

## STRUCTURE OF DEVELOPMENT OF INTELLECTUAL COMPETENCE OF THE STUDENTS

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**Abstract.** *This article reveals the structure of intellectual competence, motivational, cognitive and metacognitive components of intellectual competence. In these paper, the competency-based approach in education includes the ideas of professional and general, intellectual development, and competencies include traditional knowledge, as well as general education, intellectual, communicative, creative, interrelationships. The forms of interdependence and metasubject embodied are highlighted.*

**Keywords:** *metacomponent, cognitive experience, motivational, cognitive, metacognitive component.*

### INTRODUCTION

Deep fundamental education based on the latest achievements of science mainly increases the recognition and high prestige of Uzbek engineering education in the world. As engineers and scientists create techniques and technologies that define the frontiers of future research in science, the challenge has become more urgent. The analysis of scientific and technical literature shows that the current stage of development of science and technology is characterized by the priority of technology development.

Technological restructuring of production refers to the ability of a specialist to reconstruct the activity system, who feels the need to constantly replenish or update knowledge. In such conditions, the purpose of training an engineer at a technical higher educational institution is to form the ability to master the methodological skills of activity, the principles, methods and methods of activity along with the traditional acquisition of knowledge and skills.

### Literature review

J. Raven explains competence as a special ability (skills) needed to effectively perform specific actions in a specific subject area (including highly specialized knowledge, special skills, and ways of thinking). The nature of competence is that it can be manifested only in harmony with human interests and values. Being a mature scientist, teacher, engineer, manager means having different levels of competence (observation, performing certain actions, taking initiative, writing business letters, organizing communication with other people, etc.). In fact, we are talking here about intellectual education in the broadest sense of the word, taking into account future professional specialization. According to J. Raven, all students have different abilities in different types of activity ("competency"), and the teacher should identify and support them. English psychologist J. Raven, the founder of the psychological theory of competence, works with the concept of "*Competence* - a set of abilities and skills". In the composition of competence, equality defines two components: general competence (abilities, motivation, skills) and competence that promotes successful self-realization in society, regardless of professional activity [1].

The nature of competence is that they are the result of education and do not directly arise from it, but are the result of student development, self-organization and reflection of individual

mental experience. Development is primarily characterized by neoplasms: that is, quantitative and qualitative changes.

In our opinion, development and self-development always involve some internal laws, some self-movement, self-transformation of an object, a system, a person's self, the inner world of a certain self. refers to the construction itself. This process is irreversible, as a result of which there are quantitative and qualitative changes in intellectual, personal and activity characteristics. They are connected and interdependent. Personnel training has a special place as the basis of development. Orientation of the development process is carried out by influencing the mental development of the student, managing his cognitive activity, developing it and having targeted influence.

*O.S. Grebenyuk* describes the types of thinking in the intellectual sphere (creative, cognitive, theoretical, empirical, divergent, convergent, sanogenic, pathogenic, etc.), thinking style (analytical thinking, imaginative thinking, visual-metaphorical thinking), qualities of the mind (intelligence, flexibility, independence, criticality, the ability to act in the mind, etc.), cognitive processes (attention, imagination, memory, perception), mental operations (isolation, comparison, analysis, synthesis, systematization, abstraction, formalization, concretization, interpretation, etc.), cognitive skills (ability to ask questions, identify and formulate a problem, hypothesize, prove it, draw conclusions, apply knowledge), learning skills (plan, set) setting goals, reading and writing at an appropriate pace, taking notes, etc.), extracurricular knowledge and skills, scientific knowledge, skills and competencies, general education and special knowledge are characterized by an integrated system [2].

### **Research Methodology**

As noted by *R. Wagner*, a person with intelligence knows how to overcome a certain task, knows how to plan his time and calculate his strength to complete the task [3].

For example, a group of scientists, *G. Seydi* and *A. Wimby*, describe intelligence as a "set of skills". Similar ideas can be observed in *A. de Groot's* definition of intelligence. He calls it a mental program consisting of a number of heuristics. *R. Nickerson* defines intelligence as "skills, heuristics, methods, strategies, tactics—these are different words for the same idea—teachable components of intellectual thinking" to teach ways of thinking. *B. Russell* makes the following conclusion about the formula of intellectual thinking: "It is a process of evaluation or categorization in terms of previously acquired basic knowledge, it includes attitudes, as well as having facts and a number of thinking skills" [3].

*L.S. Vygotsky* believed that the best indicator of intelligence is not the level of knowledge accumulated up to a certain time, but how people learn new things [4].

American psychologist *R. Sternberg* is the author of the work "three theories of mind", in which he expressed the opinion that the problem of mind should be solved in the context of a wider problem, that is, how the subject manages himself. This theory is based on the answers to three questions: 1) what is the relationship between the mind and the inner world; 2) what is the mind's attitude to the outside world; 3) how intelligence relates to human experience. Within this theory, intelligence is defined as a form of mental self-management, which includes three interrelated subtheories: component, context, and experience theories. These components include:

**1. metacomponents** - the processes of organizing intellectual activity, including planning, observing how the solution is revealed, choosing the form of presenting the problem, consciously dividing attention, and organizing opinions;

**2. performance components** - processes of changing information, processes of forming feedback (linking, adding, comparing, selecting, grouping, coding);

**3. components of knowledge acquisition and use (knowledge acquisition)** processes, efficiency of application at the right time) [5].

In our opinion, intelligence is the quality of a specific form of organization of individual (mental) experience that provides the ability to effectively perceive, understand and explain what is happening. The idea of mental experience as a special mental reality that determines the characteristics of human intellectual activity (the carrier of mental characteristics) was formed in foreign and domestic research. Individual mental experience is considered a system of mental mechanisms that predetermine the type of cognitive attitude. Depending on the specific features of the composition and structure of these forms of experience, we can distinguish convergent abilities (solving normative problems in regulated situations), divergent abilities (creating new ideas based on non-standard methods of activity, acquiring new knowledge and skills ability), we can observe and measure the learning of cognitive styles (the ability to have individual specific forms of cognitive reflection).

Based on the rates given above, we divided the content of mental experience into three levels (Table 1).

**Table 1 – Content of mental experiment**

Content of mental experiment		
1-level	2-level	3-level
<b>Cognitive experience</b>	<b>Metacognitive experience</b>	<b>Target structures</b>
The subject, its environment, natural aspects, psychology of a sustainable thinking are mental structures that contribute to increase, maintain, order and provide incoming information changes. Cognitive experience includes archetypal structures; information coding methods; cognitive schemes; semantic structures; conceptual mental structures	a set of mental structures that allow voluntary and arbitrary regulation of intellectual activity (voluntary intellectual control; arbitrary control; metacognitive awareness and open cognitive attitude). Their main goal is to control the state of individual intellectual resources, as well as information processing processes	are mental structures based on individual intellectual inclinations (their main purpose is the formation of subjective selection criteria in relation to a certain subject area, the direction of finding a solution, information and its processing methods, the direction and selection of individual intellectual activity)

The considered mental structures make up the content of mental experience, so their formation means the intellectual development of a person.

We believe that the intellectual development of students includes not only the development of cognitive mechanisms of information processing, but also the formation of metacognitive mechanisms of intellectual self-control.

Analyzing the works of *R. Glazer, V. Schneider, J. Raven, M.A. Kholodnaya*, the following can be noted: intellectual competence is the main one, its formation creates the basis for the development of students in all educational areas without exception [6].

**Analysis and results**

Intellectual competence includes all components of the general educational content of education: general educational skills, meta-knowledge and subjective methods of activity. As a result, students have information skills, preparation for self-education, independent search, selection and use of information, the ability to use new technologies of interaction with information, striving to improve the methods of self-knowledge. , a desire to engage in scientific research is formed.

Thus, intellectual competence is a personal system of working with information; the ability to acquire and create a new system of knowledge as a result of shifting the semantic context of activity from functional to transformative; determines readiness to revise outdated thinking stereotypes and forms of perception that hinder mobility in professional activity. Intellectual competence determines such features as openness and flexibility in the perception of new things, variability and diversity of subjective ways of understanding the same phenomenon, awareness of different mental "views" of current events.

*I.A.Zimnyaya* “competency” taking into account that the methodological efficiency of the category is broader than the concept of "knowledge", it includes not only cognitive and operational-technological components, but also motivational, moral, social and behavioral ones, distinguishes five components of competence:

- Willingness to demonstrate competence (motivational aspect);
- Having knowledge of the content of the competence (i.e. cognitive aspect);
- Experience demonstrating competence in a variety of routine and non-routine situations (i.e. behavioral aspect);
- Content of competence and attitude to the object of its application (value-semantic aspect that plays a motivational role);

Emotional-volitional regulation of the process and result of content manifestation [7].

*M.A. Kholodnaya* defines intellectual competence as a special type of knowledge organization that provides the ability to make effective decisions on a specific topic of activity (including extreme conditions) [6]. The requirements for the organization of knowledge are not limited by the size, strength, importance of mastering. They are different types of knowledge, articulation (the main elements are clearly defined and in a certain relationship with each other), flexibility (in situations where knowledge and the relationships between them can change rapidly under the influence of various factors), a specific situation (knowledge effectiveness), transferring knowledge to a new state, wide application of knowledge, categorical (ideas related to general principles, approaches, reflexivity of knowledge play a decisive role. Intellectual competence is the ability to pose problems of different levels of complexity and The internal quality that provides the possibility of effective solution means the desire to mobilize one's intellectual abilities and personal qualities to solve professional problems based on the activation of personal experience. Thus, competence is the result of self-organization and reflection of individual mental experience. Competence can be manifested only in a coherent unity with the abilities and skills of a person.

Based on the results of the above analysis, we formed the motivational, cognitive and metacognitive components of the structural structure of intellectual competence (Table 2)

**Table 2 – Structural structure of intellectual competence**

<b>Structural structure of intellectual competence</b>		
<b>motivational</b>	<b>cognitive</b>	<b>metacognitive</b>
<i>1</i>	<i>2</i>	<i>3</i>

<ul style="list-style-type: none"> <li>- readiness for development and self-development;</li> <li>- strive to create a development and self-development strategy;</li> <li>- installation for development;</li> <li>- striving for self-improvement and professional self-awareness;</li> <li>- encouraging meaningful activity;             <ul style="list-style-type: none"> <li>- achieving success in the implemented activities;</li> </ul> </li> <li>- direction of the person;</li> <li>- the need for self-knowledge;</li> <li>- the need for competence;</li> <li>- the ability to self-educate</li> </ul>	<ul style="list-style-type: none"> <li>-to have knowledge of special subjects;             <ul style="list-style-type: none"> <li>- knowledge of the subject;</li> <li>- understanding one's cognitive stereotypes;</li> </ul> </li> <li>- readiness to search, process and provide information;</li> <li>- mastering and applying different methods of information coding;</li> <li>- use of various technologies to acquire information;</li> <li>- transferring previously acquired knowledge to creative, research, cognitive activities;             <ul style="list-style-type: none"> <li>- to realize their abilities in research, project activities</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- goal setting and planning in intellectual activity;</li> <li>- managing one's own knowledge;</li> <li>-intentional and involuntary mental control;</li> <li>- open cognitive position;</li> <li>- readiness for mutual relations, teamwork;             <ul style="list-style-type: none"> <li>- development of a person's creativity and creative direction;</li> </ul> </li> <li>- ability to reflect</li> </ul>
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**Motivational component** – the presence of motives that cause meaningful activity is a necessary component of the structure of the motivational component. With the high development of the motivational component of the activity, the student gradually builds an educational trajectory. The motivational component includes the following motives: cognitive (the need to acquire knowledge, interest in the results of one's work), personal (the need for recognition, the need to achieve a personal goal), professional (interest in future professional activity, becoming a competitive specialist), self self-affirmation motive (a person's self-esteem, level of aspirations, motivation to achieve success, the need to prove one's abilities to oneself and others), self-development motives; includes other motives that regulate the activities of students in mastering the profession and give them a purposeful character, directing them to creative self-realization. The importance of the motivational component is that its formation represents the development of other components.

**Cognitive component** - is a collection of knowledge in the process of personal and professional development. Cognitive component - cognitive competence or intellectual skills and, first of all, the ability to work with information, search, receive and process information; ability to present data in the form of diagrams, tables; ability to interpret information; ability to provide information; having methods of structuring it, transferring it from one form of presentation to another, transferring information from one method of coding to another, distinguishing between primary and secondary concepts, determining the important features of concepts, the relationship between concepts and distinguishing relationships, constructing cognitive schemas. mental activity, problem solving algorithms, ability to explain the obtained solution; the ability to write a lecture, abstract; are the abilities to generalize, draw conclusions, and analyze the obtained results.

**Metacognitive component** - is represented by self-organization and self-management skills and abilities. Goal setting stimulates the student's cognitive activity. In this case, the "impulse" goes directly from the motive to the goal, where the student independently establishes the content of his goals, distinguishing between the main and intermediate goals. Planning plays an important role in this. The set plan is forced to be implemented, and it creates a chain of actions in the mind that leads to the successful achievement of the goal.

We conducted a questionnaire in order to determine the level of intellectual competence of a group of students in the field of energy (Table 3) [8-15].

3-table

Questionaries

T/R	Savollar	The number of participating students is 50			
		I have full information	I have partial information	New information for me	I don't have any information
1	Are you aware of the prospects and development stages of renewable energy resources in Uzbekistan?	9	14	12	15
2	How well do you know about renewable and non-renewable energy resources?	10	13	11	16
3	Are you aware of the possibilities of alternative energy in Uzbekistan?	8	16	9	17
4	Do you know how to use the energy of the sea and oceans?	14	16	14	6
5	Do you know solar energy devices and equipment?	11	18	11	10
6	Do you know the principle of operation of wind energy devices?	9	11	16	14
7	Do you know about the types of non-conventional and renewable energy sources?	8	15	10	17
8	Do you know about accumulation systems?	7	18	10	15
9	Do you know about the principle of operation of hydroelectric power station and hydroaccumulating power stations?	8	13	12	17
10	Do you know the classification of geothermal energy?	7	17	11	15
	Results of the contest, in percent	18,2%	30,2%	23,2%	28,4%

Based on the results of this survey, it was shown that the degree of formation of intellectual competences of students of higher education institutions in the field of energy is 18.2% of those with full education, 30.2% of those with partial education, new information for students 23.2% of those who were educated, 28.4% of those who did not have any information. It can be seen that nowadays it is necessary to form the intellectual competencies of future electrical engineers [8-15].

We present the survey results in the form of a geometric diagram. In this case, it will be more convenient to analyze the results of our questionnaire survey (Fig. 1) [8-14].



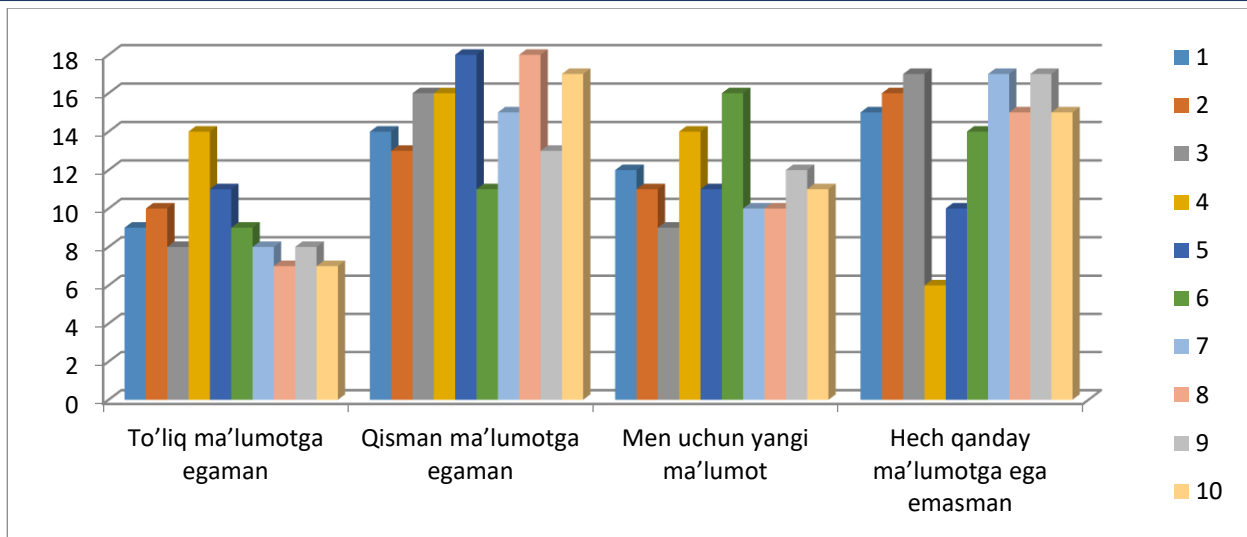


Figure 1. Geometric diagram form of survey results

### Conclusion/Recommendations

Intellectual activity planning skills include the following: the ability to choose a reasonable and optimal way to achieve the set goals; the possibility of determining the criteria for evaluating the result, drawing up a plan (action program); determine the sequence and duration of independent activity; the ability to hold several alternatives in mind at the same time to solve problems; ability to assess and control, tools and methods of assessment and control, to understand the ownership criteria, control and assessment activities, to understand algorithms, to self-evaluate and self-monitor their activities, to assess their ability activity results; ability to compare predicted and actually obtained results; skills based on self-monitoring and self-assessment include self-education and self-development, development of new tasks.

Reflexive skills - the ability to identify problems in one's work and determine their causes, the ability to enter a reflexive position (the ability to refer to internal experience, correctly evaluate it, use it in the next activity); the ability to find the cause of cognitive difficulties; the ability to refer to the individual intellectual experience of a person and determine the strengths and weaknesses of their intellectual potential; consists of creative understanding and practical skills.

The ability to organize mental activity, control the steps and implement them step by step is a necessary condition for the development of intellectual competence.

In our opinion, a student cannot acquire knowledge without understanding the mechanisms of mental activity. Reflexive activity allows you to determine the scope of the activity and build an objective activity trajectory based on it.

The following figure shows the components of the metacognitive component of the activity according to the task structure (Table 4).

4-table

<b>Components of the metacognitive component of activity according to the task structure</b>		
setting a target task and distinguishing the main purpose of the action	to establish a connection between the purpose of the action being formed and its planning	movement development

In our point of view, the first criterion for the development of intellectual competence is thought motives.

The second criterion for the development of intellectual competence is the formation of

cognitive abilities.

The third criterion for the development of intellectual competence is the formation of metacognitive skills.

The specified components are interrelated and ensure not only the development of intellectual competence, but also the development of the student's personality during the educational process.

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