THE RELATIONSHIP BETWEEN ELEMENTARY SCHOOL STUDENT'S AGE AND INTEREST IN LEARNING MATHEMATICS CONTENT

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Abstract

Student success in learning and understanding mathematical content in elementary school is determined by numerous factors. Among these factors is the student's interest in learning mathematical content. Learning success often changes with the development of student's psycho-physical characteristics. The authors researched and present in this paper the results related to the relationship between elementary school student's age and their interest in learning mathematics content. The main hypothesis was set: We expect that students have different interests in learning elementary school mathematics content and that these interests correlate with student's age. The mathematical content covered includes: addition and subtraction; equations and inequalities; geometric content; word problems; measures and measurements. Various interests were recorded, with students finding content about measures and measurements the least interesting, while showing the greatest interest in solving equations and inequalities. A correlation between age and student's interest in mathematical content was also observed, with older students showing greater interest in mathematics.

The obtained results imply that it is necessary to seek different methods and work strategies to make all educational content equally or nearly equally interesting to students. At the same time, the authors suggest that for less interesting content, higher quality teaching media should be provided, and different teaching systems, project-based and environmental teaching should be applied.

Keywords: student's age, mathematical content, student interests

1. Introduction

Mathematics as a fundamental educational discipline occupies a central place in the curricula of elementary school. However, student's interests in mathematics are not homogeneous but vary depending on numerous factors, among which age proves to be an important one, and this should be further investigated in the future. Understanding the relationship between elementary school student's age (from 1st to 4th grade) and their interest in learning mathematical content can improve teaching practice. Since not all students have the same interests, teaching should not insist only on learning mathematical content; the content is a means by which thinking, attention, and intellectual development are developed. Therefore, the goal of teaching is not exclusively the acquisition of

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knowledge but also the encouragement and development of abilities for independent learning, the development of critical and creative thinking, cognitive and metacognitive abilities (Mihajlović, Skopljak, and Jenjić, 2023). This understanding creates the conditions for the development of differentiated motivation strategies in accordance with the developmental characteristics of children.

Analysis and research of the relationship between student's age and interest in learning mathematics require knowledge of the developmental specificities of younger school-age students. Elementary school students are between 6 and 10 years old, which is a period of childhood characterized by the development of cognitive, emotional, and social traits. According to Piaget's theory of cognitive development, students of this age transition from the preoperational to the concrete operational phase of thinking, which means they increasingly understand logical relationships but are still tied to concrete situations and perceptual elements (Piaget, 1952). This is the stage of concrete operations, characterized by the way they perceive mathematical concepts.

In the younger grades, students are more curious and open to adopting new content, but motivation oscillates depending on the teacher's methodological approach, the complexity of the teaching content, and learning experiences. First and second-grade students, for example, often show high initial motivation for learning mathematics, which is associated with game-like activities and research tasks (Stipek, 2002). However, as age increases and the teaching content becomes more abstract, interest may decline. "Given the nature of mathematical content in elementary school, the importance of the active role of students and the willingness of teachers to encourage their mutual assistance is emphasized (Jenjić and Skopljak, 2023: 142). To avoid a downward trend in interest in learning mathematical content, the needs and abilities of students should be monitored.

Interest in a particular area can be defined as a relatively stable tendency to direct attention and activity towards specific content, and in the school context, it is closely related to the concepts of motivation, engagement, and achievement. Research shows that interest in mathematics among younger students declines not only due to cognitive challenges but also due to changes in student's perception of their own competence and the importance of the subject (Wigfield & Eccles, 2000). Interest is interpreted as the tendency of the subject to react positively to certain phenomena or objects in their environment and to direct their activity towards them (Encyclopedic Dictionary of Pedagogy, 1963).

In the first and second grades, students often experience mathematics as a game, a challenge, and something that encourages them to "think." Game-like teaching often appears in teaching practice. However, in later grades, the teaching content becomes more abstract (e.g., all four arithmetic operations, geometric concepts, fractions, more complex tasks), and interest may decrease in students who do not have developed learning strategies or who experience failure. Also, at this age, children begin to form more stable self-images. If they have previously formed negative experiences with mathematics, they may develop attitudes that will diminish the desire for further learning.

There has been research examining the links between the socio-pedagogical characteristics of students and their interests and achievements in mathematics teaching. For example, some research indicates that girls in the third and fourth grades more often express doubt in their mathematical abilities, despite the same or even better achievements compared to boys (Hyde et al., 2008). Yet, it is a fact that teachers play a key role in improving student's interest in mathematics. Their methodological competence contributes to better teaching quality, the application of modern digital technologies, or simply, the planning, preparation, and realization of teaching. The use of concrete materials, visualization of abstract concepts, problem-based learning, and play as a didactic method

have the potential to maintain and develop interest in mathematics throughout the entire classroom period (Boaler, 2016).

Teachers, as the most important factor in the preparation and realization of teaching, should recognize changes in student's interest. If they recognize a decline in interest, they will intervene preventively, in all grades and when covering all teaching topics. Early detection of a decline in interest enables the timely design of differentiated activities, which include various social forms of work, project-based and problem-based teaching, digital and other tools. Modern teaching strategies and teaching systems will certainly raise interest to a higher level. The application of appropriate strategies aims to develop interest in learning, as well as optimism in work and problem-solving. "Optimism is a predictor of academic success" (Goleman, 2008: 84). Burdening students with complex and overly difficult tasks reduces interest and optimism in work.

2. Method

In elementary school mathematics, students have varying success in terms of achieved results and grades. Possible reasons include the fact that they have different predispositions for learning, less or more motivation for learning, better or worse conditions for learning and work. The aim of this research is to investigate the relationship between elementary school student's age and interest in learning mathematics content. Accordingly, the research hypothesis was defined: We expect that students have different interests in learning elementary school mathematics content and that these interests correlate with student's age.

A descriptive (survey) research method was used. The research technique is surveying/scaling, and a survey questionnaire was created as the research instrument. It contained 24 items, and students expressed their level of agreement on a four-point scale: 1) I completely agree, 2) I partially agree, 3) I agree very little, and 4) I do not agree. The sample consists of third, fourth, and fifth-grade elementary school students from three different elementary schools in the city of Banja Luka in the Republic of Srpska (B&H). The independent variable of the research is age, specifically the grade of the students (third, fourth, and fifth). The dependent variables are the learning content in elementary school mathematics, divided into five categories: equations and inequalities, addition and subtraction, word problems, geometric content, measures and measurements. The research was conducted in the second semester of the 2023/2024 school year. Statistical data processing required the application of descriptive statistics and Pearson's correlation coefficient.

3. Research results and their interpretation

Student's interest in learning mathematical content is determined by various factors. These factors include, among others, predispositions for learning and understanding mathematics, the material and technical basis of teaching, environmental factors, the teacher's methodological approach in working with children, etc. It should also be added that interest in learning changes with student's age. Some students will, over time, prefer social sciences, some focus on natural sciences, arts, and some students will gradually develop a desire for more successful learning of mathematical content. Precisely for this reason, we conducted the research among students in three different grades, which is clearly visible in Table 1.

Table 1. Sample of respondents by student's age

	Frequency	Percentage	Cumulative percentage
Third grade	68	33.7	33.7
Fourth grade	67	33.2	66.8
Fifth grade	67	33.2	100.0
Total	202	100.0	

The sample of respondents is approximately uniform by age. There were 68 third-grade students, which is 33.7% of the respondents. Also, 67 or 33.2% of students who attended the fourth grade participated in the research. The same number represents the students who are in the fifth grade. Thus, a total of 202 students were included in the research. Younger students did not participate in the research. Most of the teaching content, which is the dependent variable of this research, has not yet been covered by first and second-grade students, so they could not be included in the research. In the research, we included five different thematic units that are covered in mathematics teaching: equations and inequalities, addition and subtraction, word problems, geometric problems, measures and measurements. We did not include multiplication and division, as well as fractions, because these contents are not taught in the third grade of elementary school, so third-grade students cannot comment on these contents. Table 2 shows the arithmetic means of the answers related to student's interest in learning the listed thematic units. Since students expressed their level of agreement with the answers on a scale from 1 to 4, where 1 is the best and 4 is the worst value, the arithmetic means shown in the following table indicate the level of student's interest.

Table 2. Interest in learning mathematics content

	Sample	Min.	Max	Arithmetic Mean
Equations and inequalities	202	1	4	1.71
Addition and subtraction	202	1	4	1.74
Word problems	202	1	4	1.91
Geometric conect	202	1	4	1.97
Measures and measurements	202	1	4	2.15
(N)	202			

Students show the least interest in learning the subject area of Measures and Measurements. The obtained arithmetic mean is M = 2.15, and this is the worst result from the perspective of interest in a specific mathematical content. The research did not seek the reasons for this, but it is possible that this unit receives less time compared to all others, there are fewer classes in the curricula, and it includes various quantities: length, area, mass, time, and volume. Experience shows that this is complex content for students, also because students convert smaller to larger and larger to smaller units of measurement (for example, centimeters to decimeters and meters, decagrams to grams and kilograms, and so on). However, even so, this is content that students need to master because they will use it in everyday life.

Students also do not show great interest in geometric content. The arithmetic mean M = 1.97 suggests that students do not find this interesting, despite the fact that there is more interest here than in the previous variable. However, geometric content still occupies more time in mathematics teaching. The curriculum is designed so that geometric content is not taught continuously. Much time is spent on arithmetic and algebraic content, and geometry is taught in certain time intervals, which is not particularly interesting to students. Hypothetically speaking, it can be said that students mainly perceive mathematics as arithmetic operations, which suppresses interest in geometry and geometric tasks. However, this is just a hypothesis whose validity should be verified by research.

There is slightly more interest in solving word problems. The arithmetic mean of the answers obtained from students M = 1.91 describes this. Here we can note an average partial interest of students, and the reasons for this can be found in the fact that these are more complex tasks that require greater mental activity, more effort, and slower feedback on whether the task was solved correctly or not. The verification of whether they solved correctly is usually done by the teacher, and in a smaller number of cases, students themselves can check whether the procedure and solution are correct. This somehow reduces the interest in work and at the same time shows the importance of feedback for students. It should also be noted here that word problems, unlike mathematical expressions, encourage the development of divergent and mathematical thinking more. Therefore, work should be done to develop student's interest in solving word problems in elementary school mathematics.

Addition and subtraction is an area in elementary school mathematics that students spend a lot of time on. Namely, they start with addition and subtraction when forming the concept of a natural number. Therefore, they show a higher level of interest in these arithmetic operations. This is confirmed by the value of the arithmetic mean M = 1.74. It should also be emphasized that they use these operations in all other areas of work – in word problems, measures and measurements, equations and inequalities. It is concluded that the content of addition and subtraction is more interesting to students precisely because of the continuity in work. Because if geometric contents are less interesting due to discontinuity in teaching, addition and subtraction are more interesting due to continuous application. Students add and subtract daily, in class or in extracurricular activities.

It is interesting that students are most interested in content related to solving equations and inequalities. The obtained value M = 1.71 confirms this statement. We cannot give an adequate interpretation of the real reasons for this because we did not set this as a task in the research. Or rather, we did not expect this. Precisely because of this, this can be an interesting problem for some future research. However, the fact is that solving equations and inequalities acts as a motivation for learning because each word problem that is solved by equations or inequalities is a new problem situation that creates interest in finding a solution.

Further analysis of the obtained results is focused on checking the correlation between student's age and their interest in learning all mathematical content. For this purpose, Pearson's correlation coefficient was applied. The interest in learning mathematical content represents the obtained score of several items that related to interest in learning mathematics. The obtained correlations are presented in Table 3.

Table 3. Correlations of student's age and interest in learning mathematics

		Grade	Interest in learning all mathematics content
Grade	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	202	
Interest in learning all mathematics content	Pearson Correlation	.426**	1
	Sig. (2-tailed)	.000	
	N	202	202

**. Correlation is significant at the 0.01 level (2-tailed).

The correlations between student's age, or the grade students attend, and interest in learning mathematical content have a value of $r = 0.426$ and are statistically significant at the level of $p = 0.000$. This means that interest in learning mathematical content increases with student's age. Since the research included students from the third, fourth, and fifth grades, this result does not mean that older students have better learning success. Namely, our finding is that older students better understand the importance of learning mathematics, and on the other hand, mathematics with its thematic units is probably more interesting in older grades. Students have mastered the basic arithmetic operations, geometry content, measurement, and other content, and in older age, they learn mathematics more to apply what they have learned in different situations. In any case, this should be checked in the next period. However, to obtain more valid results, research should be created and conducted that will include younger students, specifically from the first to the fifth grade.

4. Concluding remarks

The conducted research confirmed the hypothesis that students have different interests in learning elementary school mathematics content and that these interests correlate with student's age. It was noted that solving equations and inequalities is most interesting to students in elementary school mathematics. In second place of interest is content related to addition and subtraction, and students show insignificantly less interest in solving word problems. More experienced teachers generally claim, and our research has confirmed, that learning geometric concepts is less interesting to students. And finally, students show the least interest in content related to measures and measurements in elementary school mathematics. Further analysis of the obtained data in the research recorded a correlation between student's age and interest in learning all mathematical content. It was found that older students have a greater interest in learning mathematics. It is possible that this result is a consequence of a better understanding of mathematics in older age, or more specifically, mathematics is more complex for students in the younger grades of elementary school. Students need a quality methodological interpretation of mathematical concepts to understand its basics, and this happens at a younger age. Later, mathematics is more demanding but builds on the foundations from the first three grades of elementary school.

The obtained results are certainly interesting and open up some new questions for research in the methodology of elementary school mathematics. Therefore, future research should seek and find better approaches in the treatment of geometric content and measures and measurements. However, this cannot be learned by survey or descriptive research, but by experimental research with the introduction of an experimental factor in learning the mentioned thematic units. Also, in the future, a comparative study should be conducted to

learn about the content of mathematics learning in some European countries, and possibly the interest in mathematics among students in those countries. The obtained results would have great value in creating and aligning curricula, both because of learning outcomes and because of the mobility and migration of students.

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