

# Experience in Forming the Readiness of Primary School Teachers to Use Educational Robotics

Abramovskih N.V.<sup>1</sup> Sinebryukhova V.L.<sup>1</sup> Vasyagina N.N.<sup>2,\*</sup>

<sup>1</sup>*Surgut State Pedagogical University, Surgut, Russian Federation*

<sup>2</sup>*Ural State Pedagogical University, Yekaterinburg, Russian Federation*

\**Corresponding author. Email: vasyagina\_n@mail.ru*

## ABSTRACT

In the modern educational system, the use of robotics is the focus of attention of both teachers and parents. This is due to the robotic revolution that has taken place in the industry and the introduction of appropriate equipment in almost all production cycles, as well as the high demand for specialists who have advisory competences. The social order of the society to the education system for such a specialist has led to the expansion of professional training in universities in the corresponding areas. However, the formation of interest in robotics and the basics of technical thinking occurs long before students enter the professional education system. A huge role in the formation of basic competences belongs to the general education system, including primary education. In order to ensure the quality of solving educational problems related to the introduction of educational robotics, it is necessary to create conditions for professional growth of teachers in this aspect of educational activity. The purpose of this article is to present approaches to the development of a system for forming the readiness of primary school teachers to use educational robotics in the framework of master’s program “Innovative primary school” and the experience of implementing the elective course “Educational robotics”. A conscious attitude of a primary school teacher to the use of educational robotics can be formed through the use of activity-based technologies in the system of professional education.

**Keywords:** *educational robotics, primary school teacher, master’s degree, junior school age, competence*

## 1. INTRODUCTION

In accordance with the priority directions of development scientific-technical activity designated in the Federal law “On science and state scientific-technical policy”, the Decree of the President of the Russian Federation of July 07, 2011 № 899 “On approval of priority directions of development of science, technologies and technics in the Russian Federation and the list of critical technologies of the Russian Federation”, an urgent task is the formation of appropriate competences in the students. Russia has made a significant step in the development of the information and communication sphere in recent years (Borovskaya, 2018; Kulyutkin&Tarasov 2018), which has become crucial for supporting the implementation of such areas as robotics in the modern education system. Robotics is one of the most important areas of scientific and technological progress, in which the problems of technics and new technologies come into contact with the problems of artificial intelligence. However, the formation of the foundations of technical thinking necessary for the effective application and development of robotics occurs not only during the period of professional training of the future specialist, but much earlier, at the stage of studying in school, starting from the stage of primary general

education. In this regard, the sphere of education faces the task of including educational robotics in the educational process of primary schools. On the other hand, a primary school teacher should be ready to use robotics in the educational process, and possess not only a system of technical knowledge, but also the ability to draw up design and technological tasks for children of primary school age, the solution of which is based on educational robotics. However, many teachers experience significant difficulties in solving these tasks in their professional activities (Safronov&Sidorova, 2016). Therefore, it is necessary to develop the mentioned competences of teachers, through professional training in master’s program as well. It is master’s programs that have a specific focus that allow students to immerse themselves in innovative technologies not only at the level of theory, but also within the organization of practice-oriented activities.

## 2. PROBLEM STATEMENT

The need to use educational robotics in primary school is associated with the development of technical abilities of students through interest in design activities, the development of spatial representations, skills of design and technological orientation (Alimisis, 2013;

Sullivan&Kazakoff&Bers,2013; Treskova&Gagarina D. A. 2018; Esposito J.M., 2017).However, all this is possible if the teacher has a high level of organization of students' work with educational robotics. Therefore, within the framework of professional training through master's program, it is necessary to provide conditions for the development of the competence of undergraduates in the application of educational robotics in the system of primary general education through the introduction of special disciplines that ensure the solution of the set tasks. The purpose of the research is to consider the methodology for constructing the process of teaching undergraduates in the elective course "Educational robotics" in the framework of the master's program "Innovative primary school", implemented at Surgut State Pedagogical University.

### **3. RESEARCH QUESTIONS**

Questions of finding ways to activate primary school teachers in the development of methods of using educational robotics remain relevant in the modern system of professional education. In order to attract students' attention to technical creativity, including in the direction of educational robotics, it is necessary to introduce tasks into the educational system that are based on the context of important situations for students and require fairly complex technical knowledge, as well as knowledge of such activities as design, educational research, technical modeling and construction. The teacher needs to possess modern learning technologies, built in accordance with the Federal state educational standards of primary general education in the framework of the activity approach (Abramovskih, Kazayeva, Grigoryan, Taktueva (2019); Afanasenkova&Vasyagina, 2019; Bazaeva, 2011; Druzhilov, 2005). It is possible to distinguish modern methods of building professional training of primary school teachers within the framework of master's program: expanding theoretical ideas about the possibilities of modern educational robotics, independent construction of design and technological tasks by undergraduates within the subject area "Technology", development and practical approbation of group creative projects for children of primary school age using educational robotics.

### **4. PURPOSE OF THE RESEARCH**

The system of professional training of undergraduates implements separate methods and technologies for the formation of knowledge and skills related to the use of educational robotics. However, most often they are aimed at forming separate ideas within the problem under consideration and do not allow forming the necessary competences of primary school teachers on the use of educational robotics. One of the ways to solve this problem is to develop and implement an elective course within the framework of master's training, which includes

activity-based technologies for organizing the educational process at the university.

### **5. METHODS OF RESEARCH**

They are study of theoretical approaches to solving the problem in the psychological and pedagogical literature, analysis of the experience of implementing educational programs at master's level, questioning of students for master's degree.

*The experimental base of the research:*

The organization of the practical part of the experimental research work was carried out on the basis of Surgut State Pedagogical University, students in the field of training 44.04.01 Pedagogical education, "Innovative primary school" take part in the research. The period of diagnostic examination was 2018-19.

### **6. THE RESULTS OF THE RESEARCH**

The construction of the educational process in the implementation of master's programs in a modern dynamic, changing situation in the education system is aimed at realizing the opportunities of undergraduates to master the solution of complex professional tasks, to master new educational technologies, including in the aspect of technological education of students (Safronov&Sidorova, 2016). In this regard, the set of disciplines and elective courses offered for study in the framework of master's programs should take into account current trends in the development of education, the demands of society to a modern teacher and ensure the competitiveness of teachers in a modern school.

For effective implementation of educational robotics in primary schools, the teacher's readiness to master the appropriate educational technologies is necessary, which is associated with the availability of a system of special technical knowledge on the use of robotics, the ability to draw up design and technological tasks which can be solved by junior students with the use of robotics.

In order to study the didactic difficulties of primary school teachers when designing their professional activities using educational robotics in the educational process, a survey of primary school teachers (25 people) was conducted. The survey revealed the knowledge of teachers both on general issues of robotics as a type of technical activity, and knowledge of the possibilities of educational robotics for solving problems of building the educational process in primary schools.

Based on the survey, it was found that the teachers experience the following professional difficulties when designing professional activities using educational robotics:

- in assessing the quality of IT education and educational programs in primary education - 64%;
- in the purpose of educational robotics for the development of universal educational actions, technical

and technological competences and technical creativity of students - 40%;

- in the optimal integration of educational robotics, programming and the basic content of primary general education subjects (mathematics, nature studies, technology, etc.) - 84%;

- in integration of educational robotics and programming in extracurricular activities of children of primary school age at the level of primary general education - 24%;

- in determining the basic and advanced productive capabilities of special constructors used in primary general education (LegoWeDo, LegoMindstorms EV3, Fishertechnik, Scratchboard, Arduino, SmartCar, E-lab, etc.) - 48%;

- in organization of lessons and training sessions to meet the goals and objectives of the integrated program "Development of robotics and continuous IT education" - 52%;

- in competent work with robotics equipment and programming software during lessons and extracurricular activities with primary school children - 40%;

- in creating a system for monitoring and evaluating the results of learning educational robotics and the formation of universal educational actions, technical and technological competences in primary school children using educational robotics - 56%;

The results of the survey indicate that primary school teachers are not sufficiently prepared to implement the targets of technological education of students in general, and significant difficulties in choosing modern technologies for implementing educational robotics in working with primary school students. All the participants of the survey noted the need for self-improvement and self-development in the application of educational robotics and programming in the implementation of educational programs of regular and extracurricular activities of primary general education.

One of the important problems of the organization of education in the framework of master's program "Innovative primary school" was the formation of appropriate technical and technological competences in undergraduates, as well as the desire to seek and supplement their professional knowledge in this direction of building the educational process in primary school. The curriculum for the implementation of the educational program "Innovative primary school" included the elective course "Educational robotics", which was practice-oriented. The content of the course included two main modules - "Methodological foundations for the use of educational robotics in primary schools" and

"Designing the educational process in primary schools with the use of educational robotics".

Within the first module, special attention was paid to expanding the knowledge of undergraduates about the basics of using educational robotics in primary general education as a means of implementing the requirements of the Federal state educational standard of primary general education, methodological approaches to implementing intersubject relationships of the main subject areas (mathematics, computer science, technology, nature studies, etc.) when organizing lessons and classes in extracurricular activities using educational robotics, and clarifying the knowledge of the basics of programming and design when using educational robotics. The module resulted in the development of collective projects by undergraduates aimed at determining the basic and advanced productive capabilities of special constructors used in primary general education (LegoWeDo, LegoMindstorms EV3, Fishertechnik, Scratchboard, Arduino, SmartCar, E-lab, etc.).

In the second module, the undergraduates developed extracurricular programs that include the use of educational robotics in primary schools. It is important that each program provided a detailed description of the methodological support for the organization of educational activities of primary school students in the framework of classes on the basics of design, basic mechanics, basic programming with the use of educational robotics.

To assess the quality of content and methods of implementation of the elective course "Educational robotics", a repeated diagnostic study was conducted to identify the readiness of primary school teachers to use educational robotics in their professional activities. It is necessary to note a noticeable increase in the respondents' motivation to use educational robotics. The majority of teachers are aware of the role and importance of modern information technology in primary general education, able to identify goals and objectives of using robotics when working with junior students to plan their own professional activities in this direction. However, some teachers have difficulties in the integral design of extracurricular activities with the use of educational robotics, have difficulties in proper work with equipment, and have significant difficulties in evaluating the effectiveness of the educational process with the use of robotics. To solve the identified problems, it is necessary to create flexible individual educational routes within the framework of master's degree program.

## 7. CONCLUSION

Robotics classes for junior students form a wide range of both universal and subject-specific competences based on the involved interdisciplinary connections. At the same time, the effectiveness of the use of educational robotics in modern primary schools is closely related to the readiness of teachers to include it in the educational

process of teaching junior students. At the same time, master's programs have a developing potential for solving the problem of developing the professional competences of primary school teachers in this aspect due to their flexibility and innovative orientation of the applied methods of organizing the educational process.

## REFERENCES

- [1] Borovskaya, Ye.V. (2018), “Environmental approach in upbringing as the means of pedagogical knowing and environment use in pedagogical process”, Social scientific laboratory of environment and environment research in education [Sredoviy podhod v vospitanii kak instrument pedagogicheskogo poznaniya i ispolzovaniya sredy v pedagogicheskom protsesse], available at: <http://Sreda-lab.narod.ru/index/0-24>.
- [2] Kulyutkin, Yu. N., Tarasov, S.V. (2018) “Educational environment and personality development”, [“Obrazovatel'naya sreda i obrazovaniye lichnosti”], *Noviye Znaniya*: online available at: [http://www.znanie.org/journal/n1\\_01/obraz\\_sreda.html](http://www.znanie.org/journal/n1_01/obraz_sreda.html).
- [3] Safronov, P. A. & Sidorova, K. D. (2016), “Subjective innovations: pedagogical movement in conditions of radical social changes”, *Educational studies*, No. 3, pp. 224-237, available at: <https://doi.org/10.17323/1814-9545-2016-3-224-237>.
- [4] Alimisis, D. (2013), “Educational robotics: Open questions and new challenges”, *Themes in Science & Technology Education*, No. 6(1), pp. 63-71, available at: <http://earthlab.uoi.gr/theste/index.php/theste/article/view/119/85>.
- [5] Sullivan, A., Kazakoff, E.R., Bers, M.U. (2013), *The Wheels on the Bot go Round and Round: Robotics Curriculum in Pre-Kindergarten* // *Journal of Information Technology Education: Innovations in Practice*, V. 12, pp. 203-219, available at: <http://www.jite.org/documents/Vol12/JITEv12IIPp203-219Sulli-van1257.pdf>.
- [6] Treskova, U. V., Gagarina, D. A. (2018), “Is robotics necessary in school? Opinion of experts and readers”, *Entertaining robotics* [“Nuzhna li robototekhnika v shkole? Mneniye ekspertov i chitateley”, *Zanimatel'naya robototekhnika*], available at: <http://edurobots.ru/2018/05/robototekhnika-v-shkole/>.
- [7] Esposito, J. M. (2017), “The State of Robotics Education: Proposed Goals for Positively Transforming Robotics Education at Postsecondary Institutions”, *IEEE Robotics & Automation Magazine*, available at: <https://doi.org/10.1109/MRA.2016.2636375>.
- [8] Abramovskih, N. V., Kazayeva, E. A., Grigoryan, E. N., Taktueva, Y. G. (2019), “Experience of Creating Innovative And Developmental Environment In Masters’ Professional Training”, *The European Proceedings of Social & Behavioural Sciences* EpSBShttps18-25, available at: [https://doi.org/10.15405/epsbs\(2357-1330\).2019.7.1](https://doi.org/10.15405/epsbs(2357-1330).2019.7.1).
- [9] Afanasenkova, E. L., Vasyagina, N. N. (2019), “Self-development and self-realization of pedagogical workers in professional activities” [“Samorazvitiye i samorealizatsiya pedagogicheskikh rabotnikov v professionalnoy deyatelnosti”], *Pedagogicheskoye obrazovaniye v Rossii*, No. 2, pp. 10-30, available at: <https://doi.org/10.26170/po19-02-02>.
- [10] Bazaeva, F. U. (2011), “Self-realization of the person in pedagogical activity” [“Samorealizatsiya lichnosti v pedagogicheskoy deyatelnosti”], *Vestnik Adygeyskogo gosudarstvennogo universiteta. Ser. 3: Pedagogy and psychology*, No. 2, pp. 14-19, available at: [http://vestnik.adygnet.ru/files/2011.2/1198/bazaeva2011\\_2.pdf](http://vestnik.adygnet.ru/files/2011.2/1198/bazaeva2011_2.pdf).
- [11] Druzhilov, S. A. (2005), “Professional competence and professionalism of the teacher: a psychological approach” [“Professional'naya kompetentnost' i professionalizm pedagoga: psihologicheskiy podhod”]. *Sibir'. Filosofiya. Obrazovaniye*, No. 8, p. 26-44.