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Original paper

Towards coherent structure of Mathematics textbooks – analysis of textbooks according to structural blocks of TIMSS research²

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Extended summary

The research is on the analysis of the Mathematics textbook for the fourth grade of the primary school from the aspect of geometry. The Mathematic textbook is of a great value to teachers when planning lessons, so its analyses are significant for understanding students' achievements in international research projects such as TIMSS. The aim of the research is spotting tendencies in structuring pedagogical situations in geometry and textbooks for the fourth grade of the primary school in Serbia, which represent a dynamic characteristic of a textbook with activities, explanations (narratives), examples, exercises that offer learning opportunities for introducing geometrical concepts and revealing and understanding geometrical ideas.

Descriptive method was used in the research, as well as the technique of contents analysis. Register list in which the observed occurrences were recorded, was used as the instrument of the Reserch. The sample of the research consisted of Mathematics textbook for the fourth grade of the primary school of the following publishers: Eduka, Nova škola, Klett, BIGZ, Zavod za udžbenike and Kreativni centar, which were approved in the Republic of Serbia. The textbooks were analysed as a part of a unique textbook set, which is different, depending on the publisher. The textbooks were in use in the period of the research TIMSS 2011, and this is between March and May 2011. Frequency and percentge were used for data processing.

The aim of the rerserch is spotting differences (tendencies) in each of the analysed textbooks sets of Mathematics and not comparing different publishers.

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Eduka. The textbook set consists of two sets (a and b) and there were 173 blocks registered, and the greatest part of the textbook structure of geometry refers to the exercises, and this is 121 (69.94%) block. There were 32 (18.50%) narrative blocks, and among those, there were not the ones functioning as motivation of students, nor those which enable extension to other teaching or non-teaching areas. There were 13 (7.51%) leading exercises, five (2.89%) activities and only two (1.16%) worked examples. We can see that the task and leading tasks represent the majority of the structure of the textbook of the publishing house Eduka, whereas less than one third of the analysed structure belonged to mutually worked examples, activities and narrative blocks.

Nova škola. The mathematics textbook of the publisher Nova škola consists of a book. Analysed part of the Mathematics textbook referring to the Geometry contents consists of 279 blocks. The most registered blocks refer to Geometry exercises 228 (81.72%). It was noticed that 44 (15.77%) of narrative blocks among which there are those which would motivate students or which offer expanding knowledge through interesting facts from content domain of Geometry. Activities can also have a motivational role. There were five (1.79%) registered blocks. Leading exercises and worked examples enable students to gradually master geometrical knowledge. This textbook set had only two (0.72%) leading exercises. According to this division of blocks, we can conclude that in the part of the textbook published by Nova škola, there is no gradual individualisation (methodological guidelines) of students towards mastering new knowledge during completing Geometry tasks.

Zavod za udžbenike. The textbook set consists of a workbook and a textbook. In the part of the set referring to geometrical contents, there are 183 blocks. The greatest part of the analysed structure of the textbook goes to exercises, 115 (62.84%) and to the leading exercises, 33 (18.03%). There were 25 (13.66%) narrative blocks, 6 (3.28%) worked examples and four (2.19%) activities. In the textbook of Zavod za udžbenike, there is a tendency of gradual individualisation (methodological guidelines) of students towards mastering new knowledge during completing Geometry tasks, but not motivation and expanding students' interests in the field of geometry.

Klett. The mathematics textbook set of the publishing house Klett consists of two parts. Within geometrical contents presented in this textbook set, there are many blocks registered. There were 326 blocks observed, and most of them goes to exercises, 220 (67.48%). There were 49 (15.03%) narrative blocks observed, and some of them direct students to previously learnt content. There are 43 (13.19%) leading exercises in this book. Worked examples and activities are represented by 7 (2.15%). There is a visible tendency of gradual individualisation (methodological guidelines) of students through the leading exercises.

BIGZ. Textbook set of the publishing house BIGZ consists of two parts and a workbook. The total number of the registered blocks in geometry is 242. The greatest part of the structure of the textbook is taken by exercises -182 (75.21%). There are 45 (18.59%) registered narrative blocks, among which special attention is given to revision narratives. As far as other types of blocks are concerned, there are 7 (2.89%) activities observed, 5 (2.07%) of the worked examples and three (1.24%) leading exercises. This kind of division means that there is no tendency of gradual individualisation (methodological guidelines) of students towards mastering new knowledge during completing Geometry exercises.

Kreativni centrar. Textbook set of this publisher consists of two parts. There were 224 blocks registered in geometry. The greatest number of blocks in this textbook set belongs to exercises - 120 (53.57%). We registered 59 (26.34%) of narrative blocks of different subcategories in the content domain of Geometry. Motivating students is stressed in this book, and motivational narrative was mentioned 6 times (10.17%), as well as expanding students' interests, narrative for expanding knowledge was registered and correlation geometrical contents with the contents in other content domains in Mathematics or correlation to other subjects 12 times (20.35%) (correlation to Serbian language and literature, Biology, Geography, History and other subjects). There are 30 (13.39) leading exercises in this textbook, worked examples 3 (1.34%) and 12 (5.36%) activities of a different type. We have observed an equal relation of an active narrative which was registered 13 times (22.03%) and the passive narrative registered 25 times (42.37%). Structure of this textbook is considered to be more or less coherent, with some changes in the block of the narrative for revision (lessons in the textbook are mostly revises by block exercises which precede the teaching topic).

Results of the research show that the greatest part of the structure of the analysed parts of the textbook refers to the exercises and less to the activities. This kind of a division is understandable because this kind of tasks represent the essence of mathematical education and it is acceptable with proper methodological forming of the whole structure of the textbook, i.e. gradual leading of students through the activities, worked examples and leading exercises.

Our opinion is that the Geometry structure of our Mathematics textbooks should be carefully planned, so that achievements of students in the content domain of Geometry can be improved in comparison to previous two cycles of the TIMSS research. Our question is whether we could expect improvement in the new cycle of the TIMSS 2015 research, because the curriculum in Serbia has not been fundamentally changed recently, as well as the textbooks, as far as they appeared to be transformed from workbooks to non-working books with formal changes.

Results of the research can be useful for the textbook authors and publishers because of the stronger didactical-methodological forming in strengthening coherent structure for the textbook. Taking into account that structuring pedagogical situations in the textbook has influence on so-called applied curriculum, i.e. that there are occurrences within the classroom and it is necessary to focus more on structural components of activities, worked examples and leading exercises as well as blocks which would motivate students for learning geometry.

Key words: TIMSS, pedagogical situations, Mathematics textbook, geometry, Serbia.

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