

## ANNOTATION

**of the doctor of philosophy (PhD) dissertation in the field of specialty  
8D01503-"Teacher training of Computer Science"**

**Belessova Damira Tursynkhanovna**

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

**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, to put them into practice.

**Scientific hypothesis of the study:** if the theoretical foundations of programming teaching are defined, contributing to the development of computational thinking of primary school students, and a methodology and a set of tools for its implementation are developed and implemented in the educational process, then students will increase their interest in programming and improve 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 status of teaching programming in primary grades has been determined and the meaning of the concepts of "Information educational environment" and "Computational thinking" has been clarified;
- the features of the development of computational thinking in children of primary school age are determined, the principles, structure and content of the

creation of educational materials for the course "Scratch programming Environment" are determined;

-a methodology for teaching programming to primary school students has been developed, taking into account modern scientific data and advanced pedagogical experience; a set of tools has been developed to increase their interest in programming: the textbook "Scratch Programming Environment"; the «Baldyrgan» website for teaching programming to primary school students; an information educational environment created using the Ispring Suit program; an optional program the course "Scratch Programming Environment"; a system of exercises and tasks for the formation of computational thinking skills when teaching programming to primary school students.

- using the example of the course "Scratch Programming Environment", the effectiveness of the methodology of teaching programming to primary school students has been tested.

**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 in elementary grades and characteristics of the concepts of "Information educational environment" and "Computational thinking";

- features of the development of computational thinking in primary school children, principles, structure and content of creating educational materials for the course "Scratch programming environment";

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

-a set of tools that increase students' interest in programming: the textbook "Scratch Programming Environment"; the website "Baldyrgan" for teaching programming to primary school students; an information educational environment created using the Ispring Suit program; an optional program of the course "Scratch Programming Environment"; a system of exercises and tasks for the formation of computational thinking skills in teaching programming of primary school 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. – 2023. – Vol.5(1). – P. 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. – 2024. – Vol.6(1). – P. 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. Problems of teaching Scratch programming environment in elementary 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. p. 260-264.

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, сtp. 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. – 2021. - Vol. 4, No.63. – P.17-23. 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. – P.1506-1513.

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. Moscow. – P.684-691.

12. Formation of information culture of schoolchildren based on the information educational environment. //“ Proceedings of the MNPК “Auezov Readings–20: The heritage of Mukhtar Auezov is the nation property” Dedicated to the 125th anniversary of M.O. Auezova, Shymkent,-2022. – T.10. – P.63-65

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 // Materials of the VII World Congress of Turkic World Mathematicians. – Turkestan, 2023. – P.III. – P. 47-53.

15. Informatization of primary education in Kazakhstan // Materials of the VII World Congress of Turkic World Mathematicians. – Turkestan, 2023. – P.III. – P. 202-213.

### **Educational and methodological manuals:**

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

17. The environment for Scratch programming. A textbook meant for pupils in primary school. Tutorial. 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.

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