

DEVELOPMENTAL CURRICULUM AS A SOURCE OF LEARNING STRATEGIES IN THE FORMATION OF MATHEMATICAL CONCEPTS IN PRESCHOOL CHILDREN

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Abstract

The development curriculum was created as a supplement to the long-known teaching plan and program according to which educators are guided in planning teaching and the goals to be achieved. The work is based on the positive and necessary properties of compiling and using the curriculum within the planning of strategies for learning mathematical concepts in preschool children, as knowledge and skills that are difficult to master and present in a natural and spontaneous way. As mathematics requires naturalness and perfect comprehensibility, without improvisations and omissions, the developmental curriculum becomes the best way of teaching, including all methods, teaching aids, the environment, the teacher and the needs of children in its plan, which will be shown and proven to be true in the work.

INITIAL CONSIDERATION

Babies and children use their senses to get to know the environment around them. They form concepts long before they learn to speak (categories of faces, speech sounds, emotional expressions, colors, objects, animals), (Gelman, 1996), form mathematical concepts long before basic mathematical operations, such as addition and subtraction. From an early age, children form categories similar to those of adults (Gelman, Susan A. 1998). Đorđević Dejan (2004) states in his book that many factors, such as, among others, intelligence, deficiency of sensory organs, influence the process of developing concepts in children. The concept of number develops in preschool children in the following order:

- in the first year of life, the child uses the word "more" by building a tower of three to four cubes;
- in the second year of age, the child differentiates between "one" and "many";
- in the third year, there are two subjects;
- in the fourth year, the child counts, with the correct pointing of three objects;
- at the age of five, the child can already count correctly up to 13, a third of children up to 30 and more, although most mistakes occur after the number 10;
- at the age of six, counting goes up to 100, is also capable of counting in tens up to 100, as well as counting in fifties up to 50, a six-year-old child can accurately add within ten, as well as subtract within limits of 5;
- at the age of seven, he can count in fives and tens up to 100. A seven-year-old child can add within the limits of 20, as well as subtract within the limits of 10;
- already in the eighth year, he manages basic mathematical operations.

At the earliest age, mathematical concepts are basic skills that will lay the foundation for future mathematics learning. The development curriculum as a source of learning strategies is the basic document according to which educational institutions should be oriented. The development curriculum should offer clear instructions for planning learning strategies, clearly defined goals, tasks, methods that will guide educators and institutions in the process of forming mathematical concepts, in accordance with the institution, age and needs of children. However, the process of developing a quality educational program is very time-consuming. Early education of children enables the free, complete and harmonious

development of the child's personality in accordance with his rhythm and needs. The educational program aims to provide shaped stimulation, the goal of which is the intellectual, emotional, social and physical development of each child (from birth to six or seven years of age).

The types of activities that are performed in kindergartens according to the special curriculum are: playing (playing with toys, symbolic games, sensory games, sand and water games, construction games, didactic games), artistic activities, musical and movement activities, communication and creative activities, awareness activities and outdoor activities. Why is this necessary and how does it relate to mathematics? The National Council of Teachers of Mathematics emphasizes that children need play-based opportunities to develop a conceptual understanding of mathematics. (Kirova, Bhargava, 2002) Kirova and Bhargava emphasize that the creation of an environment that is mathematically empowered and mediates children's experience, in this environment represents the foundations for the construction, modification and integration of mathematical concepts in preschool children. The nature of mathematics is abstract, that's why preschool children have access to mathematical ideas only through the representation of those games, however, here we also have the undeniable fact that children learn the fastest through play and that it is the basic activity of preschool children. Najdanović and Vujičić (2014) indicate that it is necessary to subordinate every mathematical-logical activity to the rules of game-like activities, thereby making the acquisition of mathematical knowledge natural, unobtrusive and fun. It should be stated that the formation of mathematical concepts begins in the real world and ends in the mental world of the child. (Kostić et al., 2014). Sternberg (2005) indicates that some things are better and easier to present with pictures, and in other words, which gives us a starting point for mentioning the introduction of mathematical literature in the form of textbooks in preschool institutions.

According to a large number of authors, we can note the great benefits of introducing mathematical literature in the education of preschool children. A positive approach can be seen in various examples of the use of literature (picture books, poems, fairy tales, counters) that indicate the role of such forms of content in the learning process, the construction and development of mathematical concepts in preschool education. (Huppert, 2012) Books are the ones that can create realistic situations in which students are actors. Teachers have at their disposal a large number of possibilities that they could use when applying this form of teaching. According to Case et al., (2008) the introduction of mathematics literature would allow preschoolers to see mathematics in a different light. Illustrated children's literature motivates students to learn, presents mathematics as a language, shows that mathematics develops from human experience, encourages the development of number sense, and integrates mathematics into other areas of the curriculum. (Whitin and Wilde, 1992, 1995) Learning mathematics through stories introduces the child's consciousness into the sphere of pleasantness, and thus develops a positive attitude towards mathematics. (Whitin and Wilde, 1992) Given the large amount of literature that exists, teachers are faced with the question of which one to choose. When choosing literature, care must be taken to avoid negative influences or the development of misconceptions, which would lead to a decrease in children's interest. (Huppert, 2012)

Douglas H. Clements and Julie Sarama (2007) indicate that curriculum can significantly increase children's knowledge of number or geometry, however, knowledge about the impact of preschool mathematics curriculum is yet undeveloped, especially on children with small exposure to mathematical experience, which through schooling are exposed to a high risk of failure in mastering mathematical concepts. In that case, children have less mathematical knowledge, even before the first grade of primary school, and therefore have less support for learning in the home or school environment, including preschool institution. Researches show that preschool children know a lot about shapes (Clements, Swaminathan, Hannibal, & Sarama, 1999; Lehrer, Jenkins, & Osana, 1998) and can learn a lot, especially when working on a computer (Sarama, Clements, & Vukelic, 1996). In the broad areas of geometry and space, they can recognize, name, build, compare and sort two- and three-dimensional shapes, explore assembling and disassembling shapes, recognize and use slides, describe spatial locations such as above and behind, and have ideas about direction and distance of movement in its environment. (Clements, 1999a) In the areas of number, preschoolers have all the potential to learn to count with understanding, to

recognize how many objects there are in smaller groups, to compare numbers, and to learn the simple ideas of the basic mathematical operations of addition and subtraction, as the understanding of the meaning of numbers is refined growing up of the child. (Đorđević, 2004) Challenging number activities not only develop children's sense of numbers, they can also develop children's competencies in logical abilities such as sorting and arranging. (Clements, 1984)

Development curriculum

Until the last decades of the 20th century, we only had a curriculum, as a way of organizing the teaching and educational process, which was designed both for schools and preschool institutions. Its duration was not stopped, nor did the curriculum and curriculum disappear from the educational system, but they were supplemented in the form of a development curriculum that is one of the best representatives of modern pedagogy, didactics and teaching methodology. Today, the development curriculum occupies one of the leading places in the entire process that takes place within the educational system. In the process of its creation, everyone is involved, from school workers, i.e. teachers, through the competent authorities to the ministry, since it is a very complex process that involves the creation of a curriculum that includes a wide area of work and numerous aspects that must be taken into account during its creation, which are primarily sociological, psychological and economic. (Marsh, 1994)

"Thanks to significant achievements in the field of child psychology and preschool pedagogy, as well as radical reforms carried out in the educational system, we can say that today institutional preschool education and education of children [...] takes place in modern preschool institutions, in which the work of educators has been raised to a higher level level than before, thanks to the curriculum of preschool education, which is the starting point for planning and programming the work of educators, because it is based on modern conceptions of education, but does not ignore already established principles in the education of children, based on the theories of prominent philosophers and classics of preschool pedagogy, on whose ideas many contemporary authors in our society based their work." (Apostolović, 2016: 298)

The development curriculum is a document that enables continuous and systematic work planning, which improves the work of the school and raises the quality of education and upbringing of students to a higher level. Its task is not exclusively to design a plan and program according to which knowledge and abilities are transferred to students, but much more than that, since development curriculum pays attention to all segments of education, from teachers and their competences, students and their abilities, to the impact of the school environment on learning, the use of the most diverse methods and forms of work that exist, as well as the inclusion of innovative ones, readiness for changes, with the selection of appropriate content that will also affect the individual incentives of students, with their active presence in classes at every moment. The importance of the curriculum is great. Its influence refers to the spread of knowledge among students, but also to positive feelings when it comes to the preschool and school environment, when it comes to authorities and relationships with them, which are embodied in the role of teachers, teachers and educators, and most importantly, relationships is aimed at achieving a sense of belonging to the environment, culture and society to which the student belongs. Looking at it this way, the development curriculum is still waiting for its blossoming in the future, because as a part of modern pedagogy and modern didactics, it has not found itself in the center of the educational process due to the different habits that are still dominant in it. The development curriculum has another part that is of great importance, which refers to the unconscious of the students, through which they acquire certain knowledge, skills, and above all the postulates of social activity and culture. The so-called hidden curriculum requires a lot of effort and work on the part of the teacher, in order to fulfill its requirements. "That part of teaching that is not included in school programs and other public documents, but still affects teaching in the form of learned values, norms, attitudes and social skills, represents a hidden curriculum and is an important factor for a better understanding of school processes." It is that part of the school content that we learn and adopt without even being aware of it." (Šušnjara, 2014: 41)

The development curriculum, planning and encompassing the entire system of pre-school institutions, the school itself, the child as the center of the entire attention of the educational system, also refers to the

teacher, i.e. educators or teachers. By affecting the implementation of teaching, the development curriculum also affects the work of educators, looking for models and work methods that are motivating and based on the development of knowledge and competences, rather than their reproductive application in teaching.

According to all its advantages, and especially those that concern a better way of working, which is marked by the acquisition of productive knowledge and their further, unhindered use, both during schooling and throughout life itself, the development curriculum is the basis that the entire educational system needs, but also for individual subjects, which is why its importance for strategies in learning mathematical concepts in preschool children would be the best way to prepare for their further education.

Mathematical concepts are, by certain habit and practice, the most complicated to present to preschool children. However, the goals are always clear. It is necessary to reach the required level of understanding of the planned concepts, their use in the following tasks, but also to encourage the desire for independent learning and further discovery of related concepts with already learned and accepted mathematical concepts. Mathematics textbooks, literature, as well as numerous preparations, often plan the presentation of new concepts in the school environment in a concise manner. In this way, knowledge is acquired that is reproductive, and therefore useless. At the moment, the curriculum foresees everything that is outside the scope of the curricula. In addition to the expertise and methodical competences of teachers, i.e. educators in this case, the curriculum carefully and systematically involves planning the learning environment, its appearance, the layout of everything in it, the use of different methods that are pleasing to children of that age, and teaching aids that can achieve the necessary correlation with the concept that according to the plan, it is necessary to present, explain and simplify enough so that it becomes comprehensible. A valid example of a good way of working, which stems from everything that a teaching curriculum represents, would be the Little Mathematical Theater (Davidović, Stefanović, 2017), which represents the establishment of existing and processing of new mathematical concepts in children with the help of theater puppets and theater. With the help of objects, which in this case are dolls that have long been a favorite toy during the day for children of this age, with the necessary preparation of the rest of the space, which required the creation of a large number of new dolls and theater, in which the children also participated, was achieved spontaneously, natural acquisition of knowledge about certain mathematical concepts, but in addition, numerous goals focused on creativity, social skills, achieving quality interaction, as well as other numerous educational and practical goals planned in advance were achieved.

The importance of mathematics education in preschool age

The learning of mathematical terms during preschool education is not intended or planned as learning certain definitions, formulas, mathematical laws, but the acquisition of certain knowledge that is best acquired in a natural, spontaneous way, which affects certain internal processes necessary for the proper psycho-physical development of children. Mathematical education helps children of preschool age to know and understand the world, phenomena and objects that surround them in a better, easier and more comprehensible way, and to accept them as such. Thus, the greatest importance of mathematical education is indicated, which is the development of thinking and logical thinking that leads to valid conclusions. It affects the development of numerous skills, abilities, that in everyday life situations, as far as their current mental maturity allows, they act correctly and make the necessary conclusions to successfully overcome certain obstacles. Presented as a way to create logical-mathematical thinking and thinking itself, mathematical education requires exhaustive planning, numerous competencies of the educator, as well as an adaptive performance for each child, in order to achieve all goals without any error that would lead to misunderstanding or mere acquisition of knowledge needed for reproduction, where everything would end.

"The role of the educator as a practitioner and implementer of the preschool program, which implies a planned and systematic development of activities with children, is important for all participants in this process, because the final outcome of the educational process depends on his abilities, level of education, affinity and personal involvement, which takes place continuously and smoothly with children of an early age in institutions for preschool upbringing and education." (Apostolović, 2016: 306)

In order for all the planned goals to be achieved, but also for them to be set in the best possible way, the development curriculum foresees certain tasks that need to be done in order to reach the desired goal. First of all, children need to be provided with a pleasant and comfortable environment and environment in which they can learn new things and adopt newly acquired knowledge, which means that sometimes everything needs to be completely changed, layouts in the rooms, and supplemented with new teaching aids. It is necessary to create and realize such an environment in which children, without any restraint, explore, manipulate, experiment, independently come to numerous discoveries and conclusions, unhindered examine, perceive, discover and distinguish different physical properties of objects, unhindered make logical combinations for themselves, make mistakes and they become aware of the error, so that in a gradual process, all the necessary knowledge they already have will be included in the efforts to discover, understand and accept the new ones. The best way, at this age, is play, which is stimulating in itself, and when it is organized in a stimulating environment, with careful and professional guidance by the teacher, it is possible to achieve everything planned. Although this is important for all subjects and phenomena that children are taught, mathematical concepts, as sometimes difficult to accept, perhaps the most difficult of all others, require such an organization and learning strategy that can only be implemented properly and qualitatively in this way.

Development of understanding of mathematical phenomena

The contents intended for work in the preschool period are designed to prepare and contribute to the better implementation of programs and plans that are intended for the first grade in primary schools. In addition to developing logical thinking, preschool children learn and understand the concepts of space and time, as well as mathematical concepts such as set, geometric shapes, size and measurement. In the whole process, the most important person is the teacher himself, who, by carefully choosing teaching methods, tools, and the previously described environment in which children learn, achieves all the necessary prerequisites for successfully mastering the material. Some older principles, provided by the curriculum, although they are successful, also show numerous flaws that are reflected in the long-term learning process due to deficiencies such as certain tools, connecting several concepts and subjects, and the like. The development curriculum assumes the use of everything that is available in the service of acquiring certain knowledge, which is why that knowledge does not become the main goal of a certain teaching unit, but other knowledge is presented in a spontaneous and acceptable way for children, which they easily acquire and continue to use independently. This always leads to the conclusion about the importance of interdisciplinary teaching.

"The interdisciplinary approach to teaching implies connecting the content of different disciplines (subjects) into logical units organized around one problem or topic. The knowledge of different disciplines serves the purpose of multifaceted elucidation of the problem or topic under investigation. Interdisciplinary teaching is by its nature always thematic, because it connects and organizes different content into thematic units, content that is similar or common to different disciplines." (Ševkušić, Šefer, 2006: 271)

Children in preschool groups easily notice sets, assemble and disassemble them, successfully manipulate different objects and use them for different purposes, notice certain logical operations and use them, see similarities and differences between objects and phenomena, make classifications on different levels, which achieves the necessary achievement of the goals required for valid and productive work when it comes to the processing of mathematical concepts in the first grade, and in later schooling. The skills that an educator possesses make the foundation when it comes to mathematical concepts for children to be well laid, and all other superstructures then follow a natural course, with work, effort and, of course, constant proper guidance by the teacher, i.e. teacher.

All the above examples that show the need for a professional, learned and valid teaching, which is carried out in preschool institutions according to the rules of work and according to the needs of the children themselves, show that the developmental curriculum is the best way to achieve pre-achieved planning that leaves no place for improvisation, as the greatest enemy of cognitive process, regardless of the conditions, where and to whom that cognitive process is intended.

CONCLUSION

The question of the developmental curriculum as a source of strategies in learning mathematical concepts is also related to the question of the degree of adaptation and the process of changing the child. The strategy of the educational program should be based on freeing the child's imagination, supporting and enabling them to independently perceive problems around them, and develop mathematical competences. This form of strategy should be adapted to the possibilities, needs, interests, intellect of each child, and in accordance with the high competences and expertise of the teacher himself.

An important condition in this process is the correct selection of didactic materials in preschool teaching. In other words, the level and quality of acquiring mathematical concepts, acquiring mathematical competences and logical abilities will depend on what kind of didactic material was used in the lesson, that is, it will depend on how much that material awakened the child's curiosity. Not only the didactic material, but the entire environment in which children spend time, its appearance, planning in terms of encouragement and motivation, the use of all available teaching aids, together with the authority in the teacher's figure, form the necessary set in order to organize it in the best possible way, planned and implemented a process of knowledge and learning that was successful.

By analyzing the literature, we came to the conclusion that in working with preschool children, the process of acquiring certain mathematical concepts is realized through different aspects, as can be seen in the paper. In addition, it is necessary to state that there is a certain difference in the way children are treated, provided by the preschool education program, in relation to their intellectual development. The development curriculum, as modernized curricula, includes all factors of education and the environment in which it takes place, along with planning and developing strategies for working with children, regardless of the planned teaching unit. Such an approach, which in addition to planning the unit, also plans the way of working, individual approaches, research tasks, teaching that is inspiring and that encourages curiosity and the will to work, and which also includes the personality of the educator and his progress, achieves the proper and necessary development of the child. .

The developmental curriculum, as part of the strategy for learning mathematical and other concepts, represents a part of innovative teaching that is most needed in modern society, because it is included in the process in which the modern child finds himself, and therefore requires that everything be adapted to him, even learning and rules that have not changed for decades, and some for centuries. The developmental curriculum presupposes the existence of teaching that is ready for changes and that is entirely focused on one goal, the most perfect psycho-physical development of every child in the educational system.

Summary

Teaching with the use of realistic mathematical literature and learning strategies can significantly contribute to the development of mathematical competence in preschool children. The educational program must conceptually prepare children for learning mathematics in the following years of education, contribute to the development and logical abilities. The format and content during the learning of mathematical concepts must be adapted to the age of the child. The aim of this paper is to present learning strategies in the formation of mathematical skills that play a significant role in encouraging logical-mathematical thinking.

Literature:

Apostolović, D. (2016). Curricula of preschool education as a basis for planning and programming the work of educators in preschool institutions. *Contemporary preschool upbringing and education: challenges and dilemmas*. Jagodina: Faculty of Pedagogical Sciences, University of Kragujevac. pp. 297-313.

Clements and Sarma (2011)

Davidović, S. Stefanović, G. (2017). Small mathematical theater, in: Collection of works Reflections of the contemporary era on educational work in preschool institutions: no. 16. Aleksinac: College for teachers of vocational studies. Pages: 365-368

Kostić, V et al., (2014) Formation of mathematical concepts - from visual to symbolic. Proceedings of HOLIPRI. College of Vocational Studies for Education and Teachers and the Serbian Academy of Education. Pirot 180-187

Marsh, C. (1994). Curriculum: basic concepts. Zagreb: Educa.

Najdanović, M. and Vujičić, B. (2014) Play as a basic activity in the function of developing mathematical concepts in preschool children. College of Vocational Studies for Education and Teachers and the Serbian Academy of Education. Pirot 180-187

Sternberg, R. J. (2005). Cognitive psychology. Zagreb: Naklada Slap

Ševkušić, S. Šefer, J. (2006). Action research of a new approach to the teaching of social studies in the fourth grade of primary school, in: Teaching and education. No. 3, vol. 55. Belgrade: Institute for Pedagogical Research. Pages: 269-282.

Šušnjara, S. (2014). The hidden curriculum. In: Contemporary Issues; Journal of education and culture. No. 18. Mostar: Matica hrvatska. Pages: 35-42