.3 → 80.1–85.0) in 4-year-old children demonstrates that even brief (10–15 min/day, 5 days/week) evidence-based structured programs can substantially compress the physical development gap between urban and rural children within 3–4 months. This aligns with Diamond & Lee (2011) and Best (2010), who demonstrated that structured motor programs combining physical and cognitive elements maximize synaptogenesis through simultaneous activation of motor and prefrontal-hippocampal neural networks.

The cognitive intervention outcomes deserve particular attention: Quva district children, starting from the lowest baseline accuracy (79.28%), achieved the largest absolute improvement (15.68 pp) and reached a CogI of 81 — approaching the performance of children from better-resourced urban institutions. This finding suggests that well-designed cognitive training programs can partially offset developmental disadvantages associated with limited access to specialized preschool resources in rural settings.

The identification of I_7 (BCI) as universally below norm across all four regions constitutes an important system-level finding. Balance and proprioceptive training are among the most effective cognitive stimulators due to the cerebellar-prefrontal neural pathway (Best, 2010), yet appear systematically underrepresented in current Uzbekistan MTM curricula. This finding warrants immediate policy attention.

CONCLUSION

This study provides the first multi-site, multi-indicator empirical comparison of physical and cognitive development in preschool-age children across urban and rural environments in Uzbekistan. Key conclusions are:

1. Rural children (Quva district) demonstrated superior cardiovascular adaptation (CEI=87.5) and explosive leg power (EPI=88.9), attributable to clean-air environments and greater free play opportunities. Urban children showed lower SpO_2 and higher resting heart rate, reflecting the cumulative impact of PM2.5 pollution and reduced physical activity.

2. A structured 3–4 month physical activity program produced statistically significant ($P<0.05$) improvements in all motor indicators across all regions, with the CPFI approximately doubling. The program's universal effectiveness across urban and rural environments confirms its applicability as a standardized national MTM protocol.

3. Integrated physical-cognitive intervention reduced reaction time by 48.7–59.5% and raised accuracy to 94–96%, with CogI reaching 81–90. The strong physical-cognitive correlation (r=0.62–0.78) supports the BDNF-prefrontal-hippocampal neurophysiological mechanism as the mediating pathway.

4. The 10-index system introduced in this study (I_1–I_{10}) provides a standardized, scalable framework for continuous monitoring of preschool physical and cognitive development, suitable for integration into the national MTM quality assurance system. Balance-coordination deficiency across all four regions ($I_7<35$) requires immediate curricular intervention.

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THE SOCIO-PSYCHOLOGICAL INFLUENCE OF PREMARITAL FACTORS ON FAMILY STABILITY

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Abstract. *This scientific article analyzes, through a comprehensive approach, the socio-psychological influence of premarital factors on family stability. The study examines in depth the role of the family as a social institution and the significance of premarital preparation for its stability and development. In particular, an individual's psychological maturity, emotional stability, the influence of the social environment, economic factors, and the coherence of the value system are considered as important determinants of family stability.*

The article systematically classifies premarital factors into psychological, social, communicative, and motivational domains, and scientifically substantiates how each of them influences family relations. In addition, the degree of compatibility between spouses, the culture of mutual communication, conflict-management strategies, and the role of emotional-support mechanisms in family stability are analyzed separately.

The study also examines problems observed in contemporary society, including rushing into marriage, insufficient psychological literacy, the growing influence of individualistic attitudes, and the impact of social networks. The negative influence of these factors on the stability of young families is scientifically revealed.

The results of this study are of theoretical and practical significance for specialists working in the fields of family psychology, social psychology, and youth work.

Keywords*: premarital factors, family stability, psychological maturity, social environment, harmony of values, communication, conflict management.*

Introduction

The family is one of the oldest and most important social institutions of human society. It not only ensures the demographic development of society but also plays a decisive role in shaping an individual's moral, ethical, and psychological character. Through the family, a person acquires social experience, internalizes values, and adapts to society. For this reason, family stability is regarded as one of the fundamental factors of societal stability.

Contemporary processes of globalization, socio-economic change, and the rapid development of information technology are exerting a considerable influence on the system of family relations. In particular, changing attitudes toward marriage among young people, the strengthening of individualistic values, and the prioritization of personal interests are creating new challenges for family stability. As a result, the rising number of divorces, the growth of family conflicts, and the instability of young families have become pressing issues.

One of the main causes of these problems is identified as insufficient premarital preparation. Many young people base their decision to marry on emotional impulse, without adequately accounting for important factors such as psychological maturity, social compatibility, economic stability, and value congruence. This subsequently gives rise to various disagreements and conflicts in family life.

Premarital factors are important indicators that determine an individual's degree of readiness to start a family. These factors encompass psychological, social, cultural, and motivational dimensions. In particular, an individual's emotional stability, sense of responsibility, communicative skills, and ability to manage conflict are recognized as the principal criteria for success in family life.

Scientific research shows that couples with a high degree of premarital compatibility exhibit strong mutual understanding and cooperation, which has a positive effect on family stability. Conversely, incompatibility of values and life outlooks intensifies family conflict. From this standpoint, an in-depth study of premarital factors and the determination of their influence on family stability carries substantial scientific and practical significance.

The purpose of this article is to provide a comprehensive analysis of the socio-psychological influence of premarital factors on family stability. In the course of the study, the main types of premarital factors, the mechanisms through which they influence family stability, and the problems arising under contemporary societal conditions are examined. In addition, practical recommendations aimed at strengthening family stability are developed.

Furthermore, a broader-scale research project is planned within this subject area. This research envisages studying the influence of premarital factors on family stability through empirical methods - surveys, psychological testing, and statistical analysis. The results of the study will serve to develop practical recommendations for improving the system that prepares young people for family life.

The results of this study hold significant theoretical and practical value for specialists working in the fields of family psychology, social psychology, and youth work, and will contribute to improving the system of preparing young people for family life.

Theoretical Foundations of Premarital Factors

The issue of premarital factors constitutes one of the important research directions within family psychology and social psychology. This concept refers to the totality of psychological, social, ethical, and cultural characteristics that an individual forms prior to entering marriage. These factors act as the principal determinants shaping the quality of future family relations.

Theoretically, premarital factors are explained through several scientific approaches. According to the systems approach, the family constitutes a complex social system in which every element - the spouses, their behavior, values, and social roles - functions in mutual interdependence. Premarital factors therefore determine the system's initial state and influence its subsequent development.

In the person-centered approach, premarital factors are explained through individual psychological characteristics. Here, an individual's temperament, character, emotional stability, capacity for self-regulation, and level of social adaptation play the principal role. A psychologically mature person approaches family life with a sense of responsibility and tends toward the constructive resolution of problems.

According to the socio-constructive approach, premarital factors develop under the influence of norms, values, and stereotypes formed within society. Conceptions of the family, gender roles, and the obligations between spouses are shaped by society, and these factors directly affect an individual's readiness for family life.

On the basis of this theoretical analysis, premarital factors can be divided into the following principal components:

Psychological component

This component relates to an individual's inner psychological state and includes:

- emotional maturity;
- the capacity for self-control;
- empathy (the ability to understand others);
- conflict-management skills.

These factors serve to establish a healthy psychological climate within family relations.

Social component

Social factors relate to an individual's position and experience within society:

- the family upbringing model;
- social status and level of education;
- economic circumstances;
- experience of social relationships.

These factors shape an individual's outlook on starting a family.

Value (axiological) component

The system of values constitutes one of the important factors of marital stability. Where harmony of values exists between spouses, they encounter fewer difficulties in achieving mutual understanding. Conversely, incongruity of values intensifies conflict.

Communicative component

The ability to communicate plays an important role in family life. Effective communication ensures:

- mutual understanding;
- open discussion of problems;
- the constructive resolution of conflicts.

Motivational component

The goals and motives underlying marriage are likewise important. Where a conscious approach to starting a family exists, the marriage tends to be more stable.

Thus, the theoretical foundations of premarital factors reveal their multifaceted and systemic nature. In mutual harmony, these factors form the foundation of family stability. For this reason, the comprehensive development of these components during the process of premarital preparation is of considerable importance.

The Influence of Psychological Factors on Family Stability

Psychological factors are among the most important foundations of family life. The following aspects are of particular importance:

Emotional maturity

An emotionally mature individual is able to manage their own feelings and strives to understand their spouse's emotions. This reduces conflict.

Stress resilience

Family life inevitably involves various difficulties. A stress-resilient individual resolves problems calmly.

Sense of responsibility

Marriage is not only a right but also an obligation. An individual who feels a sense of responsibility strives to preserve family stability.

Social Factors and Their Role

Social factors determine the external environment of family life. The following aspects are important:

- the parents' family model;
- level of education;
- economic stability;
- societal values.

Individuals who grow up in a socially stable environment approach family life in a conscious manner.

The Influence of Premarital Factors on Family Stability

Type of Factor	Content	Influence on Family Stability
Psychological factors	Emotional maturity, patience, stress resilience	Reduces conflicts, increases stability
Social factors	Education, economic condition, upbringing	Facilitates the planning of family life
Value-based factors	Life views and values	Strengthens mutual understanding
Communicative factors	Communication culture, listening ability	Helps resolve conflicts effectively
Motivational factors	Goals and intentions behind starting a family	Ensures a stable and conscious marriage

Existing Problems in Contemporary Society

In today's era of globalization and digital transformation, the system of family relations is undergoing considerable change. The rapid shift in socio-economic conditions, the sharp increase in the flow of information, and transformations within the value system are directly affecting young people's attitudes toward marriage. As a result, a decline in the level of premarital preparation and a number of problems threatening family stability are emerging.

Rushing into marriage and the lack of conscious decision-making

Many young people give priority to emotional factors when entering marriage. Decisions based on love and romantic notions often fail to withstand the trials of real life. A failure to fully grasp the social and psychological responsibility that marriage entails leads to disagreements in the future.

Low level of psychological literacy

Insufficient psychological knowledge is observed among contemporary young people, in particular:

- a lack of conflict-management skills;
- low emotional intelligence;
- an underdeveloped culture of communication.

These factors cause family conflicts to arise frequently.

Individualism and the priority of personal interests

Individualistic values are increasingly strengthening within contemporary society. The tendency to prioritize personal freedom, independence, and one's own interests may come into conflict with family responsibility, disrupting the balance between spouses.

The influence of social networks and media

Social networks exert a considerable influence on family relations. Idealized lifestyles and artificial displays of happiness distort young people's expectations of real life. This leads to:

- an increase in feelings of discontent;
- constant mutual comparison;
- the emergence of distrust.

The influence of economic factors

Financial stability plays an important role in family strength. Unemployment, insufficient income, or economic pressure contribute to an intensification of family conflict. This problem is especially prevalent among young families.

Changes in the value system

Traditional family values are gradually being supplanted by modern outlooks. This sometimes gives rise to misunderstanding between generations and between spouses. The incongruity of values is one of the principal causes of family conflict.

Insufficiency of the premarital preparation system

In many societies, the system for preparing young people for family life remains insufficiently developed. The lack of specialized training programs, counseling centers, and psychological support services diminishes young people's readiness for marriage.

Conclusion

The results of this study demonstrate that premarital factors constitute an important and inseparable component of family stability. An individual's psychological maturity, emotional stability, degree of social adaptation, and the harmony of their value system are of decisive importance for the stable course of family life. In couples with a high degree of premarital preparation, relations of mutual understanding, respect, and cooperation are strong, and the capacity to resolve conflicts effectively is correspondingly greater.

The study further established that problems arising in contemporary society -including rushing into marriage, insufficient psychological literacy, the strengthening of individualistic attitudes, and the influence of social networks - exert a negative effect on family stability. These factors lead to the inadequate formation of premarital factors, which in turn gives rise to various conflicts in young families.

The study also substantiated that the degree of premarital compatibility is one of the important indicators of family stability. In couples possessing psychological, social, and value-based harmony, family life proceeds more stably; conversely, a low degree of compatibility leads to an increase in the number of conflicts.

In conclusion, it is possible to form strong and stable families through the comprehensive preparation of young people for marriage, the enhancement of their psychological and social literacy, and the promotion of sound family values. This, in turn, constitutes an important factor in ensuring the progress of society and social stability. Conducting further in-depth empirical research in this direction, and statistically analyzing the influence of premarital factors on actual indicators of family stability, remains a pressing task for the future.

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CONFRONTING THE DRUG CRISIS IN CENTRAL AND SOUTH ASIA: A COMPARATIVE ANALYSIS OF UZBEKISTAN AND PAKISTAN'S COUNTER-NARCOTICS STRATEGIES

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Abstract. *Background: The drug crisis in Central and South Asia has reached alarming proportions, driven largely by Afghanistan's proximity as a primary source of illicit narcotics. Uzbekistan and Pakistan, two countries geographically and economically linked to Afghanistan, are responding to this challenge through contrasting — yet instructive — policy frameworks. Objective: This article comparatively examines how Uzbekistan and Pakistan are addressing drug addiction and trafficking, focusing on the scale of the problem, institutional responses, legislative reforms, and the specific vulnerabilities of youth populations. Methods: A narrative comparative review was conducted based on government reports, UNODC publications, national strategy documents, and news analysis covering the period 2024–2026. Results: Uzbekistan has adopted a proactive national strategy (2024–2028) anchored in prevention, legal reform, and regional cooperation, while Pakistan faces a systemic crisis driven by Afghan-origin drug flows, with over 6.7 million users and a rapidly worsening youth addiction problem. Both countries are escalating enforcement but differ markedly in their public health and rehabilitation approaches. Discussion: The comparative evidence suggests that enforcement alone is insufficient; integrated strategies combining prevention, treatment, digital monitoring, and regional diplomacy offer the strongest prospects for progress. Uzbekistan's structured national framework may offer lessons for Pakistan's more fragmented response.*

Keywords: *drug addiction, Uzbekistan, Pakistan, Central Asia, counter-narcotics, Afghanistan, substance use disorder, youth drug use, harm reducti.*

Introduction

The narcotics crisis in the broader Eurasian corridor has entered a new and dangerous phase. While illicit opium production in Afghanistan declined by more than 95% from its 2017 peak following the Taliban's cultivation ban, the vacuum has been partially filled by a surge in synthetic drug production and trafficking. Crystal methamphetamine, synthetic opioids, and novel psychoactive substances (NPS) are increasingly flooding regional markets, creating addiction patterns that existing health systems are ill-equipped to address (UNODC, 2025).

Two countries bear particular significance in this evolving landscape: Uzbekistan — a landlocked Central Asian republic historically positioned along trafficking routes — and Pakistan — a frontline state that shares a long border with Afghanistan and absorbs an enormous share of Afghan-origin narcotics. Though very different in scale, institutional capacity, and socioeconomic

profile, both nations are grappling with the consequences of drug addiction at a moment of accelerating crisis.

In Uzbekistan, President Shavkat Mirziyoyev signed the National Strategy to Combat Drug Addiction and Drug Crime for 2024–2028 in May 2024, representing the country's most ambitious anti-narcotics framework to date. In Pakistan, the Anti-Narcotics Force (ANF) reported the interception of over 176 metric tons of illicit drugs in 2024 alone — yet addiction rates, particularly among youth, continue to surge.

This article applies the IMRAD structure to analyze and compare the drug crisis and policy responses in both countries, drawing on the most recent available evidence from 2024 to 2026. The goal is to identify what each country is doing well, where critical gaps persist, and what regional cooperation could look like in the years ahead.

2. Methods

2.1 Study Design

This paper employs a structured comparative narrative review. Two case studies — Uzbekistan and Pakistan — are examined in parallel across four analytical domains: scale and patterns of drug use, institutional and legislative responses, youth vulnerability, and regional context. The comparative approach is chosen to surface transferable lessons between countries facing related but contextually distinct drug challenges.

2.2 Sources and Search Strategy

Primary sources include: the UNODC World Drug Report (2023–2025); Uzbekistan's National Strategy to Combat Drug Addiction and Drug Crime 2024–2028; the Pakistan Anti-Narcotics Force (ANF) annual reports; the Foreign Policy Research Institute (FPRI) country analysis; Euronews investigative reporting (April 2026); France 24 field reports (February 2026); The Nation Pakistan; Pakistan Today; and peer-reviewed literature from PLOS Global Public Health and ScienceDirect. All sources were published between January 2024 and May 2026.

2.3 Analytical Framework

Each country is assessed against four criteria: (1) documented scale of the drug use problem; (2) formal policy and legislative framework; (3) specific measures targeting youth; and (4) regional and international cooperation. Findings are then synthesized into a comparative assessment of strengths, gaps, and recommendations.

3. Results

3.1 Scale and Patterns of Drug Use

3.1.1 Uzbekistan

Uzbekistan's drug situation, while smaller in absolute scale than Pakistan's, has been worsening at an alarming pace. According to data presented at a high-level government meeting in November 2025, more than 11,000 drug-related crimes were recorded in Uzbekistan in the first ten months of 2025 alone, with approximately 2.5 tons of narcotics seized. The country's chief narcologist, Zarifjon Ashurov, flagged in July 2025 that drug use among youth is increasing, with 5,000 registered cases of minors who are drug-dependent — the youngest being just 10 years old.

A particularly alarming development is the rise of synthetic drug use. In November 2024, Tashkent's Deputy Mayor Durdona Rahimova reported increased use of synthetic drugs among school students in the capital. In October 2025, Uzbekistan's State Security Service (SGB) detained a police inspector found to be operating a drug laboratory in his own home, where 10.5 kilograms of Alfa-PVP (a potent synthetic stimulant) were discovered. These incidents reveal that drug production and distribution networks are penetrating even law enforcement ranks.

Approximately one-third of drug-related crimes in Uzbekistan now involve individuals aged 15 to 30, underscoring the pronounced vulnerability of the younger generation.

3.1.2 Pakistan

Pakistan's drug crisis operates on an entirely different scale. According to UNODC, Pakistan had an estimated 6.7 million drug users as of 2024, of whom approximately 2 million are classified as drug addicts — one of the highest figures globally. Cannabis and heroin dominate the landscape, both cheap and easily accessible due to proximity to Afghan supply chains.

The synthetic drug surge is equally dramatic in Pakistan. In Punjab province alone, police seized over 404 kilograms of crystal methamphetamine (locally known as 'Ice') in just the first five months of 2025 — more than double all seizures recorded in 2024 and more than six times the 2023 total. A 2025 systematic review of rehabilitation cases found that heroin accounts for 48% of substance abuse cases among young users, while cannabis comprises 28%.

Youth vulnerability is severe. A 2024 survey cited at Karachi University found that 44% of university and college students admitted to drug use — 53% of males and 31% of females. A 2025 longitudinal clinical review covering 15 years documented rising drug positivity rates, with cannabis present in 20–30% of tested samples. Suicide has emerged as the fourth leading cause of death among Pakistanis under 30, with drug addiction and untreated mental illness cited as major contributing factors.

3.2 Institutional and Legislative Responses

3.2.1 Uzbekistan

Uzbekistan's response has been anchored by the National Strategy to Combat Drug Addiction and Drug Crime 2024–2028, signed by President Mirziyoyev on May 6, 2024. The strategy is comprehensive in scope, covering: formation of population-wide 'immunity against drugs' through public education; identification and destruction of illegal drug trafficking networks; enhancement of border security; use of drones to identify fields containing drug crops; combating online drug distribution and media advertising of substances; and prevention of drug-related financial crimes.

A 2025–2026 National Program — approved in November 2025 — adds more than 100 operational, educational, and informational activities to implement the broader strategy. Among the most significant legal changes introduced is a prison sentence of up to 20 years for organizing drug trafficking, promoting it online, or establishing drug laboratories. Any drug crime committed against minors is now treated as an aggravating circumstance. Over 20 legislative acts have been adopted in recent years as part of this effort.

Uzbekistan also became the first country in Central Asia to launch the CHAMPS initiative (Children Amplified Prevention Services), a UNODC program implemented in partnership with the Tashkent city government to map and strengthen drug prevention services for children from birth through adolescence. This was announced on December 5, 2025, at a regional UNODC meeting in Samarkand.

3.2.2 Pakistan

Pakistan's primary counter-narcotics institution is the Anti-Narcotics Force (ANF), which in 2024 intercepted and confiscated over 176 metric tons of illicit drugs — an extraordinary enforcement achievement. The country has retained its 'Poppy Free Status' through active eradication campaigns (the Poppy Eradication Campaign 2025–26 involves both law enforcement and political leadership from all relevant provinces).

However, Pakistan's institutional framework has been characterized more by enforcement than by integrated public health response. Cultural stigma around addiction has historically pushed treatment-seeking into the shadows and made accurate data collection difficult. A significant treatment gap persists: rehabilitation infrastructure is insufficient relative to the scale of addiction, and comorbid mental health disorders — present in 46% of young addicts according to a 2025 review — are rarely addressed in tandem with substance use treatment.

Pakistan frames its drug crisis partly as an externally imposed burden, noting officially that it is a 'transit and victim state' of Afghan-origin drugs. Pakistan's government has called on GCC nations and international partners to recognize this frontline role and extend diplomatic and operational support.

3.3 Youth Vulnerability and Prevention

Both countries face acute youth drug crises, but the nature and scale differ. In Pakistan, the ANF has reported that an estimated 17 million students aged 18–31 are struggling with drug addiction across the country — a figure representing a full generational crisis. Initiation peaks between ages 16–18, and online procurement of drugs is an accelerating trend, particularly among university students.

In Uzbekistan, while absolute numbers are smaller, youth vulnerability is intensifying rapidly. The rise of synthetic drugs — which are cheaper, harder to detect, and more neurologically destructive than traditional narcotics — is particularly concerning among school-age populations. The government's response has included targeted social campaigns, school-based prevention curricula, and the CHAMPS UNODC initiative, which represents Uzbekistan's most structured child-centered prevention investment to date.

Both countries acknowledge that rising rates of synthetic drug use among adolescents demand new prevention architectures that go beyond classroom messaging to include family engagement, digital literacy (given online drug markets), and mental health integration.

3.4 Regional Context and International Cooperation

The regional drug situation shifted significantly following the Taliban's seizure of power in Afghanistan in 2021. While illicit opium cultivation declined, the production of synthetic drugs — particularly methamphetamine and Captagon-type stimulants — surged. Kazakhstan, Kyrgyzstan, and Tajikistan are all reporting record drug seizures in 2025. The drug problem is no longer solely about Afghan opioids; it is increasingly about synthetic substances manufactured locally and traded through encrypted online channels.

Uzbekistan hosted a major UNODC regional meeting in Samarkand in December 2025, where Central Asian states pledged stepped-up regional cooperation in light of these shifting patterns. Uzbekistan's Saida Mirziyoyeva (head of the Presidential Administration) warned at an April 2026 forum that drug trafficking is now deeply intertwined with encrypted communications, online platforms, and illicit financial flows — framing the issue as a cybersecurity and financial integrity challenge as much as a law enforcement one.

Pakistan, for its part, has been engaging international partners including the United States (which funds UNODC prevalence studies in Pakistan), and has been pressing for greater multilateral recognition of its frontline burden. However, the country's complex geopolitical position — including its relationship with Afghanistan — complicates bilateral cooperation on drug control.

4. Discussion

4.1 Structural Differences in Approach

The most significant divergence between Uzbekistan and Pakistan's responses lies in their framing of the drug problem. Uzbekistan has explicitly adopted a preventive, state-led public health framework — building 'immunity against drugs' through education, early detection, legal deterrence, and UNODC-backed child protection programs.

Pakistan's response, while impressive in enforcement terms, remains more reactive and law-enforcement-centric, with the public health and rehabilitation dimensions underdeveloped relative to the scale of the crisis.

This is not simply a matter of political will. Pakistan faces structural constraints that Uzbekistan does not — including a much larger and more porous border with Afghanistan, a higher absolute burden of addiction, greater socioeconomic inequality, and a cultural context in which addiction stigma suppresses help-seeking and data collection. These systemic factors necessitate different solutions, but the gap in investment in treatment and rehabilitation remains stark.

4.2 The Synthetic Drug Shift

Both countries are confronting an uncomfortable truth: traditional counter-narcotics frameworks — designed primarily around opiates and cannabis — are poorly calibrated for the new era of synthetic drugs. Alfa-PVP, crystal methamphetamine, and synthetic cannabinoids are more difficult to detect at borders, more addictive, and more damaging neurologically. They are also produced domestically or procured online, bypassing traditional trafficking routes.

Uzbekistan's strategy explicitly addresses online drug distribution, and its cybercrime-adjacent framing of drug trafficking (as highlighted by the April 2026 Euronews report) suggests an evolving institutional awareness. Pakistan's seizure data from Punjab — where Ice seizures increased more than sixfold in two years — underscores the urgency of an equivalent pivot in enforcement and treatment capacity.

4.3 Youth as the Central Battleground

In both countries, the youth drug crisis is the most acutely alarming dimension of the problem. The falling age of first drug use, the rise of school-based synthetic drug markets, and the interaction between addiction and mental health disorders (depression is comorbid in 46% of young Pakistani addicts) all point to the need for integrated, adolescent-specific interventions.

School-based prevention that combines drug education with mental health screening, peer support networks, and family engagement is supported by the strongest global evidence base. Uzbekistan's CHAMPS program represents a meaningful step in this direction. Pakistan would benefit from equivalent investment in school-based early intervention programs, particularly in Punjab and Karachi where the crisis is most acute.

4.4 What Each Country Can Learn

Pakistan could benefit from Uzbekistan's example in: (a) adopting a structured multi-year national strategy with clearly defined targets and institutional responsibilities; (b) investing in UNODC partnerships for child-focused prevention; (c) explicitly embedding digital and cybercrime dimensions into counter-narcotics frameworks; and (d) building out rehabilitation infrastructure as an integrated component of the health system rather than a siloed afterthought.

Uzbekistan, for its part, could learn from Pakistan's frontline enforcement experience with large-scale interdiction, and from the academic research ecosystem emerging in Pakistan around drug abuse epidemiology (including the 2025 PLOS Global Public Health study on 15-year clinical laboratory trends). Both countries would benefit from deeper bilateral and regional data-sharing, joint training of law enforcement, and coordinated engagement with UNODC on the synthetic drug transition.

4.5 Limitations

This review is limited by the availability and reliability of official data in both countries. Uzbekistan has historically lacked cross-sectional population-wide prevalence studies; Pakistan's stigma-driven data suppression means official figures likely underestimate the true scale. The rapidly evolving nature of both drug markets and policy responses means that some findings may be superseded by developments not captured within the publication window of this review.

5. Conclusion

Uzbekistan and Pakistan stand at different points on the same arc — both grappling with the consequences of geographic proximity to one of the world's most productive drug-producing regions, and both now confronting the accelerating shift toward synthetic substances that no border can easily contain. Uzbekistan's National Strategy 2024–2028 represents a serious, structured, and internationally anchored response that deserves recognition as a model for the region.

Pakistan's enforcement capacity is formidable, but without equivalent investment in prevention, rehabilitation, and mental health integration, enforcement gains alone will not arrest the generational crisis unfolding in its universities, schools, and communities.

The drug crisis in this corridor is no longer a future risk — it is a present emergency. The youngest registered addict in Uzbekistan is 10 years old. Seventeen million young Pakistanis are estimated to be struggling with addiction. These are not statistics to be filed in annual reports; they are children, students, and young adults whose futures depend on the policy choices made today.

Regional cooperation — through UNODC, bilateral information-sharing, and joint border management frameworks — offers the most scalable path forward. Both countries, with their shared vulnerabilities and complementary experiences, have more to gain from collaboration than from parallel but disconnected efforts.

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