European Proceedings of
Social and Behavioural Sciences
EpSBS
www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2022.06.51

AMURCON 2021
AmurCon 2021: International Scientific Conference

TRAINING OF STUDENT-TEACHERS TO ORGANIZE CLUBS OF ENGINEERING CREATIVITY

Galina G. Kazeeva (a), Svetlana A. Berseneva (b)*
*Corresponding author

(a) Department of Informatics and Methods of Teaching Informatics, Blagoveshchensk State Pedagogical University, 104 Lenina St., Blagoveshchensk, Russia, kgg@bk.ru
(b) Primorskaya State Agricultural Academy, 44 Blukhera Ave., Ussuriysk, Russia, svshatal@mail.ru

Abstract

Engineering creativity has always attracted people. New areas of focus have appeared in this field thus making the theoretical foundations more sophisticated and changing the age range of learners who can study engineering creativity. Changes in the structure and content of the process require trained specialists who can apply new methods in teaching creative approaches to engineering tasks. The present research work is focused on the necessity of training the specialists prepared to work in different areas of children's engineering creativity and organizing a system of training such specialists. The results of a sociological survey of students and an analysis of the circle activities of the "School of Programming" based on the Centre for Organization of Pre-University Education at the Blagoveshchensk State Pedagogical University are presented. The article analyses the need and possibility of training the students, future teachers, to organize the clubs of engineering creativity. A special feature of the study is a presentation of the program of training non-physics and non-math majors to be organizers of robotics clubs.

Keywords: A student of non-physics and non-chemistry major as a leader of children's club of engineering creativity, a program of training the leaders of engineering study clubs, children's engineering creativity, engineering creativity, training of a robotics club leader

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

A new area of study – robotics - has been added to the modern education system due to the high level of engineering development. Robotics can be divided into four big sections: industrial, domestic, military and educational.

Educational robotics involves different age groups of students ranging from pre-school children (4-5 years old) and all schoolchildren to college students and higher education professionals (Keren & Fridin, 2014; Kosimov et al., 2021; Pivetti et al., 2020; Stojkovic, 2017).

This widespread popularity of robotics in education can be attributed to two major factors. On the one hand, a child has to be socially integrated into the modern technology-based environment; he/she has to be able to use a phone, modern digital appliances, programmable gadgets, and information machines while feeling psychologically comfortable in the process. On the other hand, modern technologies require the highly-qualified professionals who can ensure efficient information processes. And schools have to provide preliminary training for these professionals.

In different countries of the world robotics classes pursue different goals for students: forming and developing personal qualities (Panskyi et al., 2019), enhancing their social integration (Pivetti et al., 2020; Stojkovic, 2017), providing preliminary career guidance (Kandlhofer & Steinbauer, 2016; Ospennikova et al., 2015), teaching them team-building skills, and other goals (Filippov et al., 2017a, 2017b).

There is a great variety of forms and types of classes: clubs, schools, lessons, specialized sessions in children's camps, immersion sessions, remote, full-time, part-time, exhibitions, festivals, etc. Different approaches and methods are used (Filippov et al., 2017a, 2017b; Lynch, 2017; Panskyi et al., 2019). The age of students varies between 3 and 19 years old; the areas of training in robotics are determined by the goals of students and teachers as well as by the resource base of an educational institution.

General educational trends of modern society involve the active inclusion of robotics in the school educational process. It satisfies the needs of students, ensures their social integration in the modern world and provides for the preliminary training of future engineering professionals called to facilitate efficient informational processes in society (Kosimov et al., 2021).

Psychologists and teachers find several positive factors in robotics classes; these factors allow people to develop simultaneously with the technological processes in the society, to be ready for any changes in the social and technological spheres of the society, to improve the methods and forms of working with students, and to expand the scope of activities of a teacher and a student (Filippov et al., 2017b; Malinverni et al., 2021; Scaradozzi et al., 2015).

2. Problem Statement

Many countries have made good progress implementing educational robotics into the educational processes of their academic institutions. Teachers and students learn robotics through various methods, forms and technologies. Robotics classes are conducted in clubs, taught remotely, or become part of academic programs. Societies, centres and academies of robotics are established.

Spanish educators conducted major research on the possibility for expanding the boundaries of robotics classes into something more sophisticated than simple lessons of engineering (Lieto et al., 2017). The authors also mention that robotics can be considered a lesson of ethics and social behaviour.

A group of Russian scholars presented the experience of creating various associations for teaching robotics, organizing children in camps for deep immersion into engineering studies; the researchers also described the cases of holding robotics contests (Filippov et al., 2017b). L. Sterling from Swinburne University of Technology (Scaradozzi et al., 2015) also believes it necessary to include robotics into the basic educational process of Australian schoolchildren and emphasizes the positive influence of robotics (modelling, construction, programming, etc.) on the development of learners at different stages of the educational process.

Italian scholars (Malinverni et al., 2021), conducted experimental research of including robotics in the elementary school program. Outcomes of the experiment were undoubtedly positive: increased motivation and learning rate.

Panskyi et al. (2019), teachers and researchers from Poland share their experience of organizing afterschool, additional classes of robotics for children between 9 and 14 years old. The researchers described several forms, methods and ways of organizing the work and observed substantial positive changes in the personal qualities of learners: development of strategic and abstract thinking, attention, and skills of team communication; the schoolchildren also became less withdrawn and improved their relationships with parents. According to the teachers, out-of-school classes of robotics are organized only during the transition period and in due course school programs will be changed and robotics will be included in them as one of the main subjects.

A group of Russian teachers (Ospennikova et al., 2015) also confirm that robotics is going through a transition period from extracurricular sessions to the lessons of the main academic program. The authors share their personal experience of transiting from additional classes to including robotics in the program of mainstream education.

The teachers from a lyceum (Filippov et al., 2017a) described the methodological peculiarities of organizing classes of robotics using a method of projects. The researchers presented examples of students' works in different areas of robotics aimed at different results (contests, competitions, presentations). The amount of teaching methods is impressive. The team of authors emphasizes the personal achievements of learners: they make discoveries relevant for a specific child and it means the development of the child's personal qualities.

Italian (Alessandri & Paciaroni, 2012) and Greek (Atmatzidou & Demetriadis, 2016) researchers also proved the possibility of learners' achievements in robotics classes. The experiment in Italy was conducted using a method of deep immersion into robotics. Robotics sessions with children resulted in the following positive changes of personal qualities: visual and spatial memory, reaction time, efficiency and programming skills. Greek scholars analyzed the influence of robotics classes on math skills depending on the learners' gender.

Another team researched Italian schools; their results confirmed the results of the first team. According to the second team, robotics classes inspire the active, not passive, cognition of the world (Khuziakhmetov & Gabdrakhmanova, 2016).

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Research literature sources describe the cases of using robotics for teaching and adaptation of disabled people, of people with muscle-skeleton disorders, mental and neurodevelopmental disorders, and impaired hearing.

A team of Italian scholars (Pivetti et al., 2020) analyzed 15 sources that described classes with special needs children. The review presented convincing facts that proved the expansion of the children's needs, enhanced socialization, increased performance in interconnected subjects – Math, Handcraft, Physics, Art, etc. The authors also mentioned the possibility of efficient robotics classes with children starting from the age of 3 years old.

3. Research Questions

All the above mentioned sources emphasize that classes of engineering creativity result in positive dynamics in health problem management, involvement of children into children's groups, development of communicative skills, teamwork and social adaptation of learners, and development of research skills (Pivetti et al., 2020; Stojkovic, 2017).

Career guidance is yet another important element of engineering creativity classes. During the sessions learners get social and engineering skills; active learning of information (in personal activity) has an impact on the attitude towards science and learners' interests. All of these factors help the children in choosing their future professions while multiple aspects of robotics make the choice more specific (Kandlhofer & Steinbauer, 2016; Ospennikova et al., 2015).

The necessity of special training of teachers at the modern stage of education development is discussed by many authors. A leader of a children's engineering creativity club has to be skilful in engineering creativity himself/herself. The works by Khuziakhmetov and Gabdrakhmanova (2016) emphasize the necessity of teaching engineering creativity to the physics majors to form their qualities and individual values for creative approaches to engineering tasks. This paper describes some successful solutions used for forming the creative skills of physics majors. Experts from the Czech Republic present their experience of implementing educational robotics into the training of future teachers of Information and Communication Technology (Tocháček & Lapeš, 2012).

4. Purpose of the Study

Our project is aimed to compile an integral system of training students to organize engineering creativity clubs. The project is implemented in Blagoveshchensk State Pedagogical University (BSPU), Russia. The present article describes the results of the first stage of the project. The objectives of this stage are as follows: (1) analysis of the personnel resources and need for teachers of educational robotics in Blagoveshchensk; (2) analysis of possibilities for training BSPU students, future teachers, to organize clubs of engineering creativity.

Analysis findings show that there is an insufficiency of teachers who specialize in children engineering creativity. There is a high demand for clubs where children could model and create devices, design and program them. The available specialists, who could teach robotics with the full knowledge of all psychological and pedagogical peculiarities, cannot satisfy this demand. At the same time, some many

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

students and educators could potentially teach engineering creativity but they need additional learning or advanced training courses.

5. Research Methods

To study the need for specialists who could organize various classes in robotics we analysed the club activity at the premises of the School of Programming (henceforth the school) within the Centre of Pre-university Education in Blagoveshchensk State Pedagogical University (BSPU). The study involved interviewing the heads of educational institutions (kindergartens and schools in Blagoveshchensk), parents and learners: the polling included about 20 headteachers of schools and kindergartens, over 100 parents with their children who applied for membership in the existing clubs of engineering creativity.

The possibility of training the students for engineering club activity depends on the human resources, available facilities and the number of students who want to receive the training.

In 2017 a few students majoring in physics and math in BSPU (3rd and 4th year of Pedagogy study area) expressed their desire to teach robotics to children. A special program was developed to train them to become leaders of engineering creativity clubs. This program was successfully implemented: after completing the course, over 20 students started working within their speciality in different educational institutions of Blagoveshchensk.

Special polling was organized among the non-physics and non-math majors to find the students wishing to teach robotics and take additional training courses for that. This poll was conducted among the 2nd and 3rбчyear students of the Faculty of Industry and Pedagogy and Faculty of Primary education, BSPU. The students of the 1st and 2nd years of the Faculty of Physics and Mathematics (Pedagogy area of studies) were involved in conducting this poll. The students of three BSPU faculties (229 people) were polled.

The questionnaire included 6 questions. The answers were supposed to show if the students of the BSPU Faculty of Primary Education and the Faculty of Industry and Pedagogy were aware of the educational areas of robotics and to find the students who wanted to teach engineering aspects to children after receiving additional training.

Question 1. Are you aware of the educational areas of robotics?

Question 2. What areas of robotics do you know?

Question 3. Would you like to teach robotics to children?

Question 4. What area of work would you like to choose?

Question 5. Do you possess the necessary skills to start working right now?

Question 6. Would you like to take an additional training course on different areas of educational robotics?

Integrated analysis of the need and possibility of training the teachers of robotics was also conducted based on the results of testing the program of training the 3rd and 4th-year students of the Faculty of Physics and Mathematics, the Pedagogy area of studies, of the Blagoveshchensk State Pedagogical University.

The efficiency of the program proves the possibility of training the students to be leaders of engineering creativity clubs. And the necessity of training the professionals who know the peculiarities of

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

organizing engineering creativity clubs was revealed via the method of observation over the students who had already received the training and were conducting robotics classes.

6. Findings

6.1. Need for training the professionals

Analysis of the club activity in the School of Programming at the premises of the Centre of Pre-university Education in Blagoveshchensk State Pedagogical University. For over 20 years the School of Programming has been operating in the Centre within the Department of Informatics and Methods of Teaching Informatics. The classes at this School included preliminary learning, reinforcement and extension of the school program knowledge of programming.

During their studies in School, the children and their parents started showing an increased interest in some areas of robotics.

Analysis of the children's and parents' involvement confirmed the necessity to increase the number of robotics areas for children. The teachers of the Pedagogical University expanded the types of activities in robotics. For over 10 years the school has been carrying the name "The School of Programming and Basic Robotics". Its clubs have been in great demand among all school-age children. Currently, the School offers several areas of training (courses) in robotics, for example:

- basic principles of robotics (Lego-building);
- EV3 robot programming (Lego-robots);
- basic principles of microelectronics (design of electronic devices);
- NTI. Junior (preparing children for contests);
- microcontroller programming (Arduino);
- 3D-modeling;
- big data analytics, etc.

Heads of institutions complained about the lack of professionals prepared to teach robotics to children. Interviews with the heads of educational institutions (kindergartens, schools) showed that the institutions' facilities were getting equipped with different sets for robotics classes.

Thus, schoolchildren show a great interest in educational robotics and express their wish to study different areas of robotics. Analysis of the children's and parents' involvement confirmed the necessity to increase the number of robotics areas for children. Hence, there is a need for professionals prepared to organize engineering creativity clubs in different educational institutions.

6.2. Analysing the experience of testing the student training program

We possess experience in training the students who can organize the engineering club activity. Staffing for working with students is provided by the teachers of the Department of Informatics and Methods of Teaching Informatics, Blagoveshchensk State Pedagogical University (BSPU). They constantly improve their professional skills by attending advanced training courses and organizing seminars for experience exchange.

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

The facilities and resources for robotics classes are provided by the Centre of Pre-university Education in BSPU.

Training the students to be leaders of children's engineering creativity clubs takes a short period: the program for physics and math majors takes one semester (40 hours): 20 hours for familiarizing them with engineering devices (design kits, microcontrollers, microelectronics sets), 14 hours for learning the methods of presenting the results of club work (exhibitions, festivals, contests) and 6 hours for learning the peculiarities of organizing the teamwork of learners.

In classes the students get only specialized knowledge in a specific area of activity. For example, the course "Microelectronics for children" involved training the students' skills of selecting, compiling and delivering complicated theoretical information, finding electronic devices that can be assembled by 7–9-year-old children; the course of Lego building involved teaching the students to read circuit diagrams and then to master the methods of teaching this skill to 5–7-year-old children.

The short duration of the student training course is explained by the fact that the students learnt the majority of specialized knowledge at their major classes. The future teachers of Maths, Physics and Informatics were learning the following disciplines: Informatics, Operating Systems and Computer Networks, Programming, General and Experimental Physics, Electric and Radio Engineering, Theory and Methods of Teaching Informatics, Using ICT in Education, and others. The knowledge of these disciplines forms the basis of theoretical knowledge for a leader of engineering creativity clubs. Therefore, the students needed a short period to acquire the complete knowledge base.

This student training program was successful. Over 20 students who received the training started working in different educational institutions of Blagoveshchensk and the School of Programming and Basic Robotics (Blagoveshchensk).

A comprehensive analysis of the interviews with the heads of educational institutions and observation of students' works in engineering creativity clubs have led us to the conclusion that some areas of robotics require more specialized knowledge. For example, the course of 3D-modeling implies the skills of two-dimensional and three-dimensional drawing; the course of Lego-building, designed for 5–7-year-olds, requires the knowledge of pedagogy and developmental psychology of learners of that age. The students of physics and math faculty do not learn these aspects in their major classes. However, the students (future teachers of drawing and handcraft) of the Faculty of Industry and Pedagogy of BSPU learn the drawing skills at their major classes. The students of the Faculty of Pedagogy and Primary Education (future teachers of kindergartens and elementary schools) study psychology and pedagogy of pre-school education. Moreover, the Faculty of Pedagogy and Primary Education has a department of oligophrenopedagogy where students receive basic training in working with children with disabilities.

6.3. Possibility of training professionals (about the students' commitment)

The students from three faculties were polled to reveal the commitment of students to teaching robotics and taking additional training: 2nd and 3rd-year students from the Faculty of Industry and Pedagogy, Faculty of Pedagogy and Primary Education, and 1st-2nd year students of the Faculty of Physics and Mathematics of the Pedagogy area of studies. The students' responses were categorized into nine distinct groups based on the number of students. The present analysis describes three of them:

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

- total amount of completed questionnaire forms,
- those who know about robotics,
- those who would like to study robotics.

Table 1 and Figure 1 show the polling results.

Table 1. Polling results: the number of students who would like to study robotics

Groups	Faculty of Physics and Mathematics (FPM)	Faculty of Industry and Pedagogy (FIP)	Faculty of Pedagogy and Primary Education (FP and PE)
The total amount of completed questionnaire forms	65	89	75
Those who know about robotics	63	72	58
Those who would like to study robotics	42	15	24

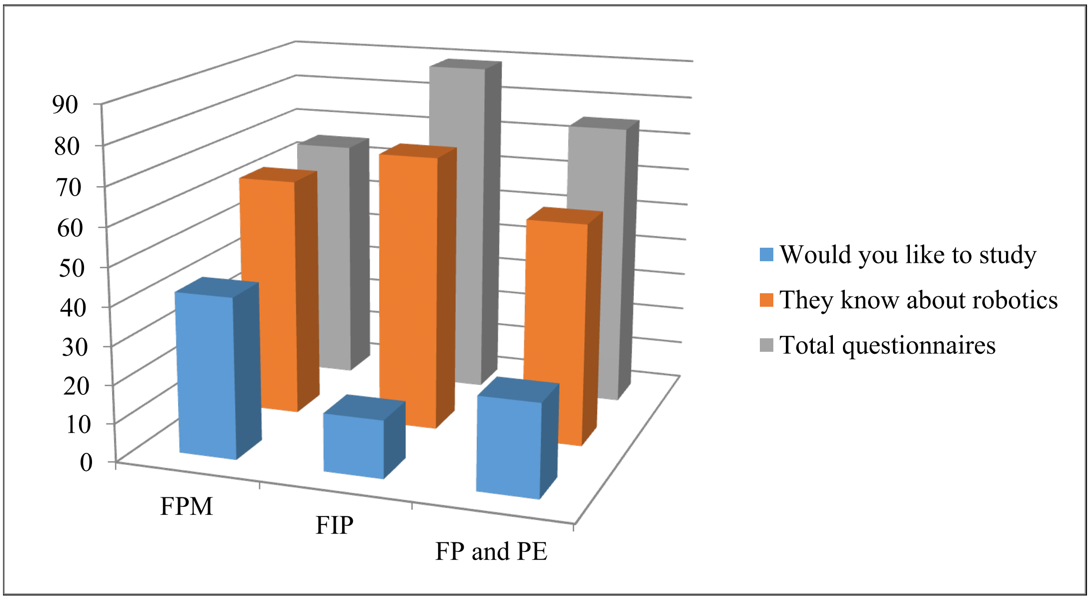

Figure 1. Distribution of students by distinct groups

The summative stage of the present research shows that the majority of students of the Faculty of Physics and Mathematics (96.92%) as well as 80.9% at the Faculty of Industry and Pedagogy and 77.33% at the Faculty of Pedagogy and Primary Education are aware of the educational area of robotics and can outline multiple areas of working with children.

The number of students who would like to teach robotics to children and are ready to take additional training courses surpassed our expectations. At the Faculty of Physics and Mathematics, they made up 64.62% of the respondents. According to the individual interviews with the students, successful examples of those who had already completed the training course and were organizing creative engineering clubs became a trigger for their desire to teach robotics to children.

The other two faculties have not had this experience of working with students yet. However, 16.85% of the respondents at the Faculty of Industry and Pedagogy are willing to work with children in

https://doi.org/10.15405/epsbs.2022.06.51
Corresponding Author: Svetlana A. Berseneva
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

engineering creativity clubs. Factually speaking, one out of five students is ready to take the training and start working. One out of three students at the Faculty of Pedagogy and Primary Education (32% of respondents) is ready to take additional training and start teaching robotics to children. During individual interviews the students of non-physics and non-math majors expressed the wish to learn programming, solving contest tasks, and microelectronics that went beyond the club specialization offered to them (3D-modeling and engineering design). Analysis of the student polling has revealed other areas in educational robotics that the students of non-physics and non-math majors want to learn and work with. For example, while answering the fourth question (What area of work would you like to choose?), the students of the Faculty of Pedagogy and Primary Education selected programming and microprocessor programming. The students of these faculties require more intensive training for working in these areas of robotics as they have not acquired fundamental knowledge of mathematics, physics, and the methods of teaching these disciplines.

7. Conclusion

Thus, we can make the following conclusions. First, educational institutions of the region need people who can become leaders of engineering creativity clubs. Second, some students are ready to take additional training, get specialized knowledge and become leaders of engineering clubs. Third, we possess experience in training students to work with children.

The outcomes of experimental training of the students from the Faculty of Physics and Mathematics to become leaders of engineering clubs were undoubtedly positive. The students will be able to apply the received knowledge and skills in their work in elementary and high schools. However, some areas of robotics require deeper specialized learning for the students of other majors. In particular, the analysis of teaching this program to students has opened the prospects of attracting the students of non-physics and non-math majors to the teaching of the two areas of robotics – 3-D modelling and engineering design – to pre-school and elementary school pupils.

Having integrated the program analysis, interviewed the heads of educational institutions and considered the students' expectations, we compiled a model of the program of training the students, future teachers of non-physics and non-math majors, to organize engineering creativity clubs. The next stage of the program will involve detailed development and testing of the program. The program is supposed to be substantially different from the existing one that was designed for the students with deep knowledge of physics, mathematics, informatics and the methods of teaching these disciplines.

The new program is designed for 4 semesters, 200 classroom hours and includes the following sections:

- fundamentals of out-of-school teaching of informatics;
- preliminary learning of programming;
- programming for solving math tasks;
- engineering design of devices (Lego);
- basic microelectronics;
- microprocessor programming;
- 3-D modelling;

- methods of presenting the results of club activity;
- peculiarities of student teamwork organization.

Every section of the program implies three components: theoretical part, practical part and independent work of students. Special attention has to be paid to the independent work of students as robotics classes require special equipment (sets for engineering design or microelectronics), specialized software (for programming or modelling). Every section of the program includes a final test where students can show the received knowledge and skills, share the challenges they faced during studies and the ways of overcoming them. This information is supposed to help the students in forming their approaches to organizing engineering creativity clubs.

The analysis has led us to the following conclusions: first, the number of educational robotics areas in working with children has to be increased. Second, the study has identified the demand for professionals prepared to organize children's engineering creativity clubs in educational institutions of different levels.

Analysis of the program of training the physics and math majors to be organizers of engineering creativity clubs has confirmed its efficiency. However, the students of non-physics and non-math majors can also work in some areas of robotics.

The next stage of research involves detailed development and testing of two programs: the program for non-physics and non-math majors and the program for training professionals in educational robotics for working with special needs children. It will result in designing an integrated system of training the students of different majors, future teachers, to organize engineering creativity clubs.

References

Alessandri, G., & Paciaroni, M. (2012). Educational Robotics Between Narration and Simulation. *Procedia*. *Social and Behavioral Sciences, 54*, 104-109.

Atmatzidou, S., & Demetriadis, S. (2016). Advancing students' computational thinking skills through educational robotics: A study on age and gender relevant differences. *Robotics and Autonomous Systems,* (75), 661-670.

Filippov, S., Ten, N., & Fradkov, A. (2017a). Teaching Robotics in Secondary School: Examples and Outcomes. *Science Direct Sc. IFAC Papers OnLine*, (50), 12167–12172.

Filippov, S., Ten, N., Shirokolobov, I., & Fradkov, A. (2017b). Teaching Robotics in Secondary School. *IFAC Papers OnLine*, (50), 12155-12160.

Kandlhofer, M., & Steinbauer, G. (2016). Evaluating the impact of educational robotics on pupils' technical- and social-skills and science related attitudes. *Robotics and Autonomous Systems,* (75), 679-685.

Keren, G., & Fridin, M. (2014). Robot (KindSAR) for children's geometric thinking and metacognitive development in preschoole ducation: A pilot study. *Computers in Human Behavior,* (35), 400-412.

Khuziakhmetov, N., & Gabdrakhmanova, R. G. (2016). Creativity in Joint Activity of Teacher and Student in the Learning Process. *International Electronic Journal of Mathematics Education,* (11), 735-745.

Kosimov, S. U., Rafiqova, M. R., & Murodova, M. I. (2021). Implementation of the Technological Competence of Future Specialists. *Creative Education*, (12), 666-677.

Lieto, M. C. D., Inguaggiato, E., Castro, E., Cecchi, F., Cioni, G., Dell'Omo, M., Laschi, C., Pecini, C., Santerini, G., Sgandurra, G., & Dario, P. (2017). Educational Robotics intervention on Executive Functions in preschoolchildren: A pilot study. *Computers in Human Behavior*, (17), 16-23.

Lynch, M. (2017). Five reasons to teach robotics in schools. *EdTech & Innovatioню* Retrievedfromhttps://theconversation.com/five-reasons-to-teach-robotics-in-schools-49357.

Malinverni, L., Valero, C., Schaper, M. M., & Garciade la Cruz, I. (2021). Educational Robotics as a boundary object: Towards a research agenda. *International Journal of Child-Computer Interaction,* (29), 100305.

Ospennikova, E., Ershov, M., & Iljina, I. (2015). Educational Robotics as an Innovative Educational Technology. *Procedia – Social and Behavioral Sciences*, (5), 18-26.

Panskyi, T., Rowinska, Z., & Biedron, S. (2019). Out-of-school assistance in the teaching of visual creative programming in the game-based environment. Case study: Poland. *Thinking Skills and Creativity,* (19), 100593.

Pivetti, M., Battista, S. D., Agatolio, F., Simaku, B., Moro, M., & Menegatti, E. (2020). Educational Robotics for children with neurodevelopmental disorders: A systematic review. *Heliyon,* (6), e05160.

Scaradozzi, D., Sorbi, L., Pedale, A., Valzano, M., & Vergine, C. (2015). Teaching Robotics at the Primary School: An Innovative Approach. *Procedia – Social and Behavioral Sciences, 174*, 3838-3846.

Stojkovic, A. (2017). The Use of Robotics in Education. *Novak Djokovic Foundation*. https://novakdjokovicfoundation.org/use-robotics-education/

Tocháček, D., & Lapeš, J. (2012). The Project of Integration the Educational Robotics into the Training Programme of Future ICT Teachers. *Procedia – Social and Behavioral*, (69), 595-599.