

CONTENTS OF THE HISTORY OF MATHEMATICS IN INITIAL MATHEMATICS TEACHING IN MONTENEGRO

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Being aware of the importance of the historical development of mathematics, this paper studies the representation of history of mathematics in primary mathematics teaching. We argue that the contents related to the history of mathematics should be taught to young learners as an important factor of encouraging children's interest in mathematics. The aim of the study is to examine the attitudes of primary teachers to the history of mathematics, its position in the curriculum of the lower grades of primary school, and teachers' readiness to teach these contents to the students. The survey was conducted on a sample of 130 participants. The results confirm the need for including history of mathematics contents in the curriculum of elementary grades, but they also point to a big failure of curriculum designers for omitting them from the compulsory teaching content.

Keywords: history of mathematics / student / teacher / math education / initial teaching of mathematics.

INTRODUCTION

If we take into account the specificity of mathematics education in primary grades, we can conclude that the first mathematical knowledge and mathematical concepts are related to the immediate environment of the child (Mićanović, 2014). This pathway of acquisition of mathematics knowledge coincides with the historical path of the development of mathematical concepts. Historical sources confirm that the mathematics had been practiced a long time before it was established as a science (Lazić & Lipkovski, 2013). The evidences can be found in the first traces of mathematical documents on the papyrus, clay tablets and on the walls of caves. The first mathematical texts from ancient Egypt and Mesopotamia were used for practical purposes, measurement of the land, construction of various buildings, etc.

In the further process of helping children acquire mathematics knowledge, we gradually leave concrete and immediately noticeable objects in the environment and move to imaginary forms. These imaginary forms are called abstractions. Abstract mathematical concepts require intense concentration and deeper thinking, which stimulates the development of thinking skills. In order to encourage primary grade students to think and learn mathematical concepts, it is recommended to integrate the stories about the emergence and development of the learned concepts. History of mathematics that is used for this purpose has a strong motivational function (Dejić & Mihajlović, 2014). The development of logical mathematical thinking in lower grades of primary school depends upon the process of practice and intensity of understanding the content. Contents of the history of mathematics intensify the development of cognitive activities (Lawrence, 2014) as an important step in the development of mental abilities resulting in further improvement and development of mathematical skills, particularly logical thinking and reasoning. Although in lower grades of primary school there are actually no complex mathematical concepts, but the very first concepts are connected to the environment in which the child grows up, and they spontaneously introduce children to the world of mathematics and logical reasoning, keeping essential guidelines of mathematical approaches to understanding the functioning of the world in which we live, it is important from the very beginning to properly guide the pupils. Due to the absence of this, very often some problems occur, from dyscalculia which create serious difficulties in learning or understanding simple math (Tajar & Sharifi, 2011), to those related to difficulties in problem solving in mathematics (Tambychika & Meerah 2010).

METHODOLOGY OF RESEARCH

The aim of research. Research studies show that although different countries have similar approaches in mathematics education, there is still a contrast between different teaching cultures in many aspects (Kaiser & Vollstedt, 2007). The subject of our research was to determine the attitudes of primary teachers about applying the history of mathematics contents in mathematics teaching in primary grades. The aim of the research was to examine primary teachers' opinions about the history of mathematics, its position in mathematics curriculum of the lower grades of primary school, and the teachers' readiness to teach these contents to the students.

The main research hypothesis. We assume that teachers are familiar with the history of mathematical concepts which they teach, and that they include these contents in their lesson plans in the process of teaching mathematical concepts provided by the curriculum.

The research sample. The survey was conducted on a sample of 130 respondents. The sample is heterogeneous in terms of gender, educational level, and years of work experience.

The method of research. For the purpose of the study, data were collected through a questionnaire technique. The instrument was anonymous and contained both closed and open-ended items. Items were constructed according to the subject, aim and problem of research, and were related to: content knowledge about the history of mathematics, representation of historical contents in the primary mathematics curriculum, teachers' interest to teach historical content in mathematics classroom, usefulness of historical content in achieving curriculum goals and objectives.

RESULTS OF RESEARCH

In order to answer the research questions, we surveyed teachers employed in primary schools in Podgorica (46 respondents), Niksic (43 respondents) and Budva (41 respondents). The description of the sample according to the years of work experience is given in Table 1.

Table 1: Sample according to the years of work experience

Sample groups	Work experience in teaching				Total
	From 0 to 10 years	From 10 to 20 years	From 20 to 30 years	Over 30 years	
Podgorica	13	19	9	5	46
Niksic	11	22	8	2	43
Budva	9	17	11	4	41
Total	33	58	28	11	130

Based on the data obtained, we can conclude that the majority of respondents belong to the category of 10 to 20 years of teaching experience (58 respondents), followed by the category from 0 to 10 years (33 respondents), followed by 20 to 30 years (28 subjects) and finally the category of more than 30 years of work experience (11 respondents).

One of the research questions was to investigate the extent to which teachers are familiar with the history of mathematics and its contents which could be applied in the primary grades. The answers according to the categories of years of work experience are given in the Table 2.

Table 2: The content of the history of mathematics by category of work experience

Sample groups	To what extent are you familiar with the contents of the history of mathematics?				Total
	very much	completely	partly	not at all	
From 0 to 10 years	11	17	5	0	33
From 10 to 20 years	23	28	7	0	58
From 20 to 30 years	9	12	7	0	28
Over 30 years	4	6	1	0	11
Total	47	63	20	0	130

The extent to which the respondents are acquainted with the contents of the history of mathematics are presented in Table 2. The majority of the participants in all categories of years of work experience stated that they were completely familiar with the contents of the history of mathematics (a total of 63 or 48.46% of the subjects). They are followed by those who were very familiar with the contents (47 or 36.15%) and partly familiar (20 or 15.38%). There were no respondents who were not familiar with the contents of the history of mathematics. Therefore, based on the research sample, we may conclude that primary teachers are familiar with the contents of the history of mathematics, which is a good precondition for its application in teaching mathematics in the primary grades.

In the following research procedure we investigated the teachers' opinion about the extent to which the historical contents in teaching mathematics were present in the primary curriculum. The obtained results are presented in Table 3.

Table 3: Teachers' opinions about the extent historical contents in teaching mathematics in elementary grades are present in the primary curriculum

The group	The representation of historical contents in teaching mathematics in primary grades				Total
	very much	enough	partially	not at all	
First grade	0	0	5	125	130
Second grade	0	0	7	123	130
Third grade	0	0	7	123	130
Fourth grade	0	0	3	127	130
Fifth grade	0	0	5	125	130

Investigation of the representation of historical contents in teaching mathematics curriculum indicate that the attitudes of the respondents were homogeneous. Respondents believe that historical contents are not present in the mathematics curriculum for grades 1-5(95% of respondents). These findings are really worrying and indicate that the authors of the curriculum should dedicate more attention to the inclusion of the historical contents as an important basis for deeper studying of mathematical concepts at all age levels.

Table 4: Readiness of teachers to present historical contents in teaching mathematics in primary grades

The group	The interest of the teachers to present the historical content in mathematics				Total
	very much	completely	partly	not interested	
From 0 to 10 years	13	19	1	0	33
From 10 to 20 years	25	31	2	0	58
From 20 to 30 years	15	13	0	0	28
Over 30 years	5	6	0	0	11
Total	58	69	3	0	130

When it comes to the readiness of the participants for teaching historical contents in mathematics classrooms, research results indicate that a majority of teachers are completely (53.07%) or very much (44.61%) interested and ready for it, while a very small number of the respondents is partly (2.3%) ready for it. There were no teachers who showed lack of readiness to present historical contents together with teaching planned mathematical concepts in mathematics teaching.

Table 5: The usefulness of historical content for achieving the curriculum goals and objectives in mathematics teaching in elementary grades.

The group	The extent to which historical contents are useful for achieving the objectives and learning outcomes of the mathematics curriculum				Total
	Very much	completely	partly	not useful	
From 0 to 10 years	28	5	0	0	33
From 10 to 20 years	47	11	0	0	58
From 20 to 30 years	26	2	0	0	28
Over 30 years	8	3	0	0	11
Total	109	21	0	0	130

We wanted to examine the opinion of teachers about the usefulness of historical contents for understanding mathematical concepts, and the obtained results are encouraging. Most of the teachers replied that historical contents are very (83.84%) or completely (16.15%) useful for achieving the objectives and outcomes of mathematics curriculum in teaching mathematics in primary grades. We believe that this opinion stems from the experience of teachers and should be taken into account when developing the curriculum and planning lessons.

CONCLUSION

Mathematics education as a product of human civilization has its own history and profound influence on personality development. It was created out of

practical needs, and for a long time mathematics has been reduced to the study of geometry and arithmetic, which presents the basis of the primary curriculum. Contents related to the history of the development of mathematical concepts as part of mathematics teaching are of great importance for the understanding of mathematical concepts as well as for students' motivation for mathematics, which makes them very useful in teaching mathematics. Since the focus of attention is a very important determinant in understanding the facts (Ognjenović, 2002), the contents of the history of mathematics should be part of the curriculum. The choice of teaching tasks is very important for the activity of students and teachers (Ni Zhou, Li & Li, 2014). A good understanding of teaching practice, well-developed communication between teachers and between pupils and teachers, and the selection of tasks, form the basis of successful learning (Olteanu, 2015). Pupils can be offered a variety of historical applications as illustrations (Hutchison, Beschorner & Schmidt-Crawford, 2012) necessary for understanding a concept.

The research results confirm the hypothesis *that teachers are acquainted with the history of mathematical concepts which they teach, that they plan and implement these contents in teaching mathematics together with teaching mathematical concepts*. The main problem in the implementation of these contents is the fact that primary mathematics curriculum does not include the contents of the history of mathematical concepts, and therefore teachers are not obliged to use them in teaching mathematics.

Presumption of successful teaching is that pupils are motivated and understand the contents being taught. Historical contents largely shed light on the need to study these concepts. Teachers play a central role in planning and implementation of instruction because they monitor the work and progress of students (Wixson & Valencia, 2011). It is, therefore, necessary to include and recommend contents from the history of mathematics in the curriculum as indispensable in teaching mathematics.

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