

ABSTRACT

of the dissertation of PhD doctoral student
of the educational program
8D01301 – “Pedagogy and Methodology of Primary Education”
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on the topic:

“Development of Cognitive Interest of Primary School Students through Teaching Robotics”

Research topic: Development of cognitive interest of primary school students through teaching robotics.

Research objective: To provide a theoretical and methodological justification for the development of primary school students’ cognitive interest through teaching robotics, to develop an appropriate methodology, to experimentally verify its effectiveness, and to formulate scientifically grounded recommendations.

Research objectives:

- to determine the theoretical and methodological foundations for the development of primary school students’ cognitive interest through teaching robotics;
- to identify the pedagogical conditions for the development of primary school students’ cognitive interest through teaching robotics;
- to develop a structural and content-based model for the development of primary school students’ cognitive interest through teaching robotics;
- to design a methodology for developing primary school students’ cognitive interest through teaching robotics, to verify its effectiveness through experimental research, and to analyze the results.

Research methods: theoretical methods – theoretical analysis and systematization of scientific-pedagogical and psychological literature, conceptual and content modeling, comparative analysis, inductive and deductive reasoning, analysis of нормативтік documents and methodological guidelines related to the use of educational robotics, and content analysis; empirical methods – questionnaires, observation, interviews, diagnostics, analysis, comparison and generalization of the results of robotics lessons and project-based activities; quantitative and qualitative processing of the results of the pedagogical experiment, percentage comparison, dynamic diagramming, as well as mathematical and statistical analysis and interpretation of the obtained data.

Main provisions submitted for defense:

- the development of primary school students’ cognitive interest through teaching robotics is theoretically considered as the interconnection of the ideas of cognition, interest, activity, and developmental learning; “cognition is an internal intellectual mechanism that, in the process of learning activity, ensures not only the acquisition of new knowledge but also its meaningful understanding and application in various situations”; “cognitive interest is a personal characteristic

that reflects a stable internal motivation and intellectual activity of a learner aimed at acquiring, understanding, and exploring new knowledge”; “teaching robotics to primary school students is an integrated pedagogical process aimed at developing students’ cognitive, logical, and creative abilities through constructing and controlling simple robotic models”; the methodological basis of the research is formed by system, activity-based, and learner-centered approaches;

- the pedagogical conditions for the development of primary school students’ cognitive interest through teaching robotics (specific features of robotics education; consideration of students’ age-related motivation; integration with the subject “Digital Literacy”; organization of the educational environment in both material and psychological aspects; use of project-based and research tasks; application of group and individual forms of work; use of the capabilities of LEGO MINDSTORMS EV3 kits) ensure the integration of robotics content with primary education content, consideration of students’ age and psychological characteristics, systematic organization of practical and research activities, and the creation of a motivating educational environment;

- the structural and content-based model for the development of primary school students’ cognitive interest through teaching robotics represents a pedagogical mechanism for the gradual development of cognitive interest based on the logical interconnection of target, content, activity, and result blocks, ensuring the implementation of motivational, cognitive, and activity components within a unified system;

- the methodology for developing primary school students’ cognitive interest through teaching robotics includes an author-designed program for primary school students (modular structure, learning topics, system of practical tasks and projects), which has been implemented in the educational process and whose effectiveness has been proven through experimental research; the results of the experimental work demonstrated that the systematic and purposeful use of robotics contributes to an increase in the level of cognitive interest among primary school students, stabilization of their learning activity, and conscious acquisition of knowledge, on the basis of which scientifically grounded recommendations were developed.

Description of the main research results:

- the essence of the concepts “cognition,” “cognitive interest,” and “teaching robotics to primary school students” was clarified, and the theoretical and methodological foundations for developing primary school students’ cognitive interest through teaching robotics were determined;

- the pedagogical conditions for developing primary school students’ cognitive interest through teaching robotics were identified;

- a structural and content-based model for developing primary school students’ cognitive interest through teaching robotics was developed;

- a methodology for developing primary school students’ cognitive interest through teaching robotics was designed, and its effectiveness was verified through experimental research.

Justification of the novelty and significance of the obtained results:

1. during the study, the scientific and theoretical foundations for developing primary school students' cognitive interest through teaching robotics were уточнены, and this issue was comprehensively examined within the context of educational robotics;
2. the pedagogical conditions and the structural and content-based model for developing primary school students' cognitive interest through teaching robotics were developed, and their interrelationship was scientifically substantiated;
3. a methodology for developing primary school students' cognitive interest through teaching robotics was designed, and its effectiveness was confirmed through experimental research.

Practical significance of the research:

The practical significance of the study is determined by the development of an author-designed program based on the use of educational robotics aimed at enhancing primary school students' cognitive interest, as well as by the experimental verification of its effectiveness through a pedagogical experiment. The proposed author's program was developed and tested within the framework of the "Educational Robotics" project implemented at I. Zhansugurov Zhetysu University under the grant funding competition for the commercialization of scientific and (or) scientific-technical results "Jas galym 2024," which confirms its practical value and applied nature.

The proposed structural and content-based model, the author's program, and the teaching and methodological materials can be used by primary school teachers, robotics club instructors, and institutions of supplementary education to effectively apply robotics in primary school settings as a motivational and pedagogical tool for enhancing students' cognitive interest.

Compliance of the research with directions of scientific development or state programs:

The research fully complies with the key regulatory and legal documents governing the development of the education system in the Republic of Kazakhstan. In particular, the content of the study aligns with the updated secondary education curriculum standards, model curricula for primary education, as well as the requirements of the regulatory documents: "On approval of the State Compulsory Standards for Preschool Education and Training, Primary, Basic Secondary and General Secondary, Technical and Vocational, and Post-secondary Education" (Resolution of the Ministry of Education of the Republic of Kazakhstan dated January 23, 2025) and "State Compulsory Standards for Preschool Education and Training, Primary, Basic Secondary, General Secondary, Technical and Vocational, and Post-secondary Education" (Order No. 12 of the Minister of Education of the Republic of Kazakhstan dated January 23, 2025), as well as "On approval of model curricula for general education subjects, elective courses, and optional subjects for general education organizations."

The results of the study are consistent with the objectives outlined in these standards, particularly in terms of developing students' functional, research, and digital competencies.

Description of the Doctoral Candidate's Contribution to Each Publication: Based on the results of the research, 10 scientific papers have been published. Within the framework of the study, the following 10 publications were made:

1. *Publication included in Scopus database:* 1. The Impact of Educational Robotics on Cognitive Outcomes in Primary Students: A Meta-Analysis of Recent Studies // *European Journal of Educational Research*. – 2023. – Vol. 12, №4. – P. 1683–1695. – DOI: 10.12973/eu-jer.12.4.1683. – URL:

<https://www.scopus.com/pages/publications/85168263336> The doctoral student's contribution to writing the article is 75% (co-authors: Ybyraimzhanov K.T. – 10%, Naubayeva Kh.T. – 5%, Mamekova A.T. – 5%, Almukhambetova B.Zh. – 5%).

2. *Articles published in journals recommended by the Committee for Quality Assurance in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan – 3 articles:*

1) Влияние курса робототехники посредством визуально-блочного программирования Scratch на вычислительное мышление младшеклассников // *ҚазҰУ Хабаршысы. Педагогикалық ғылымдар сериясы*. – 2023. – №4 (77). – Б. 101–110. – DOI: <https://doi.org/10.26577/JES.2023.v77.i4.09> The doctoral student's contribution to writing the article is 100%.

2) Бастауыш сыныпқа арналған робототехника бойынша білім беру бағдарламаларында есептеу ойлауын дамыту үшін кері байланыстың маңызы // *Л.Н. Гумилев атындағы ЕҰУ Хабаршысы. Педагогика сериясы*. – 2024. – №3 (148). – Б. 123–136. – DOI: <https://doi.org/10.32523/2616-6895-2024-148-3-122-136> The doctoral student's contribution to writing the article is 70% (co-authors: Ybyraimzhanov K.T. – 20%, Mamekova A.T. – 10%).

3) Влияние образовательной робототехники на академическую успеваемость учащихся начальной школы // *3i: intellect, idea, innovation – интеллект, идея, инновация*. – 2024. – №4. – Б. 263–270. – DOI: https://doi.org/10.52269/22266070_2024_4_263 The doctoral student's contribution to writing the article is 70% (co-authors: Ybyraimzhanov K.T. – 20%, Mamekova A.T. – 10%).

3. *Author's program: “Білім беру робототехникасы бойынша жобалық қызметті ұйымдастыру”* – 2023. – Recommended for implementation. The doctoral student's contribution – 100%.

4. *Articles published in international and national editions – 5 publications:*

1) Development of robotics in elementary school // *Proceedings of International Scientific-Practical Conference «Sustainable Development Goals: Youth Policy and Innovative Technologies»*. – Ashgabat, Turkmenistan, 15–16 February 2023. – P. 106–108. – DOI: <https://doi.org/10.5281/zenodo.7782633> The doctoral student's contribution – 100%

2) Бастауыш сынып оқушыларының қызығушылығын робототехниканы оқыту арқылы арттыру // *І. Жансүгіров атындағы Жетісу университетінің Хабаршысы*. – 2022. – №1. – Б. 141–145. The doctoral student's contribution – 100%.

3) Развитие образовательной робототехники: тенденции и перспективы // *Бизнес и общество*. – 2024. – №4 (44). – Б. 1–6. – URL: https://business-society.ru/publ/2024/4_44/razvitie_obrazovatelnoj_robototekhniki_tendencii_i_perspektivy/64-1-0-1604 The doctoral student's contribution to writing the article is 100%.

4) Преподавание робототехники в начальной школе: инновационный подход // *Актуальные проблемы науки и образования: материалы международного форума, посвященного 300-летию Российской академии наук*. – 12–13 декабря 2022 г. The doctoral student's contribution to writing the article is 100%.

5) Lego wedo 2.0 жиынтығын қолдана отырып, бастауыш сынып оқушыларына "білім беру робототехникасы" бағытын жүзеге асыру ерекшеліктері. *Университеттің 50 жылдығына арналған «Болашақ ұрпағы: ғылым мен білімнің тәжірибесі мен болашағы» атты халықаралық ғылыми-тәжірибелік конференция материалдары*. Талдықорған, 21 қазан – 2022. 264-268 бб. The doctoral student's contribution to writing the article is 80% (co-author: Medera Xalmatov – 20%).