

ANNOTATION

**of the doctor of philosophy (PhD) dissertation in the field of specialty
8D01503: "Training of a Computer Science Teacher"**

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Research topic: Scientific and methodological foundations of teaching programming to primary school students.

Purpose of the research study is to create a technique grounded in science and a collection of methodological resources for teaching primary school pupils programming in a way that fosters the growth of their computational thinking.

Principal goals of the research:

- examine the current state of primary school programming instruction as well as scientific and methodological approaches;
- investigate the characteristics of young children's psychological and cognitive development and how they relate to computational thinking;
- create methods for teaching programming to primary school students based on scientific principles and provide a set of methodological tools with instructional materials;
- test the methodology's efficacy experimentally by teaching primary school students the "Scratch Programming Environment" course as an example.

Research methods:

- theoretical methods (analysis, synthesis and systematization of pedagogical, psychological and scientific-methodological literature, dissertations, monographs, educational standards, legal documents, materials on the research topic);
- empirical methods (observation, testing, formulation and surveys);
- mathematical and statistical methods of data processing obtained during experimental studies.

Scientific novelty of the research:

- the characteristics of primary school-aged children's psychological and cognitive development and their relationship to computational thinking were examined; new techniques and instruments were suggested for researching the psychological aspects of learning to program;
- a review of the state of teaching programming in primary schools and existing scientific and methodological approaches was made, with a focus on identifying their main advantages and disadvantages;
- a methodology for teaching programming and a collection of teaching aids have been established, taking into account contemporary scientific facts and extensive pedagogical expertise, in an effort to spark students' interest in programming in primary school: The "Scratch Programming Environment" textbook is used to teach programming to primary school students. The Baldyrgan website is

an informational and educational space that was made possible with the assistance of Ispring Suit. The "Scratch Programming Environment" optional course program consists of a series of exercises and tasks designed to foster computational thinking skills in students.

-practical testing has been done to determine the efficacy of the approach for teaching programming to primary school pupils, with the "Scratch Programming Environment" course serving as an example.

The study's theoretical contributions include supporting the notion that teaching programming to primary school students is necessary to help them develop computational thinking skills and elucidating the specific features of activity organization that should be considered when teaching programming to students of different ages.

The development of a "Scratch Programming Environment" course, the identification of techniques for measuring and tracking learning outcomes, the identification of scientific research and application techniques, and the establishment of an information-based learning environment for teaching programming to primary school pupils are where the research finds **practical application**.

Basic principles recommended for the thesis defence:

- theoretical foundations of teaching programming to primary school students;
- methods of teaching programming to primary school students in the Scratch environment;

- a series of methodological tools that heighten students' interest in programming include the textbook "Scratch Programming Environment," which is used to teach programming to primary school students, the Baldyrgan website, which provides information and an educational environment made possible by Ispring Suit, and the optional course program "Scratch Programming Environment," which consists of a set of exercises and tasks designed to foster computational thinking in students.

The reliability of the research results is based on a review of scientific, theoretical and methodological literature devoted to the research problem. Analysis of several strategies for solving the issue of teaching programming to primary school pupils utilizing a range of techniques that are relevant to the study's focus and topic. Using statistical techniques for data processing, the study's initial hypotheses were supported by the experimental study results.

Publications based on research results. There have been 19 published works on the dissertation's subject matter in total. These include 2 publications in journals listed in the Scopus and Web of Science databases, 4 scientific publications suggested by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan, 6 collections of international scientific and practical conferences (Kazakhstan, Russia), and 3 publications in scientific journals. There are two copyright certificates and two textbooks. The following scholarly journals published the research findings:

1. Digital Learning Ecosystem: Current State, Prospects, and Hurdles. Open Education Studies, vol. 5, no. 1, 2023, pp. 20220179. <https://doi.org/10.1515/edu-2022-0179>

2. The Impact of “Scratch” on Student Engagement and Academic Performance in Primary Schools. Open Education Studies, Publisher: Walter de Gruyter, CiteScore 2022: 1.8, 64 th percentile. March 15, 2024; 6: 20220228, <https://doi.org/10.1515/edu-2022-0228>

In works suggested by the Ministry of Education and Science of the Republic of Kazakhstan's Committee for Quality Assurance in the Field of Science and Higher Education:

3. Scratch programming environment in primary school // BULLETIN Toraigyrov University, Pedagogical section. № 4 (2021) Pavlodar, p. 159-171. <https://doi.org/10.48081/UESM3539>

4. Creative teaching of computer science in primary school. International scientific journal «Science and life of Kazakhstan». №12/7 (153) 2020

5. Information and educational environment for “Scratch” and “Robotics” courses in primary school: features and relevance // Bulletin «News of Abalaikhan University», Volume 68 № 1, 2023, p. 254-270. <https://bulletin-pedagogical.abalaikhan.kz/index.php/j1/article/view/739/247>

6. Using interactive videos and tasks in an information education environment. «National Academy of Sciences of the Republic of Kazakhstan » «KHALYK» Bulletin, 5 (405) September-october 2023, стр. 60-71

Research articles printed in international and Kazakh scientific journals:

7. Research of the information and educational environment in primary schools in the context of smart education. The scientific heritage (Budapest, Hungary) VOL 4, No 63 (63) (2021). DOI:10.24412/9215-0365-2021-63-4-17-23

8. Information and educational environment for Scratch and Robotics courses in primary school: features and relevance. Sciences of Europe (Praha, Czech Republic. No 107 (2022). P.82-89. <https://doi.org/10.5281/zenodo.7479758>

9. The possibilities of using ispring in teaching Scratch programming to primary school students. Eurasian Journal of Researches in Social and Economics (EJRSE), V. 10, 2023, pp. 143-156

Materials from international scientific and practical conferences:

10. On the development of an information and educational environment in primary school in the context of SMART education. Pedagogical education: history of formation and vectors of development (to the 100th anniversary of the opening of the pedagogical faculty at the 2nd Moscow State University). International scientific and practical conference. Moscow, October 14 – 15, 2021.

11. State and prospects for the development of computer science in primary school of the Republic of Kazakhstan // MNPIC “Current problems of methods of teaching computer science and mathematics in modern school”, April, 18–24, 2022

12. Formation of information culture of schoolchildren based on the information educational environment. //“ Proceedings of the MNPK “Auezov Readings–20: The heritage of Mukhtar Auezov is the nation property” Dedicated to the 125th anniversary of M.O. Auezova, Shymkent,-2022.

13. SMART educational environment in “Scratch” and “Robotics” courses in primary school. Development and use of information educational environment // Collection of materials of the IX International Forum on Teacher Education, Karaganda–Kazan, May 24, 2023, p. 176-181.

14. Problems of teaching programming to primary school students // VII International Congress of Turkic Mathematicians. Section "Modern challenges of information technology use in education"

15. Informatization of primary education in Kazakhstan //VII International Congress of Turkic Mathematicians. Section "Modern challenges of information technology use in education"

Educational and methodological manuals:

16. Scratch Jr programme. Tutorial. - Shymkent, 2022. - 90 p.

17. The environment for Scratch programming. A textbook meant for pupils in primary school. Instrument for education. Shymkent, 2023- 133 p.

Certificates of copyright:

18. Information educational environment “Scratch” (for primary school students). Certificate of information submission into the state registry of copyright-protected goods. 10.10.2022. - № 29312.

19. Scratch programming environment. Textbook for primary school students. Certificate of information submission into the state registry of copyright-protected goods. 12.10.2023. - № 39595.

The dissertation is organized as follows: an introduction, two chapters, a conclusion, a list of references, and applications comprise the research effort.