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MATHEMATICS THROUGH FAIRY TALES AND STORIES OR HOW TO MAKE LEARNING EXCITING FOR PRESCHOOLERS

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МАТЕМАТИКА ЧЕРЕЗ КАЗКИ ТА ІСТОРІЇ АБО ЯК ЗРОБИТИ НАВЧАННЯ ДЛЯ ДІТЕЙ ДОШКІЛЬНОГО ВІКУ ЗАХОПЛИВИМ

The article analyzes modern approaches to teaching mathematics to preschool children, particularly using of fairy tale plots and stories in order to develop the preschoolers' mathematical skills. It explores the possibilities of integrating fairy tales into the educational process to shape concepts of numbers, measurement, geometric shapes, and spatial relationships. The effectiveness of applying interactive methods and game-based technologies in teaching mathematics through fairy tales is determined. Special attention is given to the role of storytelling games and situation modeling in reinforcing mathematical concepts in the child's natural environment. The necessity of further research on optimal ways to incorporate fairy tales into mathematics education is substantiated, including the development of methodological recommendations and digital resources to support this process.

Key words: mathematical development, preschool education, fairy tales, interactive methods, game-based technologies.

Анотація. У статті проаналізовано сучасні підходи до навчання математики дітей дошкільного віку, зокрема використання казкових сюжетів

та історій для розвитку математичних навичок. Розглянуто можливості інтеграції казок в освітній процес для формування уявлень про числа, вимірювання, геометричні форми та просторові відносини. Визначено ефективність застосування інтерактивних методів та ігрових технологій у навчанні математики через казкові історії. Особливу увагу приділено ролі сюжетних ігор та моделювання ситуацій у закріпленні математичних понять у природному середовищі дитини. Обґрунтовано необхідність подальших досліджень щодо оптимальних способів впровадження казок у навчання математики, зокрема розробки методичних рекомендацій та цифрових ресурсів для підтримки цього процесу.

Ключові слова: математичний розвиток, дошкільна освіта, казки, інтерактивні методи, ігрові технології.

Research Objective – to analyze the impact of using fairy tales on the development of mathematical skills in preschool children; to determine the possibilities of integrating fairy tale narratives into the educational process for the formation of concepts related to numbers, measurement, geometric shapes, and spatial relationships; to assess the prospects of applying interactive methods and game-based technologies in mathematics education through fairy tales.

Problem Statement. "Mathematics is the language in which the book of nature is written" – Galileo Galilei.

Compared to other academic disciplines, mathematics stands out for its universality, making it a key subject of international research in the field of education and cognitive development. Unlike literacy, which largely depends on different writing systems, the fundamental mathematical representational systems - from Arabic numerals to algebraic symbols - are nearly universal across the world. Therefore, it is entirely logical that mathematics has become a central topic in large-scale studies aimed at comparing achievement levels across different countries.

Modern education is an integral part of the globalized historical and cultural space of the 21st century, whose primary objective is to nurture a new generation with innovative thinking, an active civic stance, and the ability for self-determination and self-education. This necessitates the modernization of educational strategies, starting from the preschool period. In this context, special attention is given to updating approaches to the mathematical development of preschool children, which involves the use of non-standard content solutions, teaching formats, and methods. These approaches should foster cognitive abilities and contribute to the formation

of each child's individual qualities. The level and effectiveness of mathematical preparation in early childhood are crucial factors in determining the success of further mathematics learning in school.

Mathematics plays a crucial role in children's lives not only in school and preschool institutions but also in everyday situations. Through routine activities such as getting dressed, brushing their teeth, having breakfast, or shopping, children can acquire mathematical concepts if the learning process is properly structured.

Research indicates that early development of mathematical skills is a stronger predictor of future academic success than reading ability or attention span. Therefore, it is essential to create conditions for the natural acquisition of mathematical knowledge from an early age. Play is one of the most effective learning methods, as it enables children to explore and comprehend mathematical ideas and concepts, fostering critical thinking, logical reasoning, and analytical skills.

Early exposure to mathematics includes fundamental concepts such as numbers and their values, measurement, spatial relationships, shapes and their properties, and pattern recognition. Children are naturally curious about the world around them and learn these concepts through interaction with their environment.

For example, by building towers with blocks, they develop skills in sorting by size and color, analyzing spatial relationships, and enhancing logical thinking. Such play-based activities help children understand which shapes can be combined, how to construct stable structures, and the underlying principles behind the creation of familiar objects.

Thus, early development of mathematical skills establishes a strong foundation for future academic success, while mastering basic mathematical concepts in childhood benefits not only education but also everyday life. Therefore, parents and educators should create conditions for preschool children to naturally acquire mathematical knowledge through play and active interaction with their environment.

Analysis of Research and Publications. The importance of mathematical education for the younger generation is reflected in legislative acts and regulatory documents governing the educational sphere. These include the Law of Ukraine "On Preschool Education" [2], the Basic Component of Preschool Education (new edition) [1], the Concept of the New Ukrainian School [3], and the Program "New Ukrainian School: Progressing Towards Values" [4].

Researchers have explored various ways to enhance and optimize mathematics education for children. In particular, they have analyzed subject-specific actions as the foundation for developing mathematical concepts (P. Halperin), the psychological mechanisms of counting and the development of number sense (M. Vovchyk-Blakytina, H. Kostiuk, M. Makliak); investigated approaches to forming set theory concepts (A. Markushevych, J. Papi), magnitude and quantitative concepts in early childhood and preschool age (V. Danylova, K. Tarkhanova); as well as the relationship between counting and measurement (R. Berezina, N. Bilous, et al.).

Various researchers at different times have focused on the following aspects: the application of visual modeling in teaching arithmetic problem-solving (N. Nepomniashcha); children's understanding of quantitative and functional dependencies (L. Bondarenko, R. Nepomniashcha, O. Kyrylova); the development of the ability to model spatial relationships (O. Diachenko et al.); the acquisition of spatial and temporal relations (K. Nazarenko, T. Rikhterman et al.); and the using of games for mathematical development (L. Artemova et al.).

The ideas of elementary mathematical education for preschoolers are represented in the works of A. Stoliar. Research on mathematics teaching methods has also been conducted in Western Europe, including the development of numerical concepts through practical operations with sets (D. Alhaus, E. Dumm, M. Fidler) and the formation of an

understanding of arithmetic operations and quantitative relationships (R. Green, W. Lakson).

Presentation of the Main Research Material. Throughout human history, people have told each other fairy tales. An ancient papyrus, dated approximately to 1700 BCE, indicates that Pharaoh Khufu, who built the Great Pyramid in Egypt, was fond of fairy tales. Moreover, many of these tales, preserved to this day, bear a striking resemblance to modern ones [5].

Fairy tales are widespread across the world, and many of them have ancient origins, as similar plots and elements appear in the cultures of various peoples on all continents. Throughout life, every person has experienced the magical influence of fairy tales on their imagination, thinking, and emotions. They are an integral part of our intellectual heritage, remaining relevant and captivating due to their simplicity, vivid imagery, and deep meaning.

At the same time, we rarely consider fairy tales not only from a moral perspective but also as a source of various types of knowledge, including mathematical concepts. Despite their educational potential, fairy tales are insufficiently used in preschool mathematics education, as their mathematical content has not yet been properly appreciated.

Fairy tales convey mathematical concepts and relationships in an accessible, imaginative form. While reading or listening to fairy tales, everyone immerses themselves in the adventures of the characters, follows the development of events, analyzes the situations they encounter, remembers the characters' phrases, and learns ways to solve various problems. Each generation has its favorite fairy-tale characters: for some, it is Kotyhoroshko, Thumbelina, or Pan Kotskyi; for others, it is Karlsson or Winnie-the-Pooh, and for others, Harry Potter.

The study of fairy tale content indicates that all their varieties contain mathematical concepts and relationships, but they are most prominently expressed in tales of wonders.

For example, in such fairy tales, the main character travels along a road until reaching a crossroads, where they must make a choice. If they turn right, they will encounter one set of adventures; if they turn left, another; while going straight will lead to entirely different events. Thus, the character is faced with three possible options and must make a decision. This storyline clearly illustrates models that form the basis of probability theory.

Fairy tales also reflect the relationship between size and measurement, using various units of measurement—such as a finger (Tom Thumb, Thumbelina), an inch (Tom Thumb), the distance of a voice's call, the length of three steps, and more. Below are examples of engaging fairy-tale activities that will capture the interest of preschool children and help them develop essential mathematical skills.

"The Three Little Pigs" – children can build houses for the pigs using straw, sticks, and bricks and then act out the fairy tale's plot with toy characters. This activity not only introduces them to the properties of different materials but also enhances mathematical skills.

During play, children can count the pigs, houses, and building materials, promoting number recognition and an understanding of quantitative

Fairy Tale	Measurement & Units	Numbers & Quantities	Direction	Geometric Relationships	Time	Examples of Fairy Tale Application
<i>Little Red Riding Hood</i>	Measuring the distance from home to Grandma's house. Determining the length of the wolf's footprint. Measuring the size of the basket with pies.	Counting characters (Red Riding Hood, Grandma, Wolf, Woodcutters). Counting the number of pies in the basket. Tracking how many times Red Riding Hood met a character.	Determining the direction of movement (from home to the forest, along the path to Grandma's house). Understanding «left,» «right,» «straight.»	Shape of Grandma's house (roof – triangle, door – rectangle, windows – squares). Placement of objects inside: table in the center, bed in the corner.	Sequence of events: left home → met the wolf → reached the house. Time intervals: how long the journey took.	Using a map to build a route, placing characters on a plane. Playing «Find the Right Path» with a maze. Comparing objects by size in Grandma's house.
<i>Snow White</i>	Measuring Snow White's and the dwarfs' height. Comparing the size of furniture in the house (big bed – small bed, big plate – small plate).	Counting the seven dwarfs, the poisoned apples. Determining the number of objects in the dwarfs' house (spoons, cups, beds).	Spatial orientation (forest, dwarfs' house, castle). Determining the route: how Snow White reached the forest, then the dwarfs' house.	Comparing the sizes of objects in the dwarfs' house (table, bed, mirror). Dividing space in the house: kitchen, bedroom, living room.	Time concepts: morning – day – evening. Time intervals between events (when the dwarfs arrived, when the queen came).	Distributing objects among the dwarfs: «If the dwarfs had 7 plates and one broke, how many are left?» More-less exercises with furniture sizes.
<i>Rapunzel</i>	Measuring the length of Rapunzel's hair. Determining the height of the tower where she lived. Comparing the sizes of different buildings.	Counting the steps in the tower. Measuring the hair length: is it long enough to climb down?	Prince's movement direction (up-down the braid). Determining climbing height. Using terms «higher,» «lower,» «longer,» «shorter.»	Comparing the tower's height with other buildings. Analyzing the tower's shape (cylindrical). Comparing geometric shapes in the fairy tale (windows – circles, roof – cone).	Time intervals: how many years Rapunzel lived in the tower. Determining the time needed to climb up and down the braid.	Using ribbons and ropes to measure hair length. Building a tower model with blocks or bricks. A game to determine the correct rope length for descent.

relationships. Additionally, by comparing the houses' height, width, and wall thickness, they learn to analyze sizes and shapes. Using words like "taller", "shorter", "closer", "farther", "stronger", and "weaker" can help children grasp spatial concepts and improve their language skills.

"Thumbelina". Children can create scenes from the fairy tale using character figurines or drawings. They can compare the sizes of Thumbelina and other characters (the frog, the mole, the swallow), helping them understand the concepts of "big" and "small". During play, they can count the petals of the flower where Thumbelina was born, the legs of the insects that accompanied her, or list the adventures she experienced. This fosters counting skills and logical thinking. Additionally, discussing spatial concepts such as "deep water", "tall flower", and "wide leaf" expands children's vocabulary.

"Kolobok". Children can mold Kolobok from dough or clay, acting out the story with toy animals. This not only develops fine motor skills but also helps them remember the sequence of events in the fairy tale. They can count the characters that Kolobok meets and determine their order in the story (first – the hare, second – the wolf, etc.). They can also compare their sizes: "The fox is bigger than the hare but smaller than the bear", reinforcing the concepts of greater and lesser.

"Pan Kotskyi". This fairy tale can be used to develop mathematical skills through play and interaction with objects. Children can sculpt Pan Kotskyi and other characters from dough or clay, enhancing fine motor skills and tactile perception. While listening to the story, they can count the animals gathered around the "fearsome beast": first – the wolf, second – the bear, third – the fox, etc., reinforcing ordinal numbers. They can also compare character sizes: "The bear is bigger than the wolf", "The mouse is the smallest of all", helping them understand relative sizes.

Pan Kotskyi lived in a small house, which children can build using geometric shapes: the roof – a triangle, the window – a square, the door – a rectangle. This modeling activity develops spatial thinking. Discussing the story, children can answer questions such as "What happened first, and what happened next?" or "Why were the animals afraid of the cat?" This helps them understand cause-and-effect relationships. Using toy animals, they can reenact scenes from the fairy tale, reinforcing mathematical concepts and event sequences.

The table below provides examples of how preschool children can grasp mathematical concepts through fairy tales such as Little Red Riding Hood, Snow White, and Rapunzel.

Conclusions and Prospects for Further Research. Thus, the use of fairy tales in preschool education contributes not only to the development of speech and social skills but also to the acquisition of basic mathematical concepts. Through fairy tale plots, children become familiar with numbers, measurement, geometric shapes, and spatial relationships in an accessible and engaging way. The use of play-based methods, such as scenario modeling and role-playing games, helps reinforce mathematical skills in a natural learning environment.

The analysis of modern approaches to children's mathematical development through fairy tales demonstrates the significant potential of this methodology for improving the educational process. However, further research is needed to determine the optimal ways to integrate fairy tale plots into educational programs, particularly considering preschoolers' cognitive characteristics and their receptiveness to different mathematical concepts.

The prospects for further research include developing methodological guidelines for educators and parents on using fairy tales in mathematics education, as well as creating

interactive educational materials and digital resources to support this process. Another important direction is assessing the effectiveness of implementing these methods in preschool education practice, which will expand the range of tools for developing children's mathematical thinking.

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