

Opinions of Computer and Instructional Technologies Students about the Robotic Coding Course

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Abstract—Robotic coding from coding training improves high-level cognitive skills. The research aims to determine the opinions of the senior students who took up the coding course in the information technologies teaching department about the robotic coding course. In this context, 41 senior year students studying in Cyprus and Russian Universities were interviewed. The qualitative research method was applied. Semi-structured interview forms were created by taking experts' opinions. Findings were analysed by the content analysis method. The answers obtained were determined; general views, perceived usefulness, gains, reinforcement outside of school and professional contributions were analysed. According to the results, pre-service teachers of the information technology departments should be oriented towards the preparation of robotics and courses in schools. They stated that there is a high demand from all school education levels for training in robotic courses.

Keywords—robotic coding, computer, technology, university, student, computer and instructional technologies department, coding

1 Introduction

The 21st century is an age where information exchange takes place rapidly. It is also very popular today, where education [1] is the most important content for any country worldwide to develop on its own. When looking at various sources, the most important feature of this age is the information age. In order to adapt to the analysis in technology, different optimisations are required [35] for education training, which will also be reviewed by school principals [23]. In this concept, the future of educational technology is revealed.

Educational includes educational training, educational practices (learning status, methods and techniques) and evaluation [2]. Educational technology plays a role in its

interpretation and review so that it can be learned and reviewed in education [6]. Educational technology tries to increase the education of teaching education, training to teach and teaching teachers and students' knowledge.

It is thought that these developments, which emerged as a result of the nature of technological progress, will also change the usual order in every field. All sectors, companies and even countries will also experience a holistic change [30]. Accordingly, there is a need for qualified individuals who can adapt to this production system dominated by advanced technologies, and even contribute to its revival and development [9]. In order not to be left behind, countries have also focused their capital on education as a separate investment area in addition to the investments made in this field [13]. For this reason, changes have begun to be made not only in scientific content but also in educational content related to technology [44]. At the onset of these changes is robotic coding training.

With the coding movement started in America, the basic knowledge and experience that form the basis of technology have been reflected in the education of young students. URL-1 [43] states that, 'Every student in school should have the opportunity to learn computer science'. This current notion, which is based on his vision, has surrounded the whole world in a short time. In addition to these web-supported trainings, subjects such as coding, robotics, programming and simple algorithms were added to the training curricula in order to regularly present information about technology [3] [26]. While making these additions, new software was prepared with the logic of 'drag and paste' instead of algorithm-based and difficult to understand programming knowledge according to the development level of the students [5] [7] [10] [12] [22]. We see that coding trainings improve the skills of individuals regarding concrete concepts.

It is very difficult for children in the concrete operational stage of cognitive development to understand abstract programming concepts. Everyone, especially children, can learn to code easily [8]. It is seen that block-based programming languages have emerged at the point of solving this problem. Block-based programming languages work on the basis of coding by combining blocks that work in a jigsaw puzzle with the drag-and-drop method. It also provides the opportunity to use multimedia elements such as pictures, audio and video in projects.

Sirakaya [41] listed the advantages of block-based programming languages as follows:

- Working with a language close to the daily language instead of syntax rules;
- Combining code blocks with the drag-and-drop method instead of writing the code;
- Code blocks can only be combined correctly like puzzle pieces;
- Absence of syntax errors (such as punctuation) caused by syntax;
- Ability to express abstract programming concepts concretely.

For students, coding education plays an important role in developing analytical and critical thinking skills [18]. At the same time, increasing reasoning skills, developing problem-solving skills and developing design-oriented ideas are at the centre of coding-oriented studies in the field of education. In addition, another measurement factor that helps to develop skills is the situation of conducting robotic studies based on coding.

Instilling these skills in children at an early age is only possible if they are part of the educational process [12] [42]. Therefore, it is of vital importance that the robotic coding course is included in the programme. The high level of contributions related to coding and robotic education is motivating for education in this direction [20] [40]. For example, the contributions of the coding and robotics course to the educational processes, providing active learning, influencing students; ability to use the computer actively, and obtaining more efficient measures from the learning process, help them to develop activeness in the learning process. At the same time, it has increased the importance of coding and robotic coding trainings, as it helps in the formation of individual learning on the subject and course faster [15] [16]. There are many studies on robotic coding education.

When we look at the studies on coding, with the aim of determining students' opinions about robotics, in the seventh-grade science and technology lesson on 'Force and Motion', the effects of robotic-assisted experimental activities on students' scientific process skills and motivation towards science and technology lesson were examined. Ozyurt and Ozyurt [31] conducted a study on 325 students studying in 3 different computer programming departments of the computer programming department of the vocational school on determining the attitudes and programming self-efficacy of computer programming students and stated that their programming self-efficacy is moderate [40]. It is stated that block-based programming languages are evaluated by students as easy to use [8] [21] [45] and fun. Erol and Kurt [11], in their study in 2017, examined the attitudes of CEIT students towards programming and concluded that they had positive attitudes. Again, the results of many studies show that children have a positive attitude towards coding education [14].

As a result of the technological developments in the world, developed countries have grasped the importance of information technologies, and coding and robotics education is given to their children in order to instill their ability to dominate the computer and direct technology at an early age. In this change, it is necessary to prepare new curricula, train many teachers and make changes in classroom environments. Therefore, educating teachers who teach computational thinking is an important part of the puzzle [16]. Professional development is extremely important for teachers to develop their computational thinking pedagogies effectively [48]. The task of preparing the growing generations for the future in these rapidly changing conditions is undoubtedly attributed to education and, therefore, to teachers. It is the duty of teachers to help individuals discover their talents, to prepare them for the future, to gain the ability to lead their lives in qualified conditions and finally to ensure that they can contribute to social life [34]. Computer science researchers have roles in teacher education. In this case, it is important to examine the opinions of future teacher candidates about robotic coding education in detail.

1.1 Purpose of the research

In this study, it is aimed to determine the opinions of prospective teachers of computer education and instructional technologies education on robotic coding education

in Cyprus and Russia. In this general purpose, answers were sought for the following sub-objectives:

1. What do you think about the use of technology in education?
2. What is the purpose of robotic coding?
3. What are the advantages and disadvantages of robotic coding (in terms of the learner)?
4. What are the disadvantages of robotic coding (in terms of the learner)?
5. Do you find the coding course you have taken sufficient?

2 Method

The qualitative research method was used in the research. In cases where there are many unknowns, starting with a qualitative research method often makes the research more qualified [33]. The descriptive/descriptive case study type of the case study was used. Case study is a method in which a single situation or event is examined in depth longitudinally, data are collected systematically and what happens in the real environment is examined. With the results obtained, it reveals why the event occurred in that way and what should be focused on in future studies.

2.1 Research group

The convenient sampling method was used as the sampling method. In this method, the researchers try to reach the target sample number starting from their immediate environment (Buyukozturk et al., 2008). The study group of the research consists of 41 teacher candidates studying in the Department of Computer Education and Instructional Technologies in Cyprus and Russia. In Table 1, the demographic information of the teacher candidates is given.

Table 1. Demographic information of the instructors

Gender	F
Female	20
Male	21
Total	61

2.2 Data collection tools

A demographic information form was developed by the researchers to determine the opinions of prospective teachers studying in the Department of Computer Education and Instructional Technologies on robotic coding. In addition, semi-structured interview questions consisting of open-ended questions were used as a data collection tool. The open-ended questions in the questionnaire were created using the literature and the researchers' own experiences. The questionnaire was first examined by four experts experienced in qualitative research and necessary corrections were made according to

their feedback. As a result of the interviews, the questions were finalised and five questions were included.

2.3 Analysis of the data

In the analysis of the data collected by the robotic coding opinion survey, categorical analysis and frequency analysis techniques were used to analyse the content analysis types. Frequencies were determined according to the repetition frequency of the coded expressions. In addition, in order to facilitate the understanding of the questions in the themes and codes, sample expressions from the views of the participants were included. In the categorical analysis process, the stages of coding the data, creating the themes, organising the themes, defining and interpreting the findings were carried out (Corbin & Strauss, 2007).

3 Results

3.1 Opinions about the place of technology in education

Table 2. Students' views on technology in education

	N
To keep up with developments	30
Enjoyable and efficient learning opportunity	10
Easy and permanent learning opportunity	9
Computational thinking	2

The answers given by the pre-service teachers studying in the Computer and Instructional Technologies Department to the question ‘What is the place of technology in education?’ were keeping up with developments (30), pleasant and productive learning environment (10), easy and permanent learning environment (9) and the opportunity to present information-processing skills (2). It is seen that most of the views of pre-service teachers about the place of technology in education are ‘to keep up with the developing and changing world’. Developing technology takes place in every field of our lives. The field of education has an important place in the lives of individuals, for raising useful individuals for the society and for professional gains. It has been found that it is very important to include technological developments in the education process, which is an important period of our lives.

Some of the students' opinions are as follows:

“Technology and the concepts of education are inseparable. The concept of educational technology is very important. We need to change the education according to the developing and changing living conditions. It is very important for us, as educators, to use technology in education”.

“I think that if we can effectively use the technology that exists in all areas of our daily life in the education process, fun and enjoyable learning will be provided. The

variety of smartphones and mobile applications is increasing day by day. Almost all of us have smartphones in our hands. While technology is developing so much, the importance of using technology in education emerges once again”.

3.2 Opinions about the purpose of robotic coding

Table 3. Students’ answers regarding the purpose of robotic coding

	N
Turning abstract concepts into concrete	30
Technology-supported education	8
Making it easier to understand	6
Possibility of different learning options	3

When the answers given by the pre-service teachers studying in the Department of Computer and Instructional Technologies to the question ‘What is the purpose of robotic coding’ were examined, it was found that abstract concepts were transformed into concrete concepts. This definition is compatible with the definition of robotic coding. Likewise, there are teacher candidates who say that it provides technology-supported education for the purpose of robotic coding, since robotic coding is a technology-supported education method. There are also pre-service teachers who say that robotic coding aims to facilitate the understanding of individuals in education and that it allows learning through different methods.

Some of the students’ opinions are as follows:

“Robotic coding facilitates learning by transforming abstract concepts into concrete ones. They need an event or an object to embody abstract concepts, so they adapt the robots they code to the real world with robotics and coding training”.

“The best example of the success of technology in education is robotic coding. When technological tools are included in education, robotic coding becomes one of the most widely used technology-supported education”.

3.3 Advantages of robotic coding

Table 4. Students’ views on advantages of robotic coding

	N
Cognitive skill acquisition	31
Problem-solving ability	21
Creative thinking	13
Numerical thinking	12

When the answers given by the pre-service teachers studying in the Department of Computer and Instructional Technologies to the question ‘What are the advantages of robotic coding’ were examined, it was found that the acquisition of cognitive skills was the greatest advantage. In the same way, they stated that learners acquired problem

solving skills, creative thinking skills and numerical thinking skills, which are among the acquired behaviours.

Some of the students' opinions are as follows:

“The advantages of robotic coding include developing cognitive skills and the concept of cognitive skills. Cognitive skills include high-level cognitive gains such as understanding, perceiving, grasping, analysing and synthesising. I think that robotic coding is very useful in achieving these gains”.

“Most programmes can be made easier with robotic coding. It develops students' problem-solving skills. This behaviour, which is taught to students, is effective not only in the subjects taught but also in their daily lives. From my point of view, my perspective on every event has changed after I received robotic coding training. I am able to solve problems more easily and I learn to grasp the subjects faster”.

3.4 Disadvantages of robotic coding

Table 5. Students' responses to the disadvantages of robotic coding

	N
Crowded classroom	19
The gains are measurable and not evaluable	8
Content is determined by the teacher	7
Educational environment suitability	7

When the answers given by the pre-service teachers of the Computer and Instructional Technologies Department regarding the disadvantages of robotic coding are examined, we can see that most prospective teachers stated that it is very difficult to implement in crowded classrooms. If we look at another answer, we can see that they stated that the gains in robotic coding application are not a measurable and evaluable technique. Seven pre-service teachers stated that the content in robotic coding would differ as it was determined by the teacher. Seven pre-service teachers stated that as a disadvantage of robotic coding, the suitability of the school, the suitability of the class and the suitability of the tools should be adjusted as a disadvantage.

Some of the students' opinions are as follows:

“Robotic coding is a very effective method. It enables students to both learn and have fun while learning. I see it as a disadvantage that it cannot be applied in crowded classrooms”.

“We have gains in the education process. There is no specific evaluation criterion with robotic coding in the measurement and evaluation phase of the gains. This is also a disadvantage”.

“There is a certain curriculum in schools. Trainings are given according to this content. The content for robotic coding is determined by the teacher himself. This is a disadvantage. The reason is that it can differ with other teachers or schools”.

3.5 Opinions about the coding course given at the university

The answers of the Computer and Instructional Technologies Department teacher candidates to the question about the adequacy of the robotic coding course they took during the education process are quite thought-provoking. 37 out of 41 pre-service teachers found the coding course they took insufficient. They stated that the number of courses related to coding education should be increased. In addition, four pre-service teachers stated that the education they received was sufficient. The pre-service teachers stated that all pre-service teachers should take the robotic coding course, not just the students of the CEIT department. They stated that the pre-service teachers were given limited training on coding and they did not have any information about current coding programmes.

Some of the students' opinions are as follows:

“Coding education is important. Not only robotic coding, but also other coding lessons should be added. The course contents given in the field of robotic coding are insufficient. We have to do individual research ourselves”.

“Even though the course given is an applied course, we do not practice in terms of content. Theoretical topics are mainly explained. This may be the reason why our classroom is crowded, but effective learning is not provided”.

4 Conclusion and discussion

The results of this study, which aims to determine the opinions of prospective teachers of computer and instructional technologies about robotic coding, are generally positive. Considering the results of teacher candidates regarding education and technology, their opinions are quite positive. Pre-service teachers defined the concept of technology and education as "keeping up with the times". With the developing technologies, education methods are also changing. It is very pleasing that pre-service teachers state the importance of including education in technology. They defined education given using technology as permanent and easy learning for learners. They also found the concepts of technology and education effective in comprehending and applying knowledge. Developing technology takes place in every field of our lives. The field of education has an important place in the lives of individuals, for raising useful individuals for the society and for their professional gains. It has been concluded that it is very important to include technological developments in the education process, which is an important period of our lives. Selwyn [37] talked about the importance of education and technology in his study. He mentioned the progress of education with technology and the effect of changing the techniques used in education with the developing technology on learning.

When the results regarding the purpose of robotic coding are examined, it is seen that pre-service teachers give similar answers with the definition of robotic coding. They defined the purpose of robotic coding as transforming abstract concepts into concrete concepts. Likewise, there are teacher candidates who say that it provides technology-supported education for the purpose of robotic coding, since robotic coding is a technology-supported education method. Goncu et al. [16] determined the views of

prospective teachers on coding education in their study. It is consistent with the results obtained from this study.

From the findings regarding the advantages of robotic coding, it was concluded that there is relational skill acquisition. In the same way, it has been concluded that the learner contributes to gaining problem-solving skills, gaining creative thinking skills and gaining numerical thinking skills. The results from this finding are supported by other studies. Pakman [32], in his study conducted in 2018, examined the ‘effects of basic level coding, robotics, 3D design and game design education applied to the 8–10 age group students on problem-solving and reflective thinking skills’. A positive increase was observed between the values of students’ problem-solving skills and reflective thinking skills before and after education. Goksoy and Yilmaz [15] determined that the teachers who teach the educational robotic coding course are of the opinion that this course provides students with advantages such as problem-solving, creative thinking, numerical thinking, efficient working, systematic and analytical thinking, and design skills and increased motivation [17] [24] [27].

The results of the Computer and Instructional Technologies Department teacher candidates regarding the disadvantages of robotic coding are consistent with other studies. The difficulty of applying the course in crowded classrooms, which is one of the disadvantages of technology-assisted education, is also supported by the result of this research. Considering the disadvantages of robotic coding, the fact that it cannot be applied in crowded classrooms, that the achievements are not measurable and evaluable and that the content selection can differ because it is made by the teacher are results due to the unsuitable educational environment.

The answers of the Computer and Instructional Technologies Department teacher candidates to the question about the adequacy of the robotic coding course during the education process they received at the university are quite thought-provoking. Almost all of the pre-service teachers found the education they received insufficient. 37 out of 41 pre-service teachers found the coding course they took insufficient. This is a serious rate. It has been concluded that all teacher candidates should take the robotic coding course, not just the CEIT students. The conclusion from this finding is important. Jai-pal-Jamani and Angeli [19] stated that teachers who teach educational robotics coding should have high self-efficacy. Kalelioglu and Gulbahar [21] states in her study that students like coding education and want to improve themselves. Yet another researcher [46] concluded that pre-service teachers want to use the Scratch programme while giving coding training in their professional lives. Similarly, Cetin and Demiral [47] stated that secondary school students are satisfied with taking up the coding training and they would like to take it up again.

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