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Preparing Pedagogy Students for Teaching Programming in Early Childhood Education

Abstract

The article discusses the competencies of modern teachers in utilizing information and communication technologies, particularly in the context of programming. The main objective of the research was to assess the knowledge and skills of future early childhood education teachers in applying this knowledge to practical tasks. The study was conducted among students from two public universities in Poland using a diagnostic survey method, with a questionnaire based on a knowledge test as the research tool. The test design was based on the theoretical assumptions of Niemierko (2009) regarding educational objectives An analysis of the results showed that future early childhood education teachers possess theoretical knowledge of programming. However, only 35% of them were able to explain programming principles in detail. The application of this knowledge in practice was less effective, with success rates of 45% for typical tasks and 47% for problem-solving tasks. These results suggest the need to modify study programs by increasing the number of hours dedicated to programming-related subjects and placing greater emphasis on solving programming tasks through practical experience. Based on the conducted research and observations, the authors propose increasing the number of hours dedicated to programming-related topics. This approach would allow students not only to acquire theoretical knowledge but also to effectively apply it to practical tasks. After all, future teachers will be responsible for introducing students in grades 1–3 to the world of programming and developing their computational thinking. Another important aspect is ensuring a teacher education and training system that enables teachers to develop and deepen their digital competencies in programming. New technological solutions emerge rapidly, and teachers should keep up with them to adequately prepare students for future challenges and foster skills such as problem-solving and logical thinking. The authors also suggest that further research is needed on various components of digital competencies to help future teachers adapt pedagogical programs to the realities of the modern world and equip them with the necessary knowledge and skills.

Keywords: competencies, early childhood education, higher education, programming teacher

Basic Research

The ongoing digitalization and development of artificial intelligence require advanced technological and IT skills. These competencies are crucial for receiving, creating, and utilizing information in everyday life. Generation Alpha students develop these skills at school with the help of teachers, who should also possess such competencies. However, research indicates that educators still prefer traditional pedagogical methods over integrative technology. It is important to note that studies confirm the effectiveness of using modern technologies in teaching (Adebanjo & Rasheed, 2021; Konca & Erden, 2021) and learning processes (Bitante et al., 2017).

Mikulski (2017, p. 280) emphasizes that programming skills are only a part of the broader digital and media competencies. The ubiquity of communication technologies means that the quality of life in modern society increasingly depends on the ability to understand and use information conveyed through the media. Programming should be understood not only as building algorithms but also as exercises that foster computational thinking, which is based on problem-solving using digital tools. This is a key skill for individuals of all ages as its absence can lead to media illiteracy (Rzońca & Warchoł, 2023).

To prepare students for programming, early childhood education teachers must possess the appropriate competencies. Research findings indicate that teachers still combine modern technologies with traditional resources (Peirats et al., 2018), often without fully realizing their value for professional development (Jack & Higgins, 2019). Therefore, it is important to emphasize the significant role of teachers in creating a learning environment that integrates information and communication technologies. When working with digital resources, teachers act as designers, deciding whether to create their own materials and how to adapt them to their students' needs (Gallardo et al., 2019). Thus, their media competencies and willingness to expand knowledge in this area, as well as incorporating technology into the teaching process, are crucial.

Hayak & Avidov-Ungar (2020), based on their research, discovered a relationship between a teacher's career stage and their attitude toward technology integration. Meanwhile, Alieto (2024) argues that the use of technology correlates with teachers' technological competencies and access to devices. Based on research conducted by Adebanjo & Rasheed (2021), it is recommended to organize training programs on the latest technologies for early childhood education teachers.

Programming has become a fundamental skill for teachers in the modern educational environment. It not only enriches teaching practices but also equips students with key skills essential for success in a technology-driven world. By engaging in programming education, teachers can nurture a generation of students who are not only proficient in coding but also capable of problem-solving and analytical thinking – skills that are becoming increasingly important in the 21st century.

An example of such an initiative is the program in Latvia titled "Fundamentals of Programming in a Visual Programming Environment Using Scratch," aimed at enhancing teachers' professional competencies. The program's results indicated that teachers positively evaluated the area related to learning programming. According to the surveyed teachers, the program significantly improved their knowledge of programming as well as their overall digital competencies (Medveckis, Pigozneb & Tomsons, 2021).

This article focuses on assessing teachers' preparedness in terms of their knowledge and skills in programming, which serves as a modern foundation for the further learning of preschool and early childhood education students.

Teachers' Technological and Information Competencies

Teacher competencies in the context of programming education, as indicated by Jolanta Szempruch (2013), are primarily: interpretative-communicative, creative-critical, cooperative, pragmatic, and information-media competencies.. In the context of research on the preparation for teaching programming in grades 1–3, media competencies are particularly significant. Their importance was highlighted during remote education due to the COVID-19 pandemic. Therefore, students in pedagogical fields should be prepared to use media, including programming. However, it is crucial to emphasize that due to the rapidly evolving technological landscape, digital skills must be continuously developed throughout a teacher's professional career.

Competencies can be defined as broad attributes related to the ability to use knowledge, social skills, and/or methodological approaches in professional or educational settings, as well as in personal and professional development (EU Science Hub). It is important to remember that individuals acquire competencies through learning, meaning they can be developed, updated, and evaluated by others through observation.

Focusing on teachers' competencies, the literature on the subject defines them as "a cognitive structure composed of knowledge, skills, personality traits, and values that characterize a teacher in performing professional tasks, manifest in specific behaviors, are subject to development, and are measurable" (Szempruch, 2013, p. 103). Thus, competency, as a human attribute, consists of several elements. From this definition, we can conclude that it includes knowledge, skills, personality traits, and values. Figure 1 illustrates the components of competencies, emphasizing the complexity of this individual disposition.

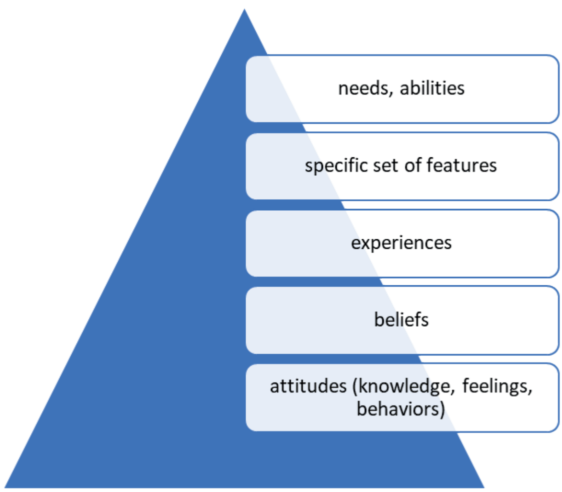

Figure 1. Components of Competencies

Source: Own elaboration based on Popławska, 2016.

Teachers' competencies are multifaceted and encompass not only subject-specific, didactic, psychological, and organizational skills but also leadership and mentoring abilities. A modern teacher must be not only an expert in their field but also an effective leader, mentor, and organizer of the educational process. The development of these competencies is crucial for ensuring high-quality teaching and supporting students on their path to academic success.

In the context of teacher competencies, it can be stated that teacher education programs form the foundation for acquiring these skills, followed by a lifelong learning process.

The authors of this article focused on the preparation of teachers for teaching programming at two public universities. Given the structure of the research process, it is necessary to specify the course names taught at these universities, where information and technology competencies are particularly emphasized.

At the University of Warsaw, these courses include:

- Fundamentals of Computer Education (30 hours)
- Methodology of Computer Education and the Use of Information and Communication Technologies (45 hours)
- Fundamentals of Programming and Media Education (45 hours)

At the University of Rzeszów, the relevant courses include:

- Media Education with Elements of Programming (30 hours)
- Computer Science (45 hours)
- Methodology of Computer Education and the Use of Information and Communication Technologies (30 hours)

These data come from the curriculum for students who began their studies in the 2019/2020 academic year as this group participated in the research conducted by the authors.

It is also important to recognize that the use of new technologies should be integrated into other courses so that future teachers can effectively utilize new media in their work, not just during computer science classes.

Programming is an essential component of digital competencies, which is reflected in the course titles. Therefore, it is crucial to equip future early childhood educators with the knowledge and skills needed for programming as they will be responsible for teaching these concepts in alignment with curriculum guidelines.

Analysis of the Curriculum in the Field of Programming in Early Childhood Education

The new curriculum, introduced in Poland in September 2017, placed a significant emphasis on teaching computer science in primary schools, as well as on the essential development of basic programming skills in early education. In early childhood education, computer education focuses on understanding, analyzing, and solving problems, programming, using computers and other digital devices to solve problems, as well as computer networks (Regulation of the Minister of National Education, 2017, p. 44).

Preparing students for programming in early education can be achieved through logical sequencing of images, texts, and instructions that include everyday activities, creating instructions or sequences of instructions for specific action plans leading to goal achievement, solving tasks, puzzles, and riddles that lead to discovering algorithms (Regulation of the Minister of National Education, 2017; Przytomska-Pietrzak, 2017). Various tools are used for such activities, including direct block programming or educational games that introduce fundamental programming concepts.

In this context, different lesson scenarios are implemented in various environments, requiring students to apply the knowledge they have acquired. The result is the development of competencies related to problem formulation and resolution, as well as the acquisition of independent thinking skills. Lessons in such formats allow students to actively explore their surrounding reality while fulfilling educational functions. Students become active researchers and discoverers, conducting analyses, generating various concepts, verifying their correctness, moving to the implementation stage, developing solutions, and drawing conclusions from this process (Nowak-Łojewska, 2015, p. 45).

Activating programming competencies through practical activities is considered one of the most effective approaches to the learning process, and its effectiveness is high (Educational Research Institute, 2013, p. 55). At the early education level, students develop their programming skills using digital devices, where they visually program simple situations or stories according to their own ideas and concepts developed in collaboration with other students. They program both individual commands and their sequences, controlling an object on a computer screen or another digital device (Regulation of the Minister of National Education, 2017, p. 44).

The activities undertaken by students in early childhood education aim to prepare them for creating programmable structures designed according to strictly defined rules and principles. According to the curriculum, by the end of early childhood education, students should be able to create commands or sequences of commands for a specific action plan leading to goal achievement, solve tasks, puzzles, and riddles that lead to discovering problem-solving methods, thereby creating simple algorithms (Morańska, 2018, pp. 39–40).

Methodology

Based on a review of the literature in this field and the authors' own observations, the following research questions were formulated:

RQ1: Does the place of study differentiate the theoretical knowledge about programming possessed by future teachers?
RQ2: Does the place of study differentiate pedagogy students' understanding of the acquired theoretical knowledge in programming?
RQ3: Does the place of study differentiate students' skills in applying acquired knowledge to typical programming tasks – both standard and non-standard?

In the process of designing the research methodology, the following research hypotheses were formulated:
H1: Students studying in two different cities possess equal knowledge of programming.
H2: Students studying in two different cities show slight differences in their understanding of the acquired knowledge.
H3: The place of study differentiates students' skills in applying acquired knowledge to typical programming tasks – both standard and non-standard.

The research at both universities followed a similar research procedure, which involved assessing students' knowledge and skills in programming. The study was conducted using the Computer Assisted Personal Interview (CAPI) technique (Boguszewski & Hipsza, 2012, pp. 65–82).

Questionnaire, Research Objective, and Research Questions

The subject of the authors' research was the level of programming knowledge and skills among pedagogy students.

The cognitive objective was to determine the state of knowledge and the ability to apply it in practical programming tasks among students of preschool and early childhood education programs.

The practical objective was to develop guidelines for the education of future teachers in preparation for teaching programming.

The main research problem is expressed in the following question:

What is the level of knowledge and skills of pedagogy students needed to prepare students in grades 1–3 for learning programming?

The study used the diagnostic survey method within which a questionnaire was developed in the form of a knowledge and skills test. The tool was designed based on the theoretical assumptions of Niemierko's ABC Taxonomy Model of Domain B. All educational content presented in the test was structured to meet the requirements of the spiral model of education (Walat, 2010; Walat, 2017). The test consisted of 20 questions, divided into two categories, one focusing on memorized knowledge and understanding, and the other on the ability to apply knowledge to typical tasks and problem-solving. Each completed task was awarded 1 point, with a maximum possible score of 20 points.

The next step in the research procedure was sampling selection. A purposeful sampling method was used. Fourth-year master's degree students in preschool and early childhood education were selected. The respondents were informed about the research objectives and provided their informed consent to participate. The study was conducted as part of media competence development courses at two universities in Poland, in Warsaw and Rzeszów. Both universities have similar educational goals in training students for preschool and early childhood education and allocate a similar number of hours to technology and IT-related subjects during their studies.

The research sample consisted of 150 students, including both full-time and part-time students. Students from Rzeszów (UR – University of Rzeszów) accounted for 65% of the sample, while those studying in Warsaw (UKSW – Cardinal Stefan Wyszyński University in Warsaw)accounted for 35%. It is also worth noting that almost the entire research group consisted of women (99%), which reflects the feminization of the early childhood education teaching profession in Poland. Regarding place of residence, more than half of the participants lived in cities, while the remaining part resided in rural areas (Boguszewski & Hipsza, 2012, pp. 65–82).

Results and Statistical Tests

The first part of the research analysis focused on the level of knowledge retention among pedagogy students in the field of programming. This aspect of programming knowledge is crucial as it determines the effectiveness of its application in practice at higher levels.

The initial scope of the study concentrated on students' retained theoretical knowledge of programming and their understanding of it. In this section, students were required to select correct answers to the following questions:

Statement 1: What is the name of the application that allows learning programming in early childhood education?

Statement 2: What is an algorithm?

Statement 3: Loops in programming are…

Statement 4: Programming develops…

Statement Question 5: What is a variable?

Figure 2 presents the data obtained from the knowledge test, displayed in the format of the percentage share of correct answers provided by the students.

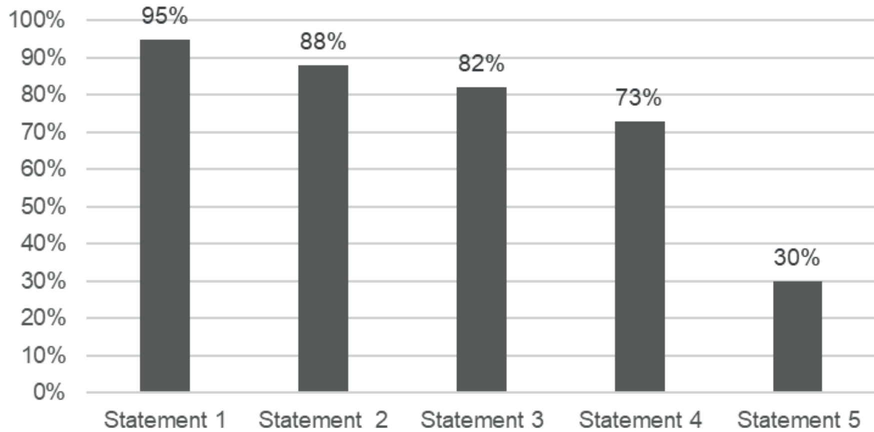

Figure 2. Percentage Share of Correct Answers in the Area of Programming Knowledge Among Future Teachers

S o u r c e: Own work.

The presented data indicate that students possess theoretical knowledge in the field of programming as the average percentage of correct answers in this area is 73%. Students do not encounter difficulties with basic definitions such as "algorithm" and "programming," but they struggle with more specialized terms such as "loop" and "variable." This may suggest that programming education at universities covers a broad range of topics but lacks depth (Tuczyński, 2021, pp. 54–65).

A comparison of correct answers divided by the two universities is presented in Figure 3.

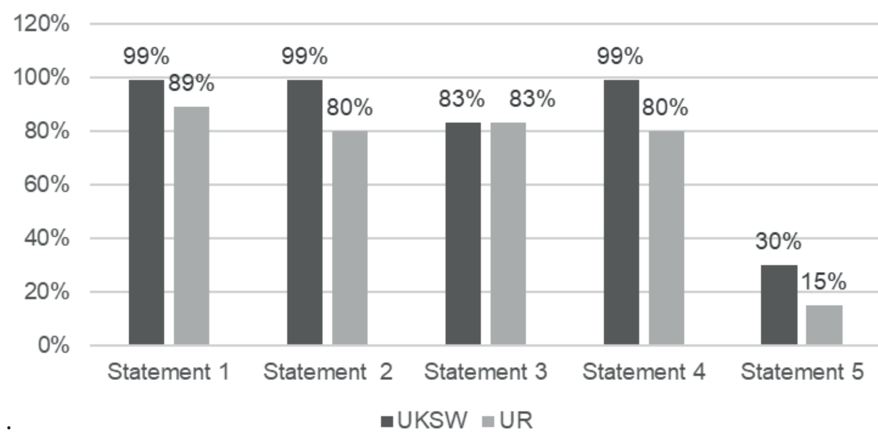

Figure 3. Comparison of the Percentage of Correct Answers in the Area of Programming Knowledge Among Future Teachers

S o u r c e: Own Work.

UKSW students achieved very high scores (99%) on most questions, which may indicate their high level of knowledge retention. UR students obtained slightly lower scores (80–89%), suggesting some difficulties in memorizing information compared to UKSW. The largest difference (19 percentage points) in favor of UKSW was observed in questions 2 and 4. The only case where both universities had the same result (83%) was the question about loops in programming.

Based on the obtained data, it can be concluded that hypothesis H1, proposed in the study, has been confirmed. This means that students studying in two different cities possess basic theoretical knowledge of programming, with better results observed among those studying in Warsaw.

The Second Part of the Research Analysis Focused on the Understanding of Programming by Pedagogy Students

The next part of the test focused on understanding programming concepts, which involved correctly interpreting and comprehending the definitions from the previous tasks. In this section, students had to choose the correct answer to the following five statements:
Statement 6: A loop always…
Statement 7: Scratch is an example of a programming language…
Statement 8: The methods of presenting algorithms used in working with children are…
Statement 9: Name some groups of blocks used to create scripts in the Scratch environment.
Statement 10: Scratch can be used for programming…

The results obtained in the study were once again presented as the percentage of correct answers given by students, as illustrated in Figure 4.

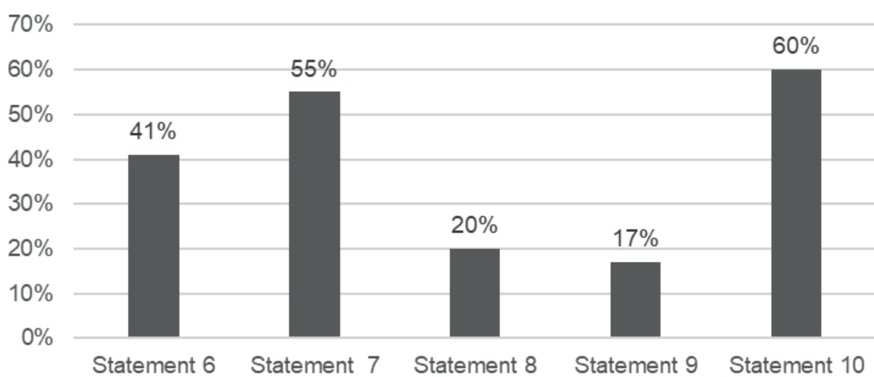

Figure 4. Percentage of correct answers in understanding programming knowledge among early childhood education students

S o u r c e: Own work.

Based on the research results, it can be concluded that the most challenging questions for students were those numbered 8 and 9. They required students to demonstrate substantive knowledge about programming methods and the classification of presented programming blocks. A significant portion of the study participants seemed to struggle with them. This may be due to the curriculum focusing more on teaching methods rather than deepening programming knowledge, possibly because of the limited number of hours allocated to subjects strictly related to programming. It appears that modern early childhood education curricula should be more closely aligned with the current educational framework, which precisely defines the directions of educational transformations at the primary education level (Borgensztajn et al., 2018). In the next stage, the responses of students from the two universities participating in the study were analyzed and presented in Figure 5.

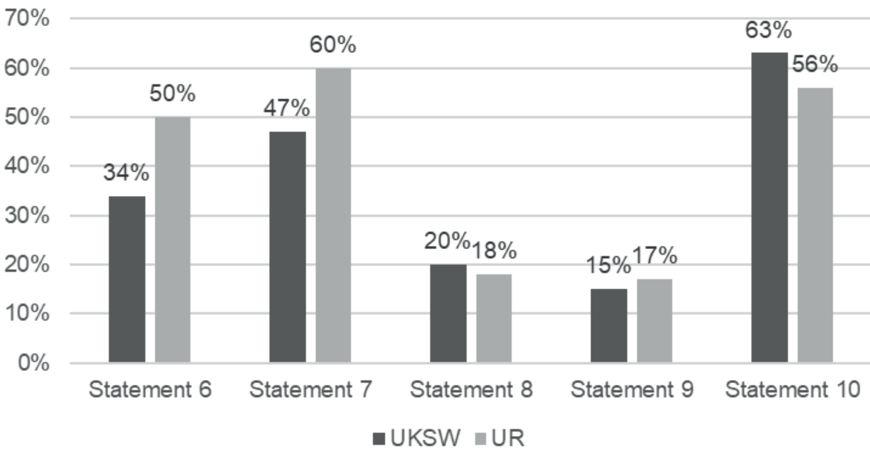

Figure 5. Comparison of the Percentage of Correct Answers in the Area of Programming Knowledge Among Future Teachers

Source: Own Work.

UR students achieved better results in statements 6 and 7, which may suggest that they have a better understanding of the topics covered there. In statements 8 and 9, the results of both universities are similar, indicating a comparable level of understanding in these areas. In statement 10, UKSW students performed better (by 7 percentage points), which may indicate that they have better assimilated the knowledge related to this topic. The largest difference (16 percentage points) in favor of UR appears in the area related to the definition of loops.

Based on the obtained data, the average score in this research area was 35%. These results can be interpreted as low and therefore insufficient for further application in practical tasks or professional work.

Hypothesis H2 has been confirmed as slight differences in the understanding of programming concepts are noticeable. The average score, in turn, indicates that students are familiar with the theoretical foundations of programming, although they struggle with understanding certain issues, such as methods of presenting algorithms used in working with children and the classification of blocks in the Scratch environment.

Analysis of Research Results on the Application of Knowledge by Future Teachers in Typical and Problem-Solving Programming Tasks

The next part of the test focused on the skills of future teachers, specifically on applying acquired knowledge to typical tasks commonly performed in computer science lessons. These tasks may involve various conditions, logical diagram structures, interpreting program modules based on given input data, etc. For this area, five additional questions were prepared, covering the following topics:
Question 11: How many times will the loop be executed in the given diagram?
Statement 12: Based on the diagram, propose what needs to be done to display the screen shown in Scratch.
Statement 13: Based on the given diagram, determine which field the ghost marked "X" will be on when executing the presented commands.
Statement 14: Based on the given suggestions, determine the correct program code for coding on the mat.
Statement 15: Based on the presented diagram, determine what the ghost will do when it detects color.

The results obtained in the study are once again presented as the percentage of correct answers given by students in Figure 6.

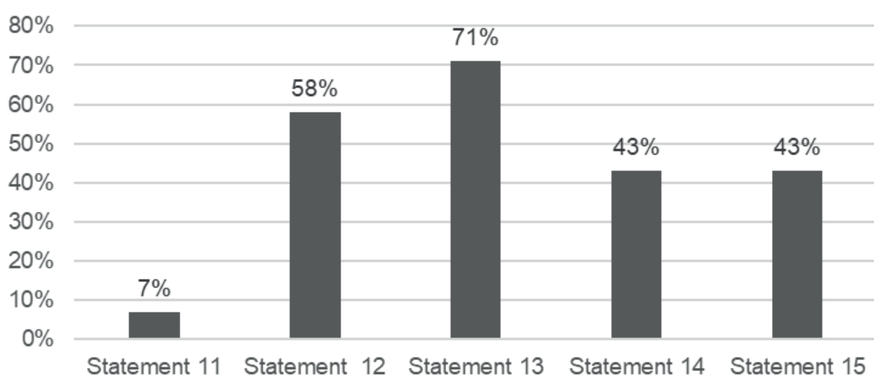

Figure 6. Percentage of correct answers regarding the application of programming knowledge by early childhood education pedagogy students in typical programming tasks

Source: Own work.

The average score for this area is 45%, which is close to 50%, indicating that approximately every second pedagogy student is able to handle tasks related to applying knowledge in typical scenarios. An exception in this area is question 11, where students had difficulty correctly calculating the number of loop iterations. Further analysis of this question reveals that most students miscalculated by one iteration. This may be due to a misinterpretation of the diagram, inaccuracies in calculations, or difficulty in understanding how the loop functions.

A comparison of student responses from both universities is presented in Figure 7.

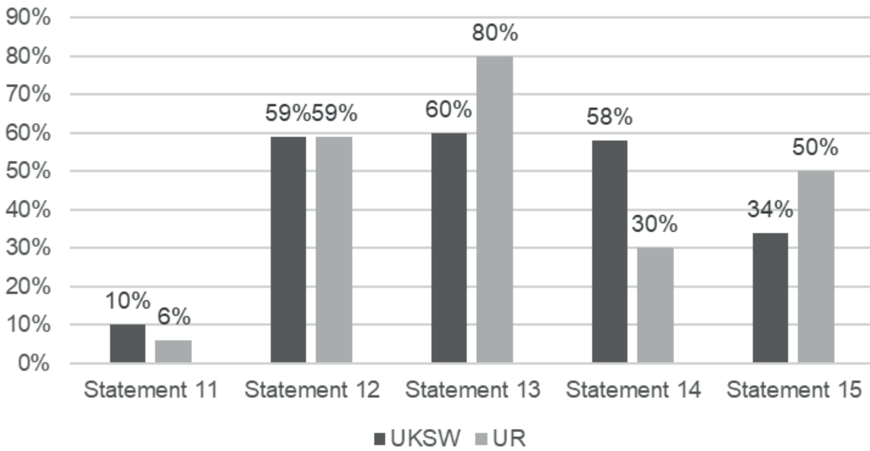

Figure 7. Comparison of the percentage of correct answers in the field of programming knowledge among future teachers

S o u r c e: Own work.

The analysis of collected data indicates that students from UKSW achieved better results in question 11 and statement14. Particularly, in the question regarding coding on a mat, the difference is significant (28 percentage points). In statements 13 and 15, UR students performed better, with the largest difference (20 percentage points) observed in identifying the field where the ghost will be after executing the given commands. It is worth noting that in statement 12, the results for both universities are identical (59%), suggesting a similar level of skills in working with the Scratch environment.

The final area of research focuses on students' ability to handle problem-solving situations, find the correct solution path for a given problem, and identify alternative ways to eliminate errors and other associations.

Once again, five statements were presented in this area:

Statement 16: Based on the diagram, determine what needs to be changed in the given program code so that the cat (ghost) can draw triangles.

Statement 17: Based on the provided code, decide what will happen if the ball touches the ballerina.

Statement 18: Analyze the given diagram and propose the role that the presented program code might play in any Scratch game.
Statement 19: Based on the provided diagram, deduce why the ghost has zero points.
Statement 20: Check the correctness of the code shown in the diagram, considering that the ghost's task is to detect red and green colors.

The results for this research area are presented in Figure 8, where the data is shown as the percentage of correct answers provided by students.

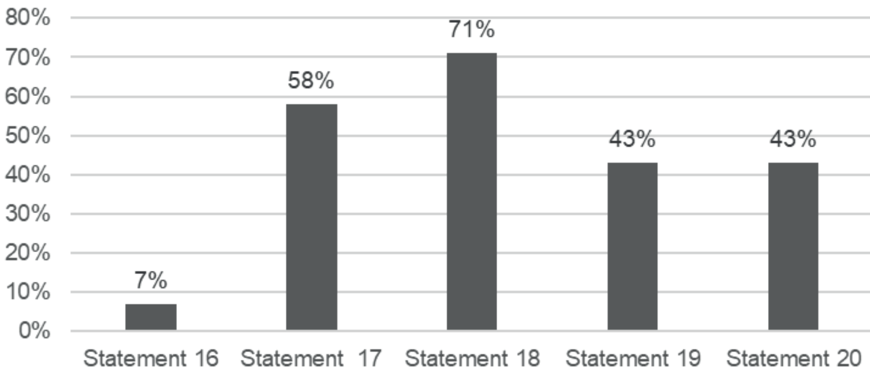

Figure 8. Percentage of Correct Answers by Pedagogy Students in Applying Programming Knowledge to Problem-Solving Tasks

Source: Own Work.

Based on the obtained data, it should be noted that only Statement 16 received a lower percentage of correct answers than the average score of 47%. This may be related to the previous conclusion regarding the application of knowledge in typical tasks, as this question also focused on the use of loops.

Statement 17, in which students demonstrated both knowledge of sensor blocks and the correct interpretation of blocks related to character control in a game, yielded results above the average.

A division of responses regarding the use of knowledge in problem-solving tasks, taking into account the place of study, is presented in Figure 9.

The obtained results indicate that UKSW students performed better in four out of five statements (16, 17, 18, and 20), with the most significant differences observed in Statement 20 (40 pp.) and Statement 16 (25 pp.). This may suggest that UKSW students are better prepared to tackle more complex practical problems.

On the other hand, UR students performed better in only one question (Statement 19), where they outscored UKSW students by 16 percentage points. The most balanced results were in Statement 18, where the difference was just 5 pp.

Therefore, based on the data on problem-solving skills in both standard and non-standard tasks, the H3 hypothesis was partially confirmed. Specifically, students studying in Warsaw performed better in problem-solving tasks. However, in typical tasks, it is difficult to determine whether the place of study significantly influences problem-solving abilities, as in one question, both groups achieved identical results. Additionally, each university's students excelled in two separate areas.

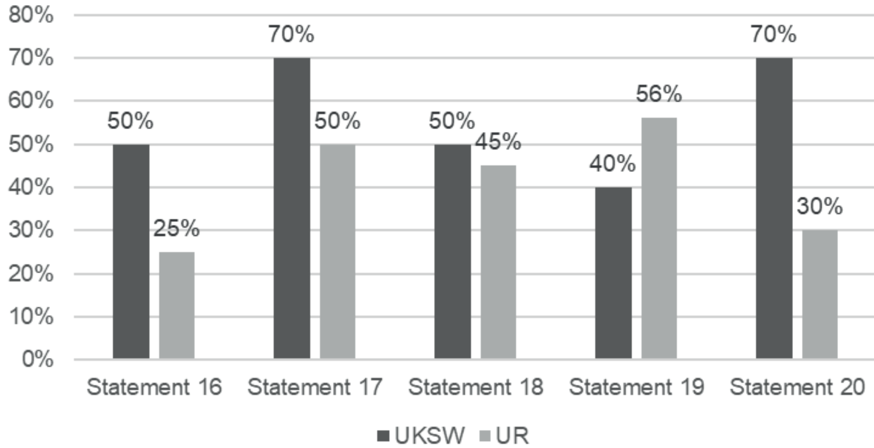

Figure 9. Percentage Comparison of Correct Answers Among Pedagogy Students in Applying Programming Knowledge to Problem-Solving Tasks

Source: Own Work.

Discussion

Programming is a part of everyone's life, and its elements such as coding are introduced as early as preschool age. In early childhood education, according to the curriculum, teachers are required to conduct programming classes as part of computer education. As a result, it has become essential to prepare teachers for this task, initially during their pedagogical studies and later through professional development programs.

Future teachers demonstrated theoretical knowledge of programming but encountered difficulties with more specialized topics. It is worth noting that one in two students is capable of applying their acquired knowledge in practice and correctly solving both typical and non-typical programming tasks.

Based on the presented research, it can be concluded that students are prepared in terms of knowledge and skills to teach programming in grades 1–3. Hypotheses 1 and 2 were fully confirmed, while hypothesis 3 was partially confirmed. This indicates differences based on the place of study, which may be due to variations in the number of hours allocated to programming-related topics at the two universities.

However, it is clear that more effort should be made to improve students' understanding of programming methods and the classification of programming blocks. Greater emphasis should be placed on applying acquired knowledge rather than just memorizing it.

Recommendations and Further Research

Based on the conducted research and observations, the authors propose increasing the number of hours dedicated to programming-related topics. This would allow students to better understand the acquired knowledge and apply it more effectively in practical tasks. Ultimately, future teachers are responsible for introducing students in grades 1–3 to programming and fostering their computational thinking skills.

It is also crucial to establish a system of education and training for teachers, enabling them to develop and deepen their digital competencies in programming. As new technological solutions continue to emerge, educators must stay up to date to prepare students for future challenges and help them develop fundamental skills such as problem-solving and logical thinking.

Further research should be conducted on various components of digital competencies for future teachers. This would allow for the adaptation of the teacher training curriculum and ensure that educators are equipped with the necessary knowledge and skills to effectively teach programming in early childhood education.

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Przygotowanie uczniów do nauczania programowania w edukacji wczesnoszkolnej

Streszczenie

Artykuł omawia kompetencje współczesnych nauczycieli w zakresie wykorzystania technologii informacyjno-komunikacyjnych, szczególnie w kontekście programowania. Głównym celem badań było ocenienie wiedzy i umiejętności przyszłych nauczycieli edukacji wczesnoszkolnej w zakresie stosowania tej wiedzy w praktyce. Badania przeprowadzono w grupie studentów dwóch uczelni publicznych w Polsce, wykorzystując metodę sondażu diagnostycznego, a narzędziem badawczym była ankieta oparta na teście wiedzy. Konstrukcja testu została oparta na założeniach teoretycznych B. Niemierki, dotyczących celów nauczania.

Analiza wyników wykazała, że przyszli nauczyciele edukacji wczesnoszkolnej posiadają wiedzę teoretyczną z zakresu programowania, jednak tylko 35% z nich potrafiło dokładnie wyjaśnić zasady programowania. Zastosowanie tej wiedzy w praktyce okazało się mniej efektywne, z wynikami na poziomie 45% dla zadań typowych i 47% dla zadań związanych z rozwiązywaniem problemów. Te wyniki sugerują konieczność modyfikacji programów studiów, aby zwiększyć liczbę godzin poświęconych przedmiotom związanym z programowaniem oraz większy nacisk na rozwiązywanie zadań programistycznych poprzez doświadczenie praktyczne.

Na podstawie przeprowadzonych badań oraz obserwacji, autorzy proponują zwiększenie liczby godzin poświęconych tematom bezpośrednio związanym z programowaniem. W ten sposób studenci będą mieli możliwość nie tylko przyswajać teoretyczną wiedzę, ale również skutecznie ją stosować w praktycznych zadaniach. W końcu to właśnie przyszli nauczyciele będą odpowiedzialni za wprowadzenie uczniów klas 1–3 w świat programowania oraz rozwijanie ich myślenia obliczeniowego.

Ważnym elementem jest także zapewnienie systemu kształcenia i szkoleń dla nauczycieli, który umożliwi im rozwój i pogłębianie kompetencji cyfrowych w zakresie programowania. Nowe rozwiązania technologiczne pojawiają się w szybkim tempie, a nauczyciele powinni nadążać za nimi, aby odpowiednio przygotować uczniów do przyszłych wyzwań i rozwijać u nich umiejętności takie, jak rozwiązywanie problemów i myślenie logiczne.

Autorzy sugerują również, że konieczne są dalsze badania nad poszczególnymi komponentami kompetencji cyfrowych przyszłych nauczycieli, aby dostosować programy pedagogiczne do realiów współczesnego świata i wyposażyć je w niezbędną wiedzę oraz umiejętności.

S ł o w a   k l u c z o w e: kompetencje, wczesna edukacja dzieci uczenie się na poziomie edukacji wyższej, nauczanie programowania

Ewelina Rzońca, Tomasz Warchoł

Preparación de los estudiantes de pedagogía para enseñar programación en la educación infantil temprana

R e s u m e n

El artículo discute las competencias de los docentes contemporáneos en el uso de las tecnologías de la información y la comunicación, particularmente en el contexto de la programación. El objetivo principal de la investigación fue evaluar los conocimientos y habilidades de los futuros maestros de educación infantil en la aplicación de estos conocimientos en tareas prácticas. La investigación se llevó a cabo entre estudiantes de dos universidades públicas en Polonia, utilizando el método de encuesta diagnóstica, y la herramienta de investigación fue un cuestionario basado en una prueba de conocimientos. El diseño de la prueba se basó en las suposiciones teóricas de B. Niemierka sobre los objetivos de la enseñanza.

El análisis de los resultados reveló que los futuros maestros de educación infantil poseen conocimientos teóricos en programación. Sin embargo, solo el 35% de ellos füe capaz de explicar detalladamente los principios de la programación. La aplicación de estos conocimientos en la práctica resultó ser menos eficaz, con un 45% de aciertos en tareas típicas y un 47% en tareas relacionadas con la resolución de problemas. Estos resultados sugieren la necesidad de modificar los programas de estudio para aumentar el número de horas dedicadas a asignaturas relacionadas con la programación y poner más énfasis en la resolución de tareas de programación mediante la experiencia práctica.

Con base en la investigación realizada y las observaciones, los autores proponen aumentar el número de horas dedicadas a los temas directamente relacionados con la programación. De este modo, los estudiantes tendrán la oportunidad no solo de adquirir conocimientos teóricos, sino también de aplicarlos eficazmente en tareas prácticas. Al fin y al cabo, serán los futuros maestros los responsables de introducir a los alumnos de los grados 1–3 al mundo de la programación y de desarrollar su pensamiento computacional.

Un aspecto importante es también garantizar un sistema de educación y formación para los maestros que les permita desarrollar y profundizar sus competencias digitales en programación. Las nuevas soluciones tecnológicas están surgiendo rápidamente, y los maestros deben mantenerse al día con ellas para preparar adecuadamente a los estudiantes para los desafíos futuros y desarrollar habilidades como la resolución de problemas y el pensamiento lógico.

Los autores también sugieren que es necesario realizar más investigaciones sobre los diversos componentes de las competencias digitales para los futuros maestros, con el fin de ajustar los programas pedagógicos a las realidades del mundo moderno y dotarlos de los conocimientos y habilidades necesarios.

P a l a b r a s c l a v e: competencias, educación infantil, educación superior, programación docente

Эвелина Жоньца, Томаш Вархол

Подготовка студентов педагогики к преподаванию программирования в раннем детском образовании

А н н о т а ц и я

Статья обсуждает компетенции современных учителей в использовании информационно-коммуникационных технологий, особенно в контексте программирования. Основной целью исследования было оценить знания и навыки будущих учителей начальных классов в применении этих знаний на практике. Исследования были проведены среди студентов двух государственных университетов в Польше с использованием метода диагностического опроса, а инструментом исследования была анкета, основанная на тесте знаний. Конструкция теста была основана на теоретических положениях Б. Немьерки, касающихся целей обучения.

Анализ результатов показал, что будущие учителя начальной школы обладают теоретическими знаниями в области программирования. Однако только 35% из них смогли подробно объяснить принципы программирования. Применение этих знаний на практике оказалось менее эффективным: результаты составили 45% для типичных заданий и 47% для задач по решению проблем. Эти результаты указывают на необходимость модификации учебных программ для увеличения числа часов, посвященных предметам, связанным с программированием, а также на более значительное внимание к решению программных задач через практический опыт.

Основываясь на проведенных исследованиях и наблюдениях, авторы предлагают увеличить количество часов, посвященных темам, непосредственно связанным с программированием. Таким образом, студенты получат возможность не только усваивать теоретические знания, но и эффективно применять их в практических заданиях. В конце концов, именно будущие учителя будут отвечать за введение учеников 1–3 классов в мир программирования и развитие их вычислительного мышления.

Важным аспектом является также обеспечение системы образования и подготовки учителей, которая позволит им развивать и углублять цифровые компетенции в области программирования. Новые технологические решения появляются с высокой скоростью, и учителя должны успевать за ними, чтобы подготовить учеников к будущим вызовам и развивать у них навыки решения проблем и логического мышления.

Авторы также предлагают, что необходимы дополнительные исследования различных компонентов цифровых компетенций будущих учителей, чтобы адаптировать педагогические программы к реалиям современного мира и оснастить их необходимыми знаниями и навыками.

К л ю ч е в ы е с л о в а: компетенции, раннее детское образование, обучение в высшем образовании, преподавание программирования