AI AND IoT PRACTICAL EDUCATION

Lee Seungjik
Professor, Artificial Intelligence, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi

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Abstract*. Teaching methods that enable students to think creatively and independently are very important. Many educators are educating while thinking about these things. Especially in engineering, hands-on education is more important than anything else. I believe that professor give the task to students, students have to solve the tasks that received from professorson their own. I would like to introduce what I teach at TUIT, the Department of Artificial Intelligence, where I work, to teach students how to solve problems on their own and be creative.*

For practical training in engineering education, practical equipment is very important. We brought practice equipment for students from Korea and allowed them to use it freely. Additionally, students can freely use all equipment, including 3D printers, installed in the lab. It doesn't matter what the student creates using this equipment. Discuss together only when they have questions. Research online with your student to find the best answer. Let's take a look at which students around the world have similar concerns as you. Through this process, students' interest is aroused. Find information on your own on the Internet. Students receive this type of education and create their own robotic arms using a 3D printer and control the robotic arms using a computer. Student satisfaction is high. We also suggest good methods for education in IoT and AI to others.

Keywords*: practical education, creative education, education that stimulates students' interest, practical education equipment.*

Introduction

A lot of research on educational methods is currently underway [1-5], but most of the papers are in the field of humanities education. However, there are some, but not many, papers on engineering education [6-7]. How do universities effectively deliver engineering education? What types of studies do they do, and how do students want to be educated? How do we educate our students so that they can unleash their creativity and grow into outstanding IT leaders of Uzbekistan in the future? The ultimate goal of IT and engineering education is to enable students to unleash their creativity and achieve results on their own. In the education of students, the professor should not be the main character, but the students should be the main character. Professors need to figure out what students want to study. It is important to present the direction or project that students want to study and create an environment where students can solve problems on their own. And it is effective for professors to find solutions together with students.

With the recent development of SNS, we live in a world where everyone shares information from around the world. Both students and professors can easily access information. These days, it is important to always check online with students to find out what famous professors, students, and engineers in developed countries such as Korea, the United States, and Europe are thinking and researching, and to find the best solutions. More importantly, students must have an interest in the field of engineering. Professors should always think about these issues. Since professors have more experience than students, it is easy for them to keep up with the world's technological

trends. To keep students interested, it is important to always seek out new ideas and understand them in detail.

Professors find and implement things that students have not thought and showing them directly to students is effective in arousing students' interest. Students develop a desire to create things on their own. It is important to create an environment where students with this way of thinking can practice it on their own. This type of training is hands-on training. In order to provide such education, professors must prepare the following subjects:

1) Computers that can be used with students

2) Educational equipment that students can practice directly

3) Electronic components that can carry out the project

In the classroom, which is a traditional teaching method, professors explain in front, students look at textbooks, listen to explanations, and summarize in notes should be avoided. Although this method is necessary to some extent in engineering education, students must actively use the Internet to access a lot of information. It is effective for professors to give only a certain topic and have students find information and discuss it.

Additionally, practical training should be encouraged. In order for mobile phones and cars made in Uzbekistan to become the best in the world in the future, it is absolutely necessary for students to practice making small mobile phones and cars themselves. This is because students can learn many basic and applied skills through the process of making them themselves. In this study, we tried various methods to provide effective practical education directly to TUIT students.

Methods

In order to provide hands-on training to students, the following policies were established and provided.

1) A laboratory where students can freely discuss and practice

Engineering laboratories at Uzbekistan universities do not seem to be very active. TUIT Department of Artificial Intelligence created ‘AI & IoT Lab’ and opened it to students. All AI students were encouraged to come to the lab in their free time to study and practice on their own. Not long after the lab opened, many interested students came to visit us. Figure 1 is the nameplate of the lab, and Figure 2 is the students studying in the lab.

Figure 1. Laboratorn name plate

Figure 2. Students in the Lab.

2) Preparation of experimental equipment

Because we needed educational equipment for the students' practical training, we prepared and brought the educational equipment directly from Korea. Here in Uzbekistan, it is not easy to obtain such educational equipment and it is quite expensive.

This is domestic Aduino and Raspberry Pi educational equipment, which are the most important computer equipment in the IoT and IoT fields. The university department provided computers, monitors, keyboards, and mice. The students also prepared 3D printers for the students. Students use these devices to study and practice on their own. All electronic and other necessary parts needed for practice were prepared. Everyone prepared an environment for students to practice.

Figure 3 is the Arduino board, and Figure 4 is the Raspberry Pi board. Figure 5 is the Arduino training board, and Figure 6 is the Raspberry Pi training board. Figure 7 shows the mouse, keyboard and monitor. And Figure 8 is five computers. Figure 9 shows the soldering tools, and Figure 10 shows the 3D printer.

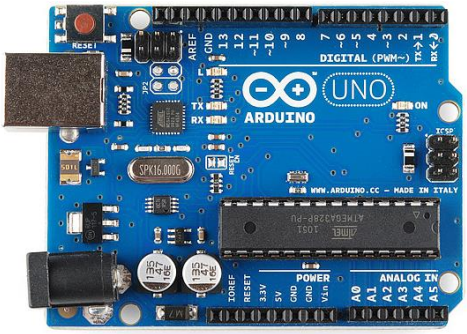

Figure 3. Arduino Board

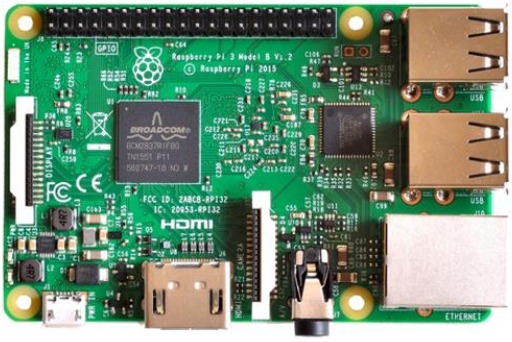

Figure 4 Raspberry Pi Board

Figure 5 Arduino educational board

Figure 6 Raspberry Pi educational board

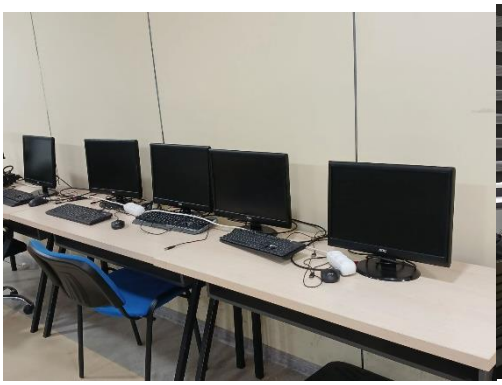

Figure 7 Momonitor sets

Figure 8 Computers

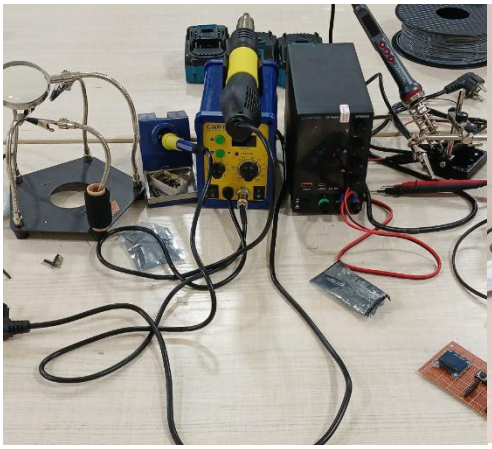

Figure 9 Soldering machine

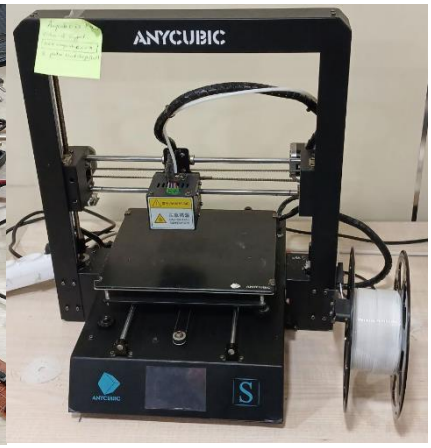

Figure 10 3D printer

3) Students carry out the project on their own or the professor explains the project.

Interested students come to the lab with tasks they want to do on their own. Additionally, students can freely use Arduino and Raspberry Pi educational equipment, which could not be used due to the high price, to perform tasks on their own. For students who cannot decide on an individual task, an appropriate task is presented and they are encouraged to perform it on their own. Students who are new to computers or educational equipment ask questions to experienced students next to them or to me, the professor.

Students also experience things little by little by going through many implementation processes. Experienced students and first-time students all work together as a team, showing a synergistic effect. When students do not have the parts they need on their own, they go to a Tashkent parts store to buy the parts themselves. In the process of purchasing them, they learn to understand various electronic parts and how to purchase the parts they need. This is actual practical training. Figures 11 and 12 show the robot hands and arms that students made using a 3D printer. Figure 13 shows students practicing using the Raspberry Pi education board, and Figure 14 shows students experimenting using the Arduino education board.

Figure 11 Robort Hand

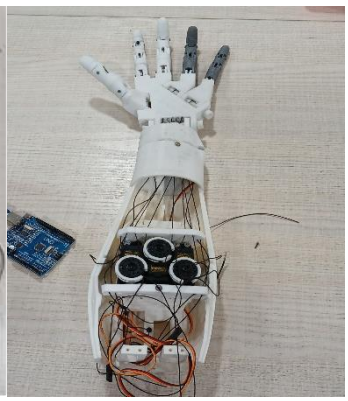

Figure 12 Robort Arm

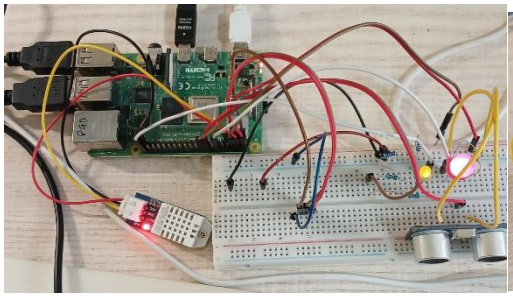

Figure 13 Exp[eriment for Raspberry pi

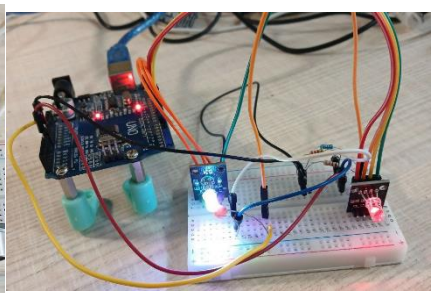

Figure 14 Experiment for Arduino

4) Students' practice methods

Students discuss with each other in the lab and practice individual assignments. Design and construct circuits related to the assignment and program them using Arduino and Raspberry Pi computers. And the program is written using C or Python. You can also design and construct the circuit you want to make. Then, a circuit is created on the universal board. If necessary, design a 3D design and print the result on a 3D printer to create the required shape. The written circuit is directly executed using a computer, and if an error occurs, the program can be debugged or the circuit modified. When I have a problem, I use the Internet to research what other students and engineers around the world are doing. Sometimes we use Chrome to find the best way. Discuss in teams and listen to other students' opinions. Figure 15 shows a student soldering, and Figure 16 shows a student programming while discussing. Figure 17 is a scene where the student tests the operation of the robot arm he created.

Figure 15 Solderting

Figure 16 Programming

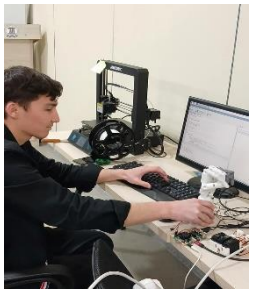

Figure 17 Testing

2. Results

1) Students made a robot arm (using a 3D printer).

The design was done using a 3D graphic design tool on a computer and the results were printed. We printed out the finger joints one by one, assembled them, created robot fingers, and completed the five fingers and hand. Connect the thread for control to each finger and check the movement of the finger by first adjusting the thread for control. Next, the frame of the robot arm was printed using a 3D printer. By connecting the robot arm and the robot hand, a complete robot arm was created. The robot arm was completed by connecting five servo motors.

2) Writing a control program on a computer

I wrote programming to control the robot arm using the Arduino and Raspberry Pi computers inside the education board. Students using Arduino wrote programs using C language, and students using Raspberry Pi wrote programs using Python language. The written program was connected to the servomotor attached to the robot arm to finally complete the desired robot arm movement. Many errors occurred while completing this work, but the students corrected the errors one by one and completed it. Students' computer programming skills improve as they create and modify control programs.

Conclusion

Using a 3D printer, students were able to create 3D designs by creating the necessary frames, and they also gained a complete understanding of how 3D printers work. Additionally, programming skills have greatly improved by programming in C or Python languages. Students solved difficult problems on their own while performing the assignment. In the end, students gained pride in being able to do things on their own by solving problems that arose. Since necessary educational equipment and materials are needed for students' practical education, universities must prepare these. Additionally, professors need to accurately understand how to use the equipment needed for practice and related theories. In addition, professors should first practice

the contents of practical training in advance to identify problems that may arise during practical training. By carrying out this practical training, it can be seen that the training effect is very good. This is why practical education must be emphasized, especially in engineering education.

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