

A Model for Improving Students' Technical Creative Competences Based on Robotic Elements

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Abstract

In the world, a number of researches are being carried out on the effective use of robotics elements in the development of technical creativity competencies of schoolchildren, improvement of technical creativity competencies of students [1, p. 4]. In particular, to adapt schoolchildren to the conditions of innovative technologies, to update the polytechnic training of students in technical and innovative areas such as robotics, to educate and educate the future consumers of the robotic environment in a goal-oriented manner, to develop robotics and the training of future experts, manufacturers of robotic systems, is gaining importance. Implementation of polytechnic education in physics classes, development of designing and modeling skills of robotic devices, providing students with mastery of the scientific foundations of modern technologies are of urgent importance in the development of students' technical creativity competencies.

Key words: technical creativity, competence, robotics, model, design, modeling.

I. Introduction

The use of robotics elements in the organization of the educational process in schools of general secondary education, in increasing students' interest in science, allows students to acquire competencies in new directions of the methodology and theory of polytechnic education. provides [8, p. 46]. Competencies for teaching the assembly and modeling of simple robots from special construction manuals for robotics are integrated with educational processes. In our republic, there are tasks that need to be carried out in this direction, some problems that need to be solved. First of all, it is necessary to establish national educational literature intended for students in this field, as well as to solve the relevant tasks, systematic work is required [10, p. 360]. In addition, the necessary tools and equipment for training are mainly produced abroad. For the development and popularization of robotics, it is necessary to design and model robotic devices created by engineers with the participation of students, to demonstrate robotic devices in various competitions and contests held with the participation of students at the district level.

II. Literature review

In the near future, the development of robotics will lead to significant changes in people's lifestyles. Many conveniences are created in people's living conditions and lifestyle. A person

living in a new environment will need a new level of thinking and behavior, readiness to maintain and update modern robotic equipment. In this regard, two socio-pedagogical problems have been identified in the science of pedagogy, the solution of which is associated with important socio-economic and political effects:

- 1) training of qualified personnel for the production of robots and robot systems;
- 2) from robotic environment services.

III. Analysis

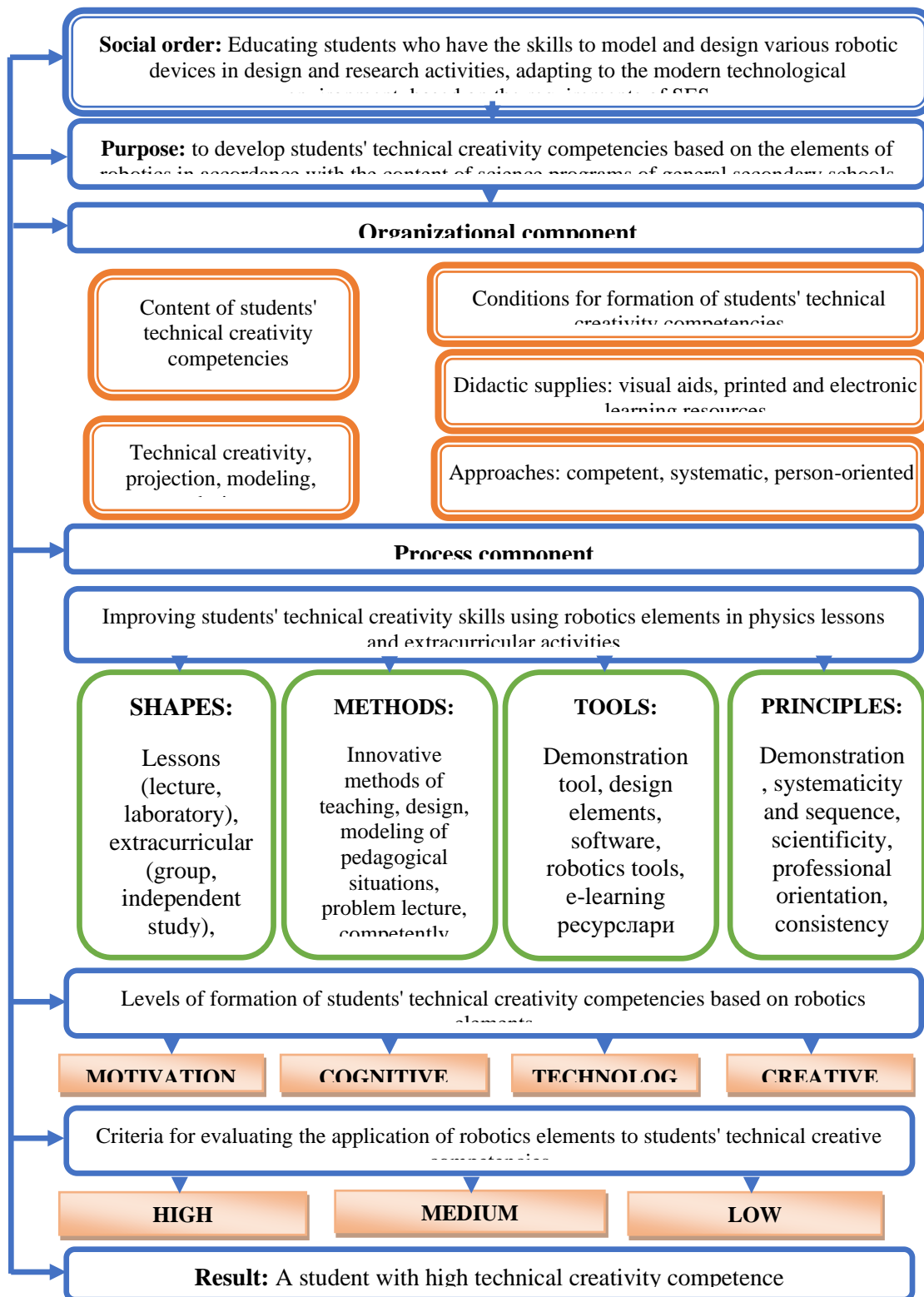
It was found that the following problems and contradictions exist in the use of robotics tools for high school students in class and extracurricular activities:

- 1) at the socio-pedagogical level: modern robotics tools meet the requirements of the local industry for the sustainable growth of the potential of learners. based on the level of vocational orientation of students in secondary school, the existence of necessary conditions for solving this problem;
- 2) at the scientific and pedagogical level: the use of robotics tools in pedagogy with the possibility of strengthening them by including robotics elements as educational materials and tools of polytechnic education courses in the content of the programs of subjects taught in secondary schools, its initial training in the educational system implementation of learning practice [4, p. 7];
- 3) at the scientific and methodological level: formation of basic knowledge and experiences on robotics educational materials and tools intended for students as a required component of the content of polytechnic education in the subjects of physics departments; development of the robotics teaching methodology for organizing the educational process, formation of educational and methodological support.

The content of polytechnic education for young people should be enriched, first of all, by studying the scientific foundations of the creation and application of new techniques and technologies used in various fields of society [2, p. 25]. Robotics is one of the important areas of modern production. It is of particular importance to study it due to the wide scope of implementation of this field, the development and improvement of the technical means of the field, and the scope of their influence on the life of the society in the future. Elements of robotics should become one of the necessary tools for students of general secondary schools to acquire polytechnic knowledge. Because it will become one of the integral parts of the future life of the growing young generation.

With the rapid development of science and technology in society, soon robots and robot systems will become an important integral part of people's lifestyle. They will become cheaper, like the computers used today, and will be designed to perform various tasks [3, p. 6]. Climate control, robotic transmissions, engine management systems for automatic parking, and many other robotic systems are used in modern cars today. Also, in medical institutions, trains and shops, modern kitchens, car maintenance workshops, factories and production facilities, various devices and devices operating on the basis of robot systems are widely used [7, p. 20]. Robotic systems are used in various scientific researches, such as studying the planets, the ocean floor, the internal structure of human organs, organic and inorganic substances in space. Today, robot systems designed for certain functions of the human body, facial expressions, speech, and movement have been created.

Currently, a model for the application of robotics elements to the educational process has been developed as a component of polytechnic education in physics for the development of technical creativity competencies of general secondary school students (Pic. 1). In the model, we explain in detail the sequence of implementation of students' technical creative abilities using robotics elements, its components.



Picture 1: Model of improvement of students' technical creativity competencies based on robotics elements

The model envisages the education of students who adapt to the modern technological environment as a social order, who have the skills of modeling and designing various robotic devices in design and research activities, based on the requirements of SES.

The goal of the model is to improve the technical creativity of students based on the elements of robotics in accordance with the content of science programs of general secondary schools.

As organizational components, improving the content of students' technical creativity competencies, technical creativity, modeling, projecting, design, conditions for the formation of students' technical creativity competencies, didactic support tools: visual aids, printed and electronic educational resources, approaches: competency-based, system-based, person-oriented approaches are included.

IV. Discussion

Improvement of the content of technical creativity competencies of students is intended to apply innovative techniques and technologies in changing the modern technological environment, to acquire modern scientific and scientific-technical knowledge in physics lessons and extracurricular activities.

Technical creativity is a type of activity that serves to ensure the strength and perfection of the knowledge acquired by students, to form active and independent thinking personality traits in them, and to develop their mental abilities.

The following can be included in the conditions for the formation of students' technical creativity competencies. It is intended to provide students with information about the history of the development of robotics and its prospects, the importance of using robotic systems in the modern technological environment, modern solutions and technologies in the field of designing and programming robots [9, p. 341].

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Let's dwell on the content of the tools presented in the model. We did not find it necessary to repeat the information about the visual aids as they have been described above.

Construction elements. Designing means the creative systematic process of developing a design document, the size and quality of this document means the preparation of the product in compliance with all the requirements of the production technology [6, p. 18]. Construction elements include: Detail drawing, assembly drawing, overview drawing, assembly drawing, schematic, parts list, etc.

Software - students use S++, Python, C# programs to design and construct various robotic devices [5, p. 121]. They will get enough information and practical skills about these programs in "Informatics" classes.

Robotics tools – includes Robokids, Lego WeDo, Arduino kits.

Electronic educational resources - textbooks and training manuals, electronic copies of methodical manuals, electronic textbooks, training tools for virtual laboratories, tables, presentation materials, etc.

We will discuss the motivational, cognitive, technological and creative levels of formation of students' technical creativity competencies based on the elements of robotics.

1) motivational - providing a meaningful connection of the educational process in robotics lessons and extracurricular activities; organization of a competitive environment, creation of creative teams of learners, directing their group activities to innovative solutions in the field of robot modeling and design;

2) to know the specific characteristics of cognitive - robotics elements, to get acquainted with their diversity, to learn the cybernetic models of robots and the scientific basis of their elementary base activity, to have the skills to evaluate development prospects and apply them in society;

3) formation of practical skills in the field of technological - technical modeling and design; development of technical culture in the field of use of robotics and robotic technological environment services;

4) creativity - mastering the elements of robotics as a condition for adapting to the modern technological environment and being able to use them in the next stages of education, and directing them to the profession in order to choose engineering and technical specialties in professional activities.

We think about the high, medium, low assessment criteria of applying robotics elements to the technical creative competencies of students in the model.

We present information on three levels of application of robotics elements to students' technical creative competencies.

Low level: very little aware of information such as technical, technological and creative capabilities of robotics, as well as design and modeling of robotic devices, design process, software, development ways, forms, methods, tools, methods of robotics; understands to a certain extent the importance of robotics in modern production facilities, in the social, economic, and cultural development of society; allows laziness in the process of designing robotic devices.

Intermediate level: sufficiently aware of the technical, technological and creative capabilities of robotics, as well as information such as the design process of various robotic devices, design and modeling ways, forms, methods, tools, methods; understands to a certain extent the importance of robotics in modern production facilities, in the social, economic, and cultural development of society; mastered the skills of designing and modeling robotic devices to a certain extent.

High level: fully aware of the technical, technological and creative capabilities of robotics, as well as the design process of various robotic devices, design and modeling ways, forms, methods, tools, methods; fully understands the importance of robotics in modern production processes, social, economic and cultural development of society; has a high level of skills in independent design and modeling of new robotic devices.

Achievements in various fields of science and technology that contribute to the development of modern robots for students: applied mechanics, electrical equipment, industrial electronics, applied optics; creation of new composite materials; Development of 3D and 4D technologies, including technologies based on biomaterials; development of consciousness based on neurocomputer interface systems; improvement of various sensors, biosensors; development of vision technologies of robots, development of navigation systems; improvement of programming and information technologies, development of virtual technologies for visual demonstration of comprehending and understanding of the world by a robot; development of competences on creation of artificial intelligence systems and others.

V. Conclusion

The use of robotics devices in improving students' technical creativity competences in physics classes helps students acquire sufficient knowledge about the operation of modern technologies, and the formation of their competences in designing and making various technical devices.

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