

# The General Characteristics Of Mathematics Textbooks For Lower Secondary School In Kosovo

Valbone Berisha

Faculty of Education, University of Prishtina

---

**Abstract:** This paper discusses the functionality of Kosovo mathematics textbooks for lower secondary school. An horizontal analysis is performed, which focuses on some key elements of the textbook content. In particular, it focuses on their potential in enhancing students motivation and comprehension to engage in mathematical learning. Further on, the organizing structure of content and the range of used or proposed teaching and learning activities throughout the textbooks is discussed, as well as their potential in the representing of the problem solving and problem solving strategies. At the end, the use of modern technologies is reviewed. The article has provided valuable data regarding the functionality level of the above mentioned textbooks.

**Keywords:** Lower secondary school, Mathematics textbooks, Motivational and comprehension factors, Pedagogical factors, Problem solving factors, Technological factors.

---

## I. INTRODUCTION

Over the last decades more and more attention is paid in analysing, comparing and improving the mathematics school textbooks. This interest comes as a result of many classroom studies and observations which show that textbooks represent an important factor in contemporary mathematics teaching and learning. This interest comes as a result of many classroom studies and observations which show that textbooks represent an important factor in contemporary mathematics teaching and learning. Moreover, in public lower secondary schools in Kosovo, currently, there is only one series of textbooks that serve for mathematics teaching and learning. These textbooks are allowed for publication by the decisions of the Ministry of Education, Science and Technology of Kosovo (MASHT). Also, according to the MASHT decisions, these textbooks represent the basic compulsory literature for mathematics teaching and learning in grades 6 – 9, and there is not any alternate textbooks choice offered on behalf of MASHT. Textbooks are free distributed to students for one year period and students have access to their mathematics textbooks at school as well as at home. Considering these circumstances, it can be said that these textbooks are highly influential in forming of the outgoing results in mathematics teaching and learning in lower secondary school in Kosovo. An analysis of the general characteristics of the textbooks in question would serve for the enlightenment of learning opportunities that are offered to students, as well as provide an overview of mathematics teaching and learning in lower secondary school in Kosovo, certainly all these compared with contemporary standards and requirements in mathematics teaching and learning.

## II. METHODS AND MATERIALS

A typical horizontal analysis [1] is performed, which includes the key elements in textbooks content that enable the functionality and effectiveness of mathematics textbooks. The above mentioned series of textbooks is examined in terms of presence, nature and quality of the following textbook features: motivational and comprehension factors, pedagogical factors, problem solving factors, technological factors. The analysed series of textbooks consists of four textbooks: Matematika 6, Matematika 7, Matematika 8 and Matematika 9 (Editing House Dukagjini, Pejë) which actually serve for mathematics teaching and learning in grades 6-9.

### III. MOTIVATIONAL AND COMPREHENSION FACTORS

It is well known that student motivation is one of the key elements in teaching and learning [2]. In mathematics teaching and learning, a more comprehensive and motivating learning environment is provided making strong connections between mathematics content and real world, everyday experiences, history of mathematics, modern technology, other school disciplines as well as using a variety of presentation styles, methods and classroom activities. Mathematics content enriched in this way is far more acceptable and interesting for students, compared to abstract and isolated mathematics information. This applies particularly to the young age of students, such as students in lower secondary school, which includes grades 6-9. Mathematics textbook, as a most important instrument (sometimes the only one), in teaching and learning mathematics, must be “a provider” of these connections. According to the Rivers Matrix [3], motivational factors include historical notes, scientist biographies, career info, practical implications and applications. Rivers Matrix, also, identifies the elements that raise the comprehension of mathematics contents, which are: the use of colors and graphical representations. Many researchers agree that colors and illustrations are a very powerful factor in terms of student’s comprehension. Comprehension can be greatly influenced by the color, layout and inclusion of graphics within a text [4]. Color and the presence and correct use of diagrams play a vital role in student’s comprehension [3].

The data obtained from the actual textbooks analysis, regarding the presence of the motivational and comprehension factors, is presented in the table 1. The collected data indicates a lack of most of the textbook features that have a motivating function. There is no kind of career info or use of proverbs, riddles, jokes. There is also no use of realistic photos. Referencing to the historical mathematical discoveries and applications, as well as providing informations on scientist biographies is almost non-existent across all of the textbooks. In general, the use of motivational factors is very rare and isolated, with no functional weight. On the other hand, we have a truly large number of illustrations. Many researchers have highlighted the relevant role of bright and attractive illustrations, e.g. [4]. However, these textbooks weakness regarding the illustrations matter is twofold. Firstly, the only colors used through all the illustrations are the black color and two or three nuances of gray color. Secondly, realistic illustrations, which actually have greater weight and importance [3] are very few, only 3.10 % of the total number of illustrations. There is no use of colors in any of the textbooks involved. Through all the textbooks, the page background is white, while the font color is black. Sometimes a nuance of gray color is used for backgrounding of the highlighted text.

**Table 1. The presence of the motivational and comprehension factors in the analyzed textbooks**

	Matematika 6	Matematika 7	Matematika 8	Matematika 9
Historical notes	1	2	1	1
Biographical notes	0	0	1	4
Humor	0	0	0	0
Colors	black, grey	black, grey	black, grey	black, grey
Tables and mathematical illustrations	253	225	142	252
Real life illustrations	8	17	2	0

### IV. PEDAGOGICAL FACTORS

Well designed, contemporary mathematics textbooks are expected to contain different teaching-learning, student-centered individual and group activities which have a number of roles. One of the important roles that these features have is providing teachers with ideas and activities for teaching students [5]. Erbaş, Alacaci and Bulut in their study [6] reveal different possibilities of using student centered activities and methods for presenting mathematical knowledge in order to turn a textbook more reader – friendly and helpful for students. Further more, the textbooks are in charge for providing help for student challenging on individual basis as well as providing help for student assessment and self assessment.

As for the pedagogical features of the analysed textbooks, it can be seen that all of the textbooks have a traditional structure of content organisation [7]. That is, all the presented units comprise of three main parts: the textual part containing necessary explanations on the topic, the worked examples that follow (or are placed before) the textual sections, and the unsolved exercises intended for individual student work. The exercises are not graded at all by their

difficulty level. This structure of content organizing is quite simple and it offers very poor possibilities of use in mixed ability classes, like ours are in the lower secondary level of schooling. Such a structure of mathematics textbooks not only that does not allow students working at their own specific levels and individual speeds, but it also does not offer any kind of help regarding students assessment and self assessment.

In particular, learning and teaching activities through all the analyzed textbooks are very few and occasional. The textbook Matematika 6 contains only five such activities, three of which are pair activities, one is group activity and one is of individual nature. Matematika 7 contains 14 different student – centered activities, Matematika 8 contains five learning activities of individual form, while Matematika 9 is the worst exemplar in the series, in which even a single used or proposed activity could not be found.

## V. PROBLEM SOLVING FACTORS

Problem solving is the center of mathematics curriculum in primary and secondary level of schooling all over the world. Solving problems is perhaps the most significant activity in contemporary teaching and learning of mathematics, as it ensures the development of students' higher order thinking skills, as well as modelling and application skills.

The development of students skills in problem solving is, also, one of the main intentions of Kosovo mathematics curriculum for lower secondary school [8], [9], [10], [11]. Of course, for the successful accomplishment of this intention, the problems that students are challenged with, should be appropriate. Likewise, the convenient procedures for solving these problems should be introduced, taught and implemented.

The actual textbook analysis, as for the problem solving part, is performed through the categorising of all the problems presented in the textbooks, as well as the examination of the problem solving procedures applied on the worked textbook examples.

Firstly, all the tasks intended for the individual students work, presented in the textbooks, were counted as problems, according to the definition that problem is every situation that needs a solution, no matter if the solution is readily available or not to the solvers [12]. Problems that can be solved in a straightforward way, only by applying a standard algorithm, formula or procedure available to the student, are characterized as routine problems. Problems that require creative thinking and can not be solved with just applying a known algorithm, are characterized as non – routine problems. As grey area tasks, are classified all the tasks that could be solved only by applying a known algorithm, formula or procedure, but students have to discover which algorithm or operation to use [13].

With respect to their contextual features, the involved tasks are divided in two categories. The non – contextual problems include all the problems with references to pure mathematics, while contextual problems include all the problems with reference to real life or artificial reality constructed by the textbook authors.

The representation of the problem solving procedures, is examined based on Polya's general strategy for problem solving and heuristics for problem solving, which are detaily presented in the literature, e.g. [12]. Polya's general strategy for problem solving consist of four steps: the understanding of the problem, devising a plan, carrying out the plan and looking back. The actual analysis examines if the solutions presented in the textbooks through worked examples, include all of the above mentioned steps of Polya's strategy. Also the amount of different solving heuristic types used in the worked examples is examined.

As for the situation of problems according to their cognitive features, the distribution of the routine problems is very high compared to the non – routine ones. As a detailed example, we can take the textbook Matematika 7, for which the above mentioned distribution is 177 routine problems, 51 non – routine problems and 47 grey – zone problems.

Regarding the contextual nature of the presented problems, the distribution of the contextual problems versus non – contextual ones, through out the whole series of textbooks is given in the table 2.

**Table 2. The percentage of the contextual problems in the total number of the presented problems in the mathematics textbooks for lower secondary school in Kosovo**

	Matematika 6	Matematika 7	Matematika 8	Matematika 9
Contextual problems	9.38%	21.25%	4.71%	14.4%

## International Journal of Novel Research in Education and Learning

Vol. 2, Issue 2, pp: (19-23), Month: March - April 2015, Available at: [www.noveltyjournals.com](http://www.noveltyjournals.com)

In this textbook series the context embedded problems are in a very low percentage. The major part of the tasks is situated into the abstract mathematics world.

Regarding the representation of problem solving procedures and heuristics, it is observed that the majority of the worked examples is solved using only the third step of Polya's strategy. There were also examples solved using two of the four steps – the second and the third one, or the third and the fourth one. We can take as an example the textbook Matematika 7, where 19 examples are solved using two steps, of total 184 examples presented in the textbook. In the same textbook, there are only 5 examples solved in more than one way. On the contrary, there was very hard finding an example solved using three or all the four steps. More precisely, throughout the whole serie of textbooks, only one worked example is found, which is solved using the three steps of Polya's strategy, and non of the examples used four steps.

Further more, the frequency of heuristics use is very low, and there are only few types of heuristics founded in the textbooks such as "use an equation", "draw a diagram", "make a table", "work backwards". There can not be found even a single explanation or a note for any of the stages of general strategies for problem solving. Also, there can not be found even a single explicit introduction for any of the used heuristics.

### VI. TECHNOLOGICAL FACTORS

Advancing technology constantly does influence the modern human society. In terms of education, technology has already strong influence on the issue of what should be taught, how and why it should be taught. The same situation is in the field of mathematics education. In addition, technology offers tools with great potential for using in the mathematics teaching and learning [14]. Textbooks, also, as the primary and dominant instrument in the teaching and learning of mathematics must necessarily reflect in this regard. Also, the integration of modern technology in the textbook contents is one of the most effective forms towards the imperative incorporation of calculator, computer, internet and other technological tools in the teaching and learning of mathematics. Nowadays, there are more concrete evidences that the incorporation of different software in the elaboration of the mathematical contents has many positive effects, such as attracting and retaining the attention of students as well as increased understanding of these contents. In addition, computers can be used for the construction of more challenging problems, projects and tasks with great benefits for students.

On the other hand, although it is known that Kosovo is a poor country and can not make "luxury" investments in education, such as providing personal calculators with high functionality or other technological tools for each student, the use of informatics cabinets and home computers which most of Kosovar families (especially in urban areas) possess, should serve as sources to improve and modernize the mathematics teaching and learning. Therefore, the bypassing of these learning opportunities for Kosovan students, should not be allowed.

After detailed analysis of Kosovo mathematics textbooks for lower secondary school, it resulted that a whole series of textbooks does not contain any single reference to any kind of technology and it does not contain any single requirement for technology use during the teaching or learning. This situation means that use of technology is ignored at all in these textbooks developing.

### VII. CONCLUSIONS

As the results show, there is a huge difference between perspectives and approaches in analyzed textbook series and modern perspectives and approaches in mathematics teaching and learning. Knowing that Kosovo Ministry of Science and Technology gives priority to the analyzed textbooks as the main source for mathematics teaching and learning in the lower secondary school, we can conclude that kosovar students, as for the learning opportunities offered by the curriculum materials, are situated in an abstract mathematic world with almost nonexistent connections with real life and other school disciplines world and no connection what so ever with modern technology. Furthermore, textbooks do not offer any support or help with classroom activities and teaching strategies. The existing organizational structure of these textbooks results in reduced opportunities and less challenge for whole parts of a heterogeneous group of students with mixed ability levels. In addition, this series of textbooks does not represent a good foundation for developing students abilities for problem solving. The presentation of problems in a whole series of analysed textbooks is very poor and inadequate one. Most of the problems that students are challenged with, are routine and non – contextual problems, giving

## International Journal of Novel Research in Education and Learning

Vol. 2, Issue 2, pp: (19-23), Month: March - April 2015, Available at: [www.noveltyjournals.com](http://www.noveltyjournals.com)

not much opportunities for developing students higher order thinking skills. Moreover, students are not introduced at all with general strategies for problem solving and the use of problem solving heuristics is very low and very poor.

This analysis brings us to conclusion that these textbooks potentials for the supporting of contemporary mathematics teaching and learning is very low and working with them is not of much use.

### REFERENCES

- [1] Delaney,S., Charlambous ,Ch., Hsu, H.,& Mesa, V., 2007, The treatment of addition and subtraction of fractions in Cypriot,Irish and Taiwanese textbooks, Proceedings of the 31st Conference of the international Group for the Psychology of Mathematics Education, vol.2, Seoul, PME
- [2] Williams, K., Williams, C., 2010, Five key ingredients for improving student motivation, Research in Higher Education Journal
- [3] O’Keeffe,L.,O’Donoghue,J., 2009, Mathematics Textbook Analysis: its role and significance for student comprehension and motivation,Proceedings of Third National Conference on Research in Mathematics Education, Dublin
- [4] Dowling, P., 1996, A sociological analysis of school mathematics texts, Educational Studies in Mathematics, 31(4)
- [5] Johansson, M., 2006, Teaching Mathematics with Textbooks, Luleå Univeristy of Technology, Departament of Mathematics
- [6] Erbaş, A., Alacaci, C., Bulut ,M., A 2012,Comparision of Mathematics Textbooks from Turkey, Singapore and the United States of America, Educational Sciences: Theory & Practice, 12(3), Educational Consultancy and Research Center
- [7] Breakell, J., 2001, An analysis of mathematics textbooks and reference books in use in primary and secondary schools in England and Wales in the 1960s. <http://faculty.ed.uiuc.edu/westbury/paradigm/BREAKELL.PDF>
- [8] MASHT, 2004a, Plani dhe programi për klasën VI të shkollës së mesme të ulët.
- [9] MASHT, 2004b, Plani dhe programi për klasën VII të shkollës së mesme të ulët.
- [10] MASHT, 2005a, Plani dhe programi për klasën VIII të shkollës së mesme të ulët.
- [11] MASHT, 2005b, Plani dhe programi për klasën IX të shkollës së mesme të ulët.
- [12] Fan, L. H., & Zhu, Y., 2007, Representation of problem-solving procedures: a comparative look at China, Singapore, and US mathematics textbooks, Educational Studies in Mathematics, 66(1).
- [13] Marchis, I., 2012, Non – routine problems in primary mathematics workbooks from Romania, Acta Didactica Napocencia, 5(3).
- [14] Wiest, L., 2001,The role of computers in mathematics teaching and learning, Computers in the schools, vol. 17, issue 1-2