International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 4, Issue 7, July - 2025
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

Psychological-Motivation Model for Improving Technology Education in The Primary Grades

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Abstract

This study offered a didactic model for a psychologically informed strategy to help primary school students develop their professional identities, technological literacy, and creative thinking. Students are inspired to learn beyond textbook level by this method. The content of technology education was revised within this framework to consider the interest and developmental requirements of the students. Particularly, emphasis was placed on the development of contemporary skills in autonomous technical thinking, research, and complex problem solving through robotics and drone construction projects.

The work combined person-centered, practice-based, and interactive methods to enhance the technological , psychological-didactic, and outcome assessment components of extracurricular activities. With the help of this model, students were able to improve their professional technological competence and direct their own personal growth.

Keywords: Primary education, technological competence, psychological approach, extracurricular activities, creativity, robotics, drone construction, didactic model, problem-solving, project activities.

Introduction

Modern teaching strategies and materials that prioritize students' personal development are essential in the 21 st century, especially for primary school students. The teaching process should consider students' interest in practical activities, their ability to think independently, and their openness to mew ideas in addition to their theoretical knowledge. In this regard, scientific research is required to examine how psychological and motivational components can be incorporated into the educational process through extracurricular activities and the development of technological skills that take into account each student's unique needs and preferences.

This study examines the ways in which technology education is structured outsiders of the classroom in various countries across the world, including Uzbekistan and the CIS. This data is utilized to improve a new model that incorporates individual-centered , creative, and useful activities. In this sense, the classes were split up into groups according to contemporary learning

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platforms such as Arduino, robotics, and drones. Enhancing student's technical thinking, professional orientation, and capacity for independent research were the main objectives. We believe that the model we developed during our research can be applied to assist students in developing their motivational, technological, and cognitive abilities in a manner that is consistent with one another. Higher-order pyscho-didactic coordination process that link creativity in primary schools are also included in the model.

Scientists from all over the world have conducted extensive research on the didactic underpinnings of contemporary technology education, the educational process's foundation in active and interactive methods, and research on encouraging students to think creatively through extracurricular activities. The theory of "experiential learning," which encourages students to actively participate in practical activities, was specifically developed by J. Dewey (USA). He places a high value on independent experience with educational material, which may offer a useful methodological foundation for extracurricular activities [1]. Papert (MIT) founded his constructionism theory on the notion that by working on a particular project, kids can gain a deeper comprehension of technology. He emphasized that students can increase their knowledge in a computer-based setting by engaging in independent activities, or extracurriculars, and that this can serve as a significant methodological foundation for extracurricular activities. Additionally, extracurricular activities that are suitable for each student's abilities can be created in technological education that is structured according to H. Gardner's Multiple Intelligences Theory. [3]

Methodology

Scientists from the CIS (Commonwealth of Independent States), particularly in Russia, have conducted extensive research into the organisation of practical and extracurricular activities in technology education. V. V. Serikov and M. N. Skatkin emphasised the importance of extracurricular activities in the comprehensive development of the individual, demonstrating that their content should reflect the real-life activities of students [4]. A.A. Verbitsky proposed the theory of contextual learning, justifying the need for students' knowledge and skills to be directly applicable in real life. This approach is relevant when organising project-based, creative, and research-oriented extracurricular activities in technology education [5]. Russian researchers I.Ya. Lerner and M. N. Skatkin emphasise the importance of preparing students for independent creative activities by using active learning methods in education. This forms the scientific and methodological basis for effectively organising the extracurricular activities system [6].

Uzbek pedagogical scientists are conducting scientific research into improving technology education and organising extracurricular activities. In particular, A.S.Kholboev has conducted in-depth analysis of creativity, labour culture, and professional orientation in technology education [7]. A.A.Tokhtayev has developed the theoretical foundations of labour education in primary education, viewing extracurricular activities as the primary means of fostering students' creative potential [8]. Additionally, Shirinov M.K's work demonstrates innovative approaches to modern education, including methods to foster independent thinking and practical skills among students through technology-related extracurricular activities [9].

The table below compares the approaches of scientists from around the world, the CIS and Uzbekistan to technology education and extracurricular activities. (See Tables 1 and 2.)

Table 1: Comparison of approaches to technology education and extracurricular activities by world scholars

Scientist / Author	Name of Model / Approach	Main characteristics	Used Countries / State
J. Dewey	Experimental learning model	Knowledge gained through practice and teaching based on problem-solving situations	USA
D. Kolb	Experimental rotation model	Experience, analysis, observation, reapplication	USA, Great Britain
J. Piaget	Constructivist model	Independent knowledge acquisition and activity-based learning	Switzerland
V.V. Kraevskiy	Didactic system model	Harmony of goal, content, method and result	Russia
G. Kershner	STEM- based project model	Project-based teaching that connects science and technology	Germany
R. Marzano	Deep learning model	Differential learning based on knowledge levels	USA
A.V. Xutorskoy	Person-centered model	An approach that takes into account individual capabilities	Russia

Table 2: Comparison of Uzbek and CIS scientists' extracurricular activities and methods for teaching technology

Scientist / Author	Name of Model / Approach	Main characteristics	Used Countries / State
V.V. Kraevskiy	The model of didactic systems	Methodical approach to education	Russia
A.V. Khutorskoy	Person-centered model	Strategy founded on the student's requirements and preferences.	Russia
M.N. Skatkin	Systemic model of the educational process.	Based on qualifications, abilities, and knowledge	Russia
Sh.S. Sharipov	Innovative teaching model	Realistic strategy grounded in contemporary technology.	Uzbekistan
X.A. Abdullaeva	Competency-based approach model	Growth of practical skills	Uzbekistan
A.S. Kholboev	Creativity, work culture and professional orientation.	Development of creative potential	Uzbekistan
A.A. Tokhtayev	Labor education theory in elementary school	Strategy for fostering creativity	Uzbekistan
Shirinov M.K.	Innovative approaches and independent thought	Development of practical skills and independent thought	Uzbekistan
Z.A. Mambetalieva	Integrated model	Balancing culture, technology, and labor	Kazakhstan
L.A. Mukhina	Psychological-age model	External activities according to age traits	Russia / Belarus

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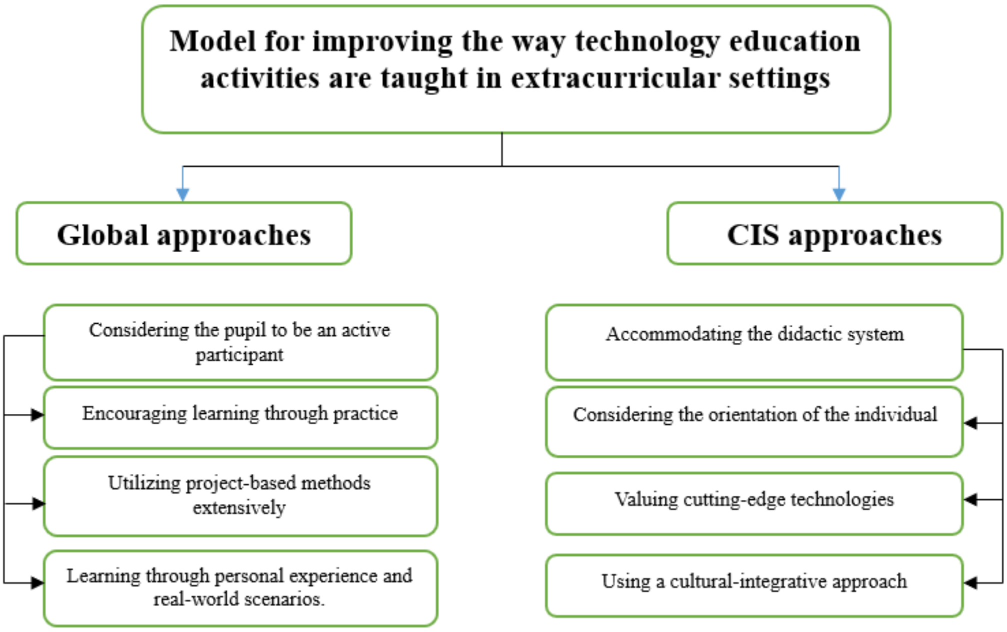

The scientists' methods in these tables were shown in pictures. Here is the diagram. (See Figure 1)

The models were made in different countries to plan technology-related activities outside of school, they all share the following main features:

1. Dependence on the didactic basis: the goal-content-method-means-result chain is the foundation of the educational process in the models of Kraevsky, Skatkin, and Marzano. These methods see extracurricular activities as part of the learning process.
2. A person-centered approach: each student's interests, unique abilities, and age characteristics are taken into consideration in the Khutorskoy, Piaget, and Marzano models as well as, to a lesser extent, in Mukhina's model. When planning extracurricular activities for students' personal growth, this connection is crucial.
3. The Dewey, Kolb, Kershner, Sharipov, and Abdullaeva models all emphasize teaching by doing, and they are all experience- and practice-based. They aim to make extracurricular activities relevant to real life and engage students as active participants. [10, 11]
4. Project-based learning and integration: STEM integration and project activities are applied to education through the Kershner, Mambetalieva, and Kolb approaches. They create a cohesive didactic system by fusing science, technology, art, and culture.
5. The stages of students' cognitive and psychological development serve as the foundation for Mukhina and Piaget's age adaptation models and psychological approach. To make extracurricular activities more effective, they are arranged similarly.

The approaches and connections of the models are presented graphically below. (Figure 2 shows the approach and Figure 3 shows the relationship.)

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Figure 1:Model for improving the provision of extracurricular activities in the global and CIS contexts.

Model connections

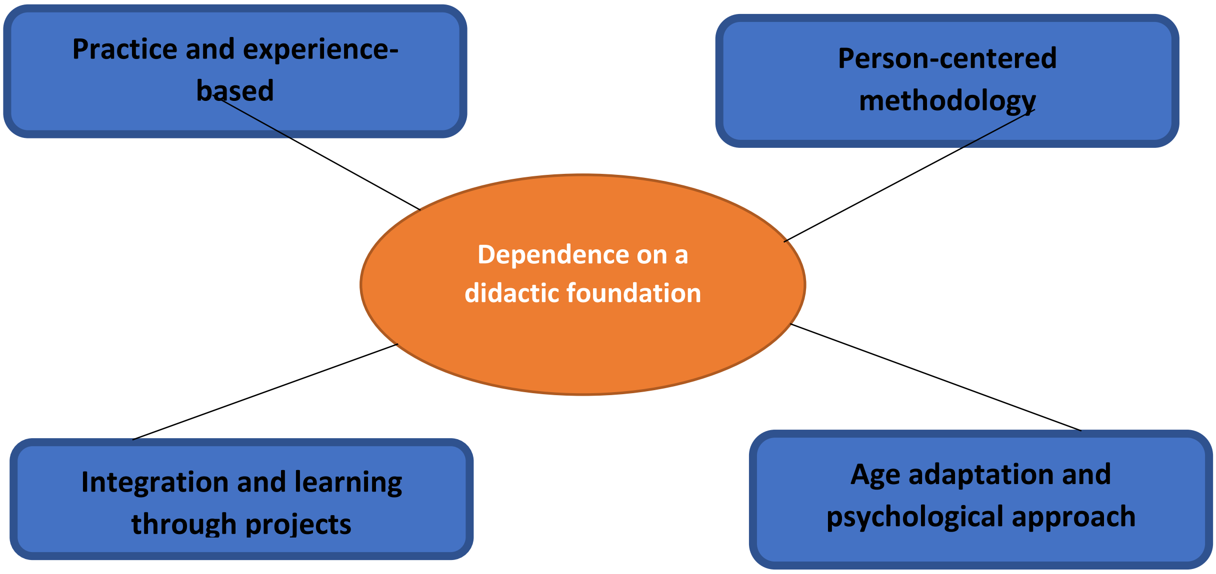

Figure 2 shows the connection between global and CIS models for enhancing the didactic delivery of extracurricular activities.

Results

Based on research into this issue, in a number of countries, including CIS countries, and work of many leading scientists of our country on a theme "Perfection of out-of-school work", we have tried to stage an experiment in a technology lesson, to create a new model of out-of-school work on the bases of designing approach that meets the current requirements. It is reinforced that children in elementary school can create things with other applications and devices and are also working on simple projects that interest them and are learning how to learn on their own. Creative exercises based on students' predispositions and interests Theoretical concepts are complemented by working with and through practical exercises, which are organized based on the inclinations and interests of students and which foster their creative thinking.

In the process of teaching technology, this model seeks to improve technical thinking, form practical skills, and foster the creative activity of elementary school pupils through extracurricular activities. The model incorporates the development of technical creativity, problem-solving skills, independent design, and practical creative activity, and it is based on contemporary educational technologies.

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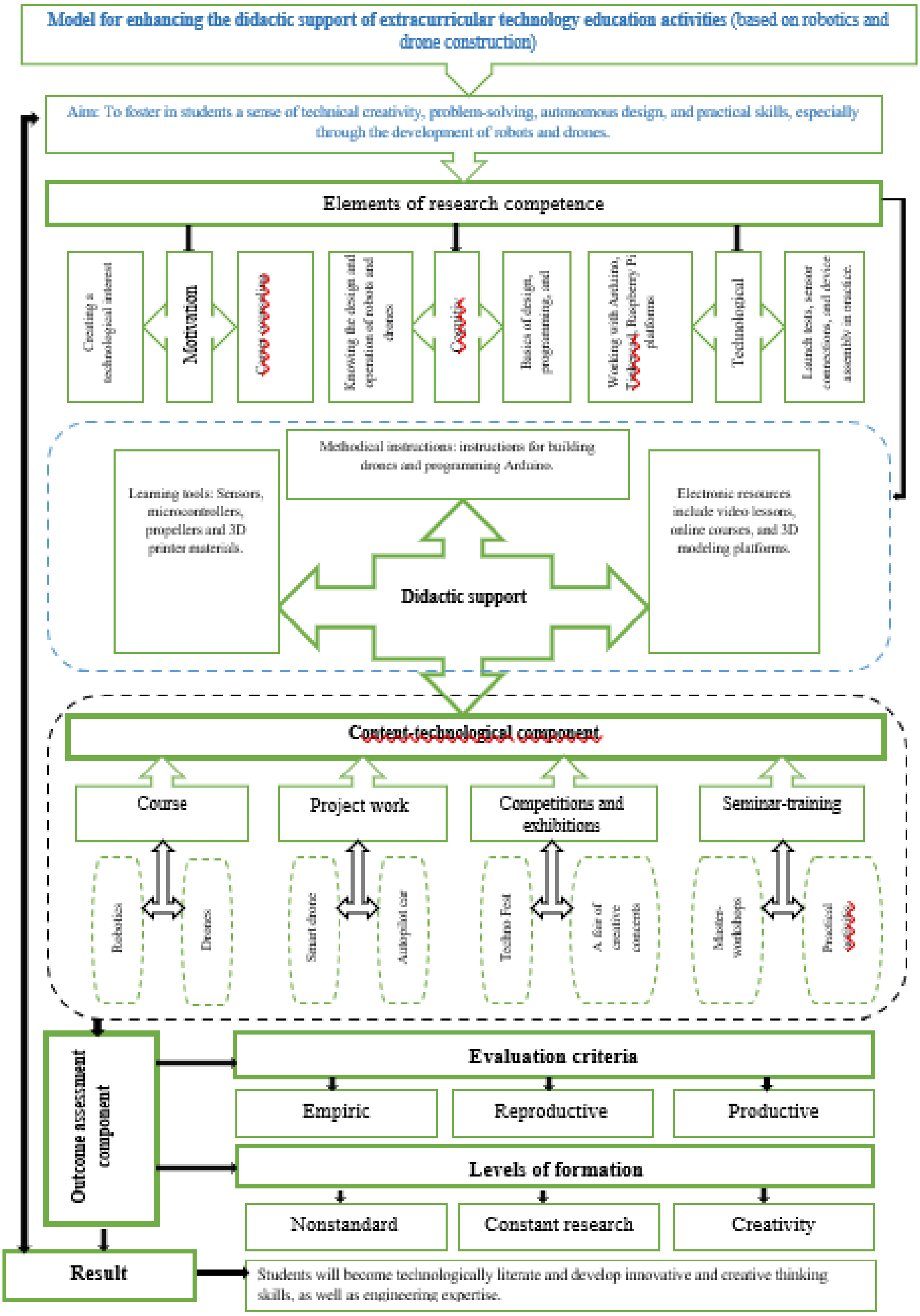

Model for enhancing the didactic support of extracurricular technology education activities is shown in Figure 3.

Discussion

With the use of contemporary technologies, especially robotics and drone construction, this model aims to develop students' technical creativity, problem-solving abilities, capacity for autonomous project creation, and practical skills. This entails cultivating technical expertise as well as the 21st-century skills of innovation, problem-solving, and creative thinking.

I. Technological, cognitive, and motivational competence are the three branches into which the components of research competence are separated. The former entails knowing the fundamentals of electronics, programming, and design as well as the structure of robots and drones, how they work, how to put together useful devices, connect sensors, conduct flight tests, and work with platforms like Arduino, Tinkercad, and Raspberry Pi.

- Interest in technological processes is sparked by technological competence.
- Cognitive competence broadens scientific knowledge and helps students choose a career.
- Positivity and initiative are formed by motivational competence.

This component's content aims to develop students' professional orientation, promote active engagement, and pique their interest in technological education. Students learn how to work on technical devices on their own and become acquainted with their structure and working principles. For instance, knowing the design and operation of robots and drones can help students get ready for their future professional decisions.

Additionally, this element develops pedagogical conditions that stimulate students' intrinsic motivation, foster their need for creative endeavors, and expand their technological knowledge according to their individual interests.

II. Didactic support. In order to guarantee that the model is used effectively in practice, this component offers a set of fundamental tools. Among its contents are methodological manuals. Instructions for building a drone and programming Arduino and other microcontrollers; guidelines for assembly; and safety precautions.

Sensors, propellers, 3D printers, microcontrollers (such as the Arduino and Raspberry Pi), and other structural elements are examples of educational tools.

- Electronic resources: Online courses, video lessons, 3D modelling platforms, interactive applications and mobile programmes. With the aid of these resources, students can study on their own, carry out experiments, and assess the outcomes. This creates the framework for adding creative forms and techniques to enhance the didactic approach.

III. The technological and content component. This element, which makes up the extracurricular activity curriculum, aims to improve students' technological literacy. Through a variety of clubs, projects, hands-on instruction, exhibitions, and competitions, students engage in activities. The following areas are suggested:

- Building, programming, and managing robots is known as robotics.
- Drones: creating flying machines and learning how to operate them.
- Smart Drones: Artificial intelligence-based drone modeling.
- Working with devices that rely on automatic control is known as autopilot techniques.

- Fair of Innovative Ideas: displays of student-conceived projects.
- Techno Fest is an annual festival dedicated to creative technology.
- Master workshop: planning hands-on lessons in collaboration with regional specialists.

Students' technological thinking abilities and capacity for autonomous decision-making in problem-solving scenarios are enhanced by the content-technology component, which allows them to apply their theoretical knowledge to real-world scenarios.

IV. The component of summative evaluation. This element is crucial for assessing the model's efficacy. The following is a description of the assessment criteria and achievement levels:

1.Evaluation standards:

Empirical stage: the pupil's capacity to perform simple tasks and adhere to directions. The capacity to replicate a product from a sample is known as the reproductive stage. Productive stage: the capacity for autonomous thought and the development of novel products and solutions.

2. Formation levels:

The student's early proficiency with technology is non-standard.

Constant search: the requirement and work required to carry out independent research.

Creativity: the capacity to adopt an original strategy and produce cutting-edge goods. In addition to identifying each student's unique accomplishments, this assessment component reviews and enhances instructional strategies.

V. The model's anticipated outcomes: Students in primary school will acquire the following competencies as a result of the instructional and hands-on activities planned using this model:

Understanding and utilizing contemporary tools and technologies is known as technological literacy.

Promoting and putting new ideas into practice is known as innovative thinking. Creativity and an engineering approach: the capacity to think in terms of projects and come up with technical answers to current issues.

Conclusion

In conclusion, the model-based techniques were recreated in a didactic-motivational setting that encourages creativity during elementary school. In order to foster the capacity to compare psycho-didactic coordination mechanisms, meta-skills, and differential approaches based on interactive communication (feedback) in the development of students' creative activity, an individualized educational approach that was customized to the student's personal development trajectory was used in this case. Through extracurricular activities, a collection of engaging didactic materials was also developed with the goal of fostering transformative pedagogical competencies in a sociocultural setting, including autonomous thought, unconventional decision-making, and self-expression. The adaptive model balanced the aesthetic, ethical, and career-guiding potential of extracurricular activities by integrating "technology + education + creative environment." Students are conceptually improved by the algorithm for their spiritual and personal development.

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