Journal of the Institute for Educational Research
Volume 54 • Number 1 • June 2022 • 5–26
UDC 37.091.64:51(497.11)
37.091.64:81′271(497.11)

ISSN 0579-6431
ISSN 1820-9270 (Online)
https://doi.org/10.2298/ZIPI2201005R
Original research paper

HOW DO FIFTH GRADERS UNDERSTAND THE LANGUAGE OF MATHEMATICS TEXTBOOKS?*,**

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ABSTRACT

A significant and insufficiently studied problem in the education in our country is the quality of textbook language. It is vital to address the issue from students' perspective (to whom this teaching aid is primarily intended), which, among other things, enables to analyse whether the textbook presents the support for students to learn, but also to examine the extent to which the textbook can help students improve their basic abilities, primarily linguistic and cognitive. Therefore, the aim of this paper is to examine how fifth graders understand the language of mathematics textbooks. Students (N = 209) of the said age from three Belgrade primary schools participated in the research. The students were asked to mark language units whose meaning they did not understand in two lessons (studied and nonstudied) in mathematics textbooks. The results indicate that there are several types of linguistic units that students evaluate as incomprehensible: words, syntagms, and sentences. They also reveal that the students understand better the language of familiar than that of unfamiliar lesson, which indicates that they would not be able to master the knowledge from these textbooks independently. In the familiar lesson, significantly more students do not understand words and syntagms belonging to general lexical system of Serbian language. In the unfamiliar lesson, however, significant percentage of students does not understand meanings of the sentences used (seven sentences in average). The students with a better grade in mathematics marked fewer unclear sentences in

* *Note 1.* This research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract No. 451-03-68/2022-14/200018).
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both familiar and unfamiliar lesson. The obtained results could be used in improving the quality of the language in mathematics textbooks, as well as in raising students' language competence.

Key words:
Textbook language, mathematics textbooks, words/syntagms and sentences, students' language competence, primary school.

INTRODUCTION

An important feature of a textbook as teaching aid is that it can be used both in the classroom and at home; this enabled the concept of textbook to survive for a very long time (Sönnerhed, 2011). Certain authors point out that a textbook is much more than a stable support of educational process; it is a mechanism by which the quality of education could be improved most rapidly (Antić, 2016; Ivić, Pešikan & Antić, 2009).

One of the probably most important quality criteria is a textbook language, i.e. its intelligibility and correctness. Language is a basic means of expression which enables a student to successfully master the knowledge presented in the textbook. Although other means, such as pictures, graphs, symbolic signs, etc., are of special importance for the construction of students' understanding, they cannot act in isolation without the language with which they form a coherent whole. A prerequisite for the effective use of textbooks is that the student understands the text he or she is learning. Thus, the language of the textbook needs to be almost perfectly adapted to the learner. It can therefore be reasonably believed that quality of language is an important factor of professional credibility and methodical functionality of the entire textbook. A textbook uses different semiotic systems, the most important of which is language. By learning from a textbook, children adopt, internalize semiotic systems of the culture which become a part of their cognitive functioning (Antić, 2014; Plut, 2003; Ivić, 1976a; Ivić, 1976b).

In general, the textbooks should be written in language which is understandable to a student. Apart from pictorial and other addendums, readability of the text is primarily influenced by the features of the language used, such as: 1. lexical complexity – a number of new, long and abstract words that are/are not appropriately explained; 2. grammatical complexity – complexity of tenses, types of functional words, complex pronouns, negative forms, negative-interrogative forms, etc.; 3. syntax structure complexity – a number of subordinate clauses connected to each other, insertions, deviations from the basic line of presentation, etc. (Plut, 2003). With this regard, as indicators of a textbook language quality standard, the following are recognized: adherence to the linguistic norm, i.e. adherence to literary language of a textbook; the explanation of unfamiliar words; and the length of all the sentences have to be age appropriate (Ivić, Pešikan & Antić, 2009).

Until recently, linguistic aspect has not been regarded as an important factor in learning/knowledge acquiring process in teaching mathematics, neither has its influence on students' achievements in this field been explored (Bullock, 1994; Gee, 2005). However, by the end of the last century and beginning of 21st century, the role of language captures attention of those researches whose focus is primarily on mathematical literacy of the primary school students. Such shift enables considering the language function in education as a semiotic system necessary for acquisition, construction and presentation of an individual's knowledge (Orton, 2004; Seah Hoon, 2016), i.e. understanding mathematical contents, identifying them and understanding their nature and a manner in which mathematical concepts are studied (Spanos et. al., 1988; Gelman & Butterworth, 2005; Barton, 2008). The majority of authors emphasise the importance that language, as a whole, has in a dialogic nature of knowledge in sociocultural context, and the fact that language changes in the use (Roth, 2014). Further, the researches show that students in English-speaking countries have difficulties in mathematics classes (up to 15%) due to the problems connected with linguistic competence (Ní Ríordáin & O'Donoghue, 2009).

Language in Mathematics Textbooks

The quality of mathematics textbooks has been a matter of numerous researches, both in our country and abroad. The examinations have most frequently been directed to the content analysis and textbook structure (O'Keeffe & O'Donoghue, 2015), as well as to expectations to be fulfilled by these textbooks in educational system (Li, 2000; Haggarty & Pepin, 2002; Brändström, 2005; Yan & Lianghuou, 2006; Hadar, 2017), while the language of those textbooks were not in the focus. Moreover, it has been emphasised that there too few studies regarding linguistic aspects of mathematics texts/textbooks viewed from the perspective of key participants in educational process– students and teachers.

Some authors point to the problem which concerns inter-dependence of formal and informal language in learning mathematics, as well as their presence and their relationship in mathematics curriculum and textbooks (Barwell, 2016). The conclusions of the researches regarding language of mathematics textbooks show, among other things, presence of noticeable use of nominalization (Herbel-Eisenmann, 2007; O'Keeffe & Donoghue, 2011), which is traditionally in linguistics regarded as a linguistic procedure that should be avoided, because nouns, unlike verbs, are static and make text monotonous.[1] As it deprives text of particularity,

[1] Nominalization implies the use of deverbative and deadjectival nouns instead of verbs (Klikovac, 2008), and it is the property of those functional styles which are instrument of intellectualized, and topically relatively general and abstract domains of linguistic use (Radovanović, 2007). Nominalization is linguistic and expressive means which is not

dynamism and colour, nominalization is not a desirable in textbook discourse. Alfredsson and associates indicate that mathematics textbooks often use concise, everyday (communicative) language when new concepts or rules are explained, while explicit explanations are used for terms and mathematical formulas (Alfredsson *et al.*, 2007 according to Sönnerhed, 2011). In the study which deliberates one of the ways in which mathematics textbook language may influence how students react to the subject itself represented by mathematics textbook, considering at the same time the use of personal pronouns in the text, it is concluded that there is no personal pronoun *I* in the analysed corpus, while the use of *you* is prevailing. According to authors, linguistic constructions like: *The graph shows you...* or *The equation tells you…* represent striking examples of "obscure human subjectivity… which points to absolutistic image of mathematics, presenting mathematical activity as something which may occur by itself, without people" (Herbel-Eisenmann & Wagner, 2007: 10). Morgan notices that absence of the first-person singular pronoun distances the mathematics textbook author from the reader/student, creating a more formal relation between them, and actually "screens" the presence of people in the text (Morgan, 1996), and causing that mathematical content appears even more abstract and inaccessible to students. By analysing cohesiveness of the texts in mathematics textbooks, Solomon and O'Neill claim that mathematical texts have logical and not temporal cohesion, as well as that mathematical discourse cannot be narrative as it is structured around logical and not temporal relations (Solomon & O'Neill, 1998). On the other hand, there are opinions that mathematics textbooks contain significantly shorter sentences than, for example, history textbooks, as well as that no study has empirically proved that texts in mathematics textbooks are more complex than texts in the textbooks of other subjects (Österholm & Bergqvist, 2013). Besides, it is emphasised that mathematics texts/textbooks do not use a special language, but that communicative language (conversational functional style) is used in a special way, which does not imply the use of terms and expressions that have a special meaning. All this could influence linguistic properties of mathematical texts and require developing special skills (linguistic) for their interpretation and reading (Österholm, 2008).

Considering the results of domestic and foreign researches, we have noticed that little attention has been paid to the language in mathematics textbooks. Nonetheless, there are almost no studies which consider the students' opinion regarding the language of mathematics textbooks they are using.

Based on the insight into the importance of quality of the language in mathematics textbooks. The aim of this paper is to examine how fifth graders understand the language of mathematics textbooks.

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completely desirable. With this regard, Klikovac points to stylistic, ideological and utilitarian aspects of nominalized statements (Klikovac, 2008).

The term *quality of understanding of mathematics textbooks language* in this paper is operationalized through type and number of linguistic units identified by students as unclear and difficult to comprehend. This indicator shows a level of language development, i.e. linguistic competences of students, but also it indirectly points at the appropriateness of the language of analysed primary school mathematics textbooks.

METHOD

Subject sample. The research has been conducted in an appropriate sample of 209 fifth-grade students form three Belgrade primary schools. The sample is homogenous genderwise (51.2% of boys and 48.8% of girls). No statistically significant differences have been noticed when observing the grade in mathematics and overall school achievement of students relating to the gender of students (Table 1). The grade in mathematics and overall school achievement of students are in a moderately strong positive correlation ($r = .514$; $p < .001$).

Table 1: The structure of sample (N = 209)

		Frequency	Percent
Gender	Male	107	51.2
	Female	102	48.8
Grade in mathematics	A	118	56.6
	B	61	29.9
	C	25	12.0
	D	5	2.4
	F	–	–
Overall school achievement	Excellent	160	76.6
	Very good	44	21.1
	Good	5	2.4
	Sufficient	–	–
	Insufficient	–	–

Textbook corpus. The textbook corpus includes solely the textbooks used in mathematics classes by the student-participants of the research. These are current editions of the primary school mathematics textbooks for the fifth grade by two publishers: Matematiskop (*Mathematics 5: primary school textbook for fifth grade*, Vladimir Stojanović) and *Klett* (*Mathematics 5: primary school textbook for fifth grade*, Nebojša Ikodinović, Slađana Dimitrijević).[2] The age is chosen since the process of adopting and automatisation of reading skill has been completed and serves for the *reading to learn* stage which depends on students' lexical-sematical development as well (their language competence).

Course of research. In order to perform the research, first we had to receive the consent form the principals of the three primary schools mentioned, and then from the parents of the fifth-grade students who agreed for their children to participate in this research. The research was conducted during the first half-term of school year 2020/2021. Participation in the research was voluntary and we emphasized that the study was not related to school, school achievement of students or grading (in mathematics and general). We also stressed that performing the research was in accordance with EU General Data Protection Regulation – GDPR and legal regulations of the Republic of Serbia in this field. All the children were questioned in group during one school class. Expert associates or a deputy principal were in charge for conducting researches and giving precise instructions in each school.[3]

Data collecting procedure. The research involved two parts. The first part of the research is based on survey. One part of the survey is related to collecting data on gender, student's grade in mathematics, and their overall school achievement. In the other part of the survey, the students responded to three questions on a four-point scale: a) they estimated how often they use the textbook (1 – never, 2 – sometimes, 3 – often and 4 – always); b) how difficult they find the textbook (1 – not at all, 2 – not much, 3 – to some extent, 4 – extremely) and c) they were offered possible reasons for the textbook's difficulty (*text is often unclear; there are non-understandable words and expressions; it contains a lot of specialist words and expressions; the explanations are not completely clear*). Each student could circle more reasons within the third question related to difficulties in understanding the textbook lessons/texts form the mathematics textbook.

In the other part of the research, the students were asked to read carefully two randomly selected lessons from the mathematics textbook[4] and to mark/underline

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[2] The textbooks mentioned are in the *Catalogue of textbooks for the first and fifth grade of primary education* (Official Gazette of the Republic of Serbia no. 27/18).

[3] In none of the schools the researches were allowed to be present in the classes when the research was conducted due to the epidemiological protective measures applied at the time because of the pandemic caused by a SARS-CoV-2 virus.

[4] All the students had the same studied and nonstudied lessons (only from the textbook used in mathematics classes).

all linguistic units they did not understand. All the students first received the unit/lesson they were familiar with, i.e. the one that they had already covered in classes (the name of the unit: *Dividing with 4 and 25* / *Divisibility by numbers 4 and 25*).[5] Afterwards, they received the second lesson they were not familiar with, i.e. the unit which they had not covered in classes until the research (the name of the unit: *Decimal Notation of a Fraction.Rounding Numbers / Decimal Notation of Fractions*).[6] Familiar and unfamiliar lessons were chosen so that we could have a more accurate insight in students' understanding of given units, i.e. to see, among other things, whether the students equally understand the language of familiar and unfamiliar text from the textbook. Every student had their own printed material. The students received precise instructions before work, and they would start their work after it had been established that they fully understood the requirements. In this research, understanding of linguistic units is based on personal assessment of the students.

Data processing. For the analysis of material/lessons in which the students marked/underlined parts of text whose meaning they did not understand, a content analysis (Titscher *et al*., 2000; Schilling, 2006; Schreier, 2012) method was used. The unit of analysis were linguistic units which students identified as unclear, i.e. whose meaning, by their assessment, they could not understand. During analysis of the material, it was established that the students underlined the following as unclear linguistic units: words, syntagms (expressions), and sentences. The unknown words were classified, first, into the words from familiar (studied) and unfamiliar (nonstudied) lesson, and then into the words belonging to general lexical system (commonly used lexical fund) and to the terms from the field of mathematics.

Lexical system of any language can be pictorially presented in the form of concentric circles (Dragićević, 2018). The core of lexicon consists of commonly used, unmarked lexis, while around it and at periphery there are a great number of lexical funds composed of lexis specified according to different criteria in line with its usability (Šipka, 2006).

The terms are the words "which are used in a profession or science" (Dragićević, 2007: 20). Jovanović indicates that terminology unit "inside particular terminology system can be used only for signifying one particular concept". The author, among other things, emphasises that the term "has to be a member of a particular terminology system", which means that a concept marked with a term can be classified within a field of concepts characteristic for given profession or science (Jovanović, 2016: 41–42).

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[5] In one analyzed textbook, the lesson (which the students had already covered) contained only the text (there were no iconic means); while in the other textbook, in a familiar lesson, in addition to the text, one illustration was given as well.

[6] The lesson that was unfamiliar to the students in one textbook contained only text; while in another textbook, both text, pictures and illustrations were used to structure the unfamiliar lesson.

The unknown words belonging to general lexical system are the words we presume a fifth-grade student with average linguistic capabilities has in their vocabulary. The category of unknown syntagms is classified as unknown syntagms (expressions) belonging to commonly used fund and syntagms (expressions) belonging to mathematical terminology system in familiar and unfamiliar lesson. Furthermore, the unknown sentences were separated in both familiar and unfamiliar lesson. Based on previously presented categories, we defined protocol for content analysis in which the data regarding frequency of underlined parts of lesson for each category and for each student were recorded. Every unknown word, syntagm (expression) and sentence marked by a student in the lesson given to them is recorded only once during data processing, regardless of how many times it reappears in the lesson, and how many times it was underlined by the student.

Variables and statistical data analysis. The research contained the following independent variables received via the questionnaire: gender, overall school achievement of students, grade in mathematics, the frequency of mathematics textbook use, estimated difficulty of studying from the textbook, difficulties (viewed from the aspect of the language of the textbook) that students have in understanding the language of the text in mathematics textbooks. Dependent variable is presented by a number of underlined linguistic units in the text that we defined as a composite variable made of: the number of underlined words belonging to commonly used lexical fund; the number of underlined terms; the number of underlined syntagms (expressions) belonging to commonly used lexical fund; the number of underlined syntagms (expressions) belonging to the system of mathematical terms, and the number of underlined sentences. Previously mentioned variables are defined independently for studied and nonstudied lesson.

For determining a number of underlined lexical units in the text, as well as for analysis of the data from the questionnaire, the techniques of descriptive statistics were used. The correlations between the variables were examined using the Pearson correlation coefficient. For the examination of differences between the average number of underlined linguistic units in a studied and nonstudied lesson, T-test for paired samples was used, while for the examination of differences regarding the number of underlined linguistic units vis-à-vis the students' gender, T-test for independent samples was used.

RESULTS AND DISCUSSION

Analysis of the linguistic units in the research material

Words in familiar and unfamiliar lessons. The data indicate that as many as 63.6% of fifth-grade students do not understand words belonging to the general lexical system in the familiar lessons of mathematics textbook. In the unfamiliar lesson, incomprehension of words from general lexical system has been recorded with fewer students (43.1%). With regard to mathematical terms, 3.8% of students have underlined them in familiar lesson, while more than a tenth (15.8%) do not understand terms in unfamiliar lesson. It is somewhat unexpected that the students understand less the words from the general lexical system in familiar than in unfamiliar lesson, as well as that the students know less the meaning of the words from the general lexical system compared to the terms, in both familiar and unfamiliar lesson. This finding can be attributed to the inadequate development of the lexical-semantic level of the students' language. Other researches also confirmed that the lexical-semantic development of students of different ages was not at a satisfactory level (Lazarević & Stevanović, 2013; Stevanović & Lazarević, 2014; Lazarević & Stevanović, 2015). Therefore, it is not a question of e.g. archaisms, but the words used in everyday communication, which are incomprehensible to children (the meaning of these words is unknown to them), because the students' language competence is not sufficiently developed.[7] The data regarding a larger number of unknown words in the lessons they have covered at school, than in the lessons they have not covered, is confirmed with the seventh-grade primary school students in the research which examined the quality of language in narrative subjects' textbooks (Lazarević & Šefer, 2009). When analysing the data regarding comprehending the words, whether belonging to general lexical system or terminology, we should bear in mind that they are also contained in the sentences underlined by majority of students in unfamiliar lesson, which is a matter of our attention in the sentence analyses.

Syntagms in familiar and unfamiliar lesson. The results of this research indicate that somewhat more students (20.1% of students) do not understand syntagms from the general lexical system in familiar lesson, comparing with the syntagms from general lexical system in an unfamiliar lesson (16.7% of the students). When considering the syntagms from the terminology system we perceive that fewer students (12.9%) do not understand their meaning in familiar than in unfamiliar lesson (41.1% of the students). This result can also be attributed to students' individual differences and

[7] It is obvious that the development of students' language competence can be reflected in the process of acquiring knowledge, because it makes us wonder how students can learn and remember in a meaningful way if they do not have the basic means of thinking and learning, such as language and other symbolic systems (Vygotsky, 1983).

their competencies, but may also, among other things, point to the question how a teacher can teach when there are so many individual differences among students regarding the basic competency: reading comprehension. On the other hand, the incomprehension of the syntagms from the terminology system in an unfamiliar lesson among a larger number of students is expected because they are linked to the terms and concepts from the field of mathematics the students are still to adopt.

Sentences in familiar and unfamiliar lesson. The data gathered indicate that 40.2% of students do not understand syntactic constructions in a familiar lesson. When considering the language of unfamiliar lesson, as many as 90% of fifth-grade students have marked/underlined sentences whose meaning they do not comprehend. We should bear in mind the fact that nonunderstanding of sentences (which contain all observed linguistic units) implies not only insufficiently developed lexical and semantical level, but also grammatical, syntactic, and other levels of students' language. The analysis established that the students most often identified as unknown the complex sentences containing more than one subordinate clause. With this regard, we would like to emphasise that children successfully master complex syntactic structures, especially compound and complex sentences, in the senior primary school grades (Nippold, 2004; 2007)[8], which is why we maintain that the structure of sentences in the examined mathematical texts (lessons) is not entirely adjusted to age and development level of students for whom the textbook is written. Long and complex sentences, with lots of inserted clauses, complicate understanding of text (Plut, 2003), even when the topic and words are known. They are justifiable only in the senior-grade textbooks and only when inevitable.

Insufficient comprehension of the sentences in unfamiliar lesson can be somewhat influenced by a higher complexity of learning material when compared to the learning material in familiar lesson. Nevertheless, it is not logical that influence of these factors is so strong when it comes to the most fundamental level of recognising denotative meaning of words, without obligation to consider this meaning relative to the context. On one hand, the received result raises a question of quality of the textbook language, since the first condition is not fulfilled – basic understanding of what has been read, and for this reason it loses one of the key intentions: enabling individual learning from any printed material, instructive material, text, textbook, for every student (Antić, 2009). On the other hand, the received data directly point at a loss of formative function of a textbook whose dominant principle is creating a possibility for the one who studies to be in a situation to individually construct knowledge specific and relevant for the particular field (Ivić, Pešikan & Antić, 2009; Pešikan & Antić, 2007).

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[8] Moreover, the relationship between the quality of written text and sentence complexity largely depends on the type of written discourse, because different types of texts have their own recognizable features at the level the syntax on which genres differ from each other (Beers & Nagy, 2009; Beers & Nagy, 2011).

By performing the qualitative analysis of words, syntagms (expressions) and sentences, we identified five examples in each category which most students marked/underlined as unknown in the selected mathematics textbooks. Here we list them separately for familiar and unfamiliar lessons.

The examples of linguistic units whose meaning students do not understand in a familiar lesson.

> The words from the global lexical system: *outcomes; applications; criterion; so as to; whereas;*
>
> The terminology system: *digit, divisibility, divisible; multi-digit; addend;*
>
> Syntagms/expressions from the global lexical system: *given that, in both cases solved; therefore; as in case; previous claims;*
>
> Syntagms/expressions from the terminology system: *two-digit ending; divisibility rules; units digit of natural number; in the case of divisibility by 4; remainder in division;*
>
> Sentences: **1.** *How shall we, without calculating the quotient, determine divisibility by 4;* **2**. *For now, we can claim that number 100 is divisible by 4, because 100 = 4 • 25;* **3**. *A natural number is divisible by 4 if its number is determined by the last two digits (two-digit ending) divisible by 4;* **4**. *Drawing conclusions as in the case of divisibility by 4, we can easily establish the rule of divisibility by 25;* **5**. *Two-digit endings of numbers divisible by 4 are listed in the table on the right.*

The examples of linguistic units whose meaning students do not understand in an unfamiliar lesson.

> Words from the global lexical system: *penultimate, operation, dextral, adding, properties;*
>
> The terminology system: *quotient; decimal; by division; numerator;*
>
> Syntagms/expressions from the global lexical system: *given that; fortunately; in the following schemes; to the left from comma; in the notation;*
>
> Syntagms/expressions from the terminology system: *decimal fractions; arbitrary fraction; rounding the numbers; decimal places; the value of a number with required accuracy;*
>
> Sentences: **1.** *So as to get a better approximate value (which we call rounded value), when deleting excess decimals, let's pay attention to the first deleted digit (with the highest place value among deleted decimals);* **2**. *If only one, last, digit is deleted, then the penultimate digit is not increased in two cases: 1) if a digit less than 5 is deleted; 2) if the digit 5 is deleted and the penultimate digit is even;* **3.** *Given that the fraction a / b represents the quotient of natural numbers a and b, by performing the division operation, we will easily translate this fraction into decimal form;* **4.** *Fortunately, when the quotient is infinitely*

extended, the groups of decimals are repeated periodically; **5**. *We act similarly when it comes to mixed numbers whose real fractions are decimal, with the difference that now the number of integers is higher than zero.*

The results of descriptive statistics regarding understanding of linguistic units per student in familiar and unfamiliar lesson (Table 2) indicate that the students, in average, underlined 1.38 words from general lexical system and almost one (.91) sentence in a familiar lesson. The result indicates individual differences among students. Regarding a familiar lesson, the highest number of students underlined sentences (7 on average) along with the terms and syntagms (expressions) from the terminology system.

Table 2: Average number of linguistic units which students do not understand in familiar and unfamiliar lessons, per student

		Familiar lesson				Unfamiliar lesson			
		Min	Max	M	SD	Min	Max	M	SD
Words	terms	0	5	.07	.48	0	12	.49	1.43
	words from the global lexical system	0	8	1.38	1.48	0	12	1.24	2.10
Syntagms	terminology system	0	4	.18	.56	0	12	1.70	2.37
	syntagms from the global lexical system	0	7	.32	.84	0	4	0.31	.78
Sentences			17	.91	1.80	0	40	7.14	5.18

In further analysis, we wanted to establish whether there are differences in the average number of marked linguistic units in familiar and unfamiliar lessons. T-test for paired samples showed that the average number of underlined linguistic units in unfamiliar lesson was statistically significantly larger than the average number of underlined linguistic units in a familiar lesson, namely: terms ($t(208) = -4.069$, $p < .001$), syntagms from the terminology system ($t(208) = -9.276$, $p < .001$), and sentences ($t(208) = -21.014$, $p < .001$). This result has been predictable as it refers to units from terminology system which the students have not covered yet at their classes. However, a great number of unknown words from general lexical system in unfamiliar lesson may indicate, as we have already stated, inadequate lexical and

semantical development of students' language and cannot be associated with the unknown content of the lesson. Numerous researches have confirmed that students can improve general understanding of texts they are reading by using several different word-learning strategies (Graves, Schneider & Ringstaff, 2018; Wright & Cervetti, 2017). This is why one of the structural textbook components should contain precise explanations of key terms and concepts from the lesson, as this can significantly improve the process of individual learning of a learner, and contribute to a better understanding of the content (Antić, 2009: 30–31), i.e. textbook language.

We have established that a total number of underlined linguistic units in familiar lesson is in positive and moderately strong correlation with the number of underlined linguistic units in unfamiliar lesson (r = .614, p < .001), which indicates that the students who marked a greater number of linguistic units in familiar lesson, did the same in an unfamiliar lesson. The number of underlined sentences in familiar lesson correlates positively with the number of underlined sentences in an unfamiliar lesson (r = .540, p < .001). The number of underlined words from the general lexical system in familiar lesson correlates positively with the number of underlined words from the general lexical system in an unfamiliar lesson (r = .421, p < .001). The correlation for the number of underlined syntagms from general lexical system is somewhat weaker (r = .294, p < .001). This data shows not only the individual quality of the participants' language development, but also initiates the question whether mathematics textbook is completely adequate for the language of students of this age. With this regard, we would like to emphasise once again that mathematics textbooks are regarded to be a key intermediate between curriculum and school practice, even in the era of digitalization, and one of the basic resources the teachers use in their work (Pepin, Gueudet & Trouche, 2013; Usiskin, 2013). Moreover, they are important *artefact* in teaching mathematics (Pepin, 2009; Rezat, 2012).

The differences between boys and girls regarding lexical units whose meaning they do not understand have not been established. T-test for independent samples has not confirmed differences between boys and girls with regard to a total number of analysed linguistic units ($t(208)$ = 492, p = .62) in both familiar and unfamiliar lessons ($t(208)$ = -.116, p = .90), which may challenge „validity of statements regarding a more advanced language development of girls" (Stevanović & Lazarević, 2014).

Correlation between quality of understanding mathematics textbook language and students' school achievement and grade in mathematics

The results of correlation analysis which point at a link between general school achievement of students and their grade in mathematics, with the quality of understanding mathematics textbook language are given in Table 3. Even though the correlations are weak, it has been established that general school achievement of students statistically significantly negatively correlates with the number of unclear

terms, syntagms from terminology system and sentences in a familiar lesson. This data indicates that the students who have better general school achievement mark fewer terms and syntagms from terminology system, as well as fewer sentences, which suggests that they have mastered the content of a familiar lesson. On the other hand, regarding unfamiliar lesson, general school achievement of students statistically significantly correlates only with the number of marked sentences. This correlation is also negative and weak in intensity. Therefore, the students who have better general school achievement mark fewer sentences in unfamiliar lesson, but this data can also mean that the texts are incomprehensible even to the students with better grades. When considering an unfamiliar lesson, both the students with better general achievement and the students whose achievement is weaker, equally (do not) know the terms from the field of mathematics.

Table 3: Correlations between number of linguistic units which students marked as unclear, and students' general school achievement and grade in mathematics

			General achievement	Grade in mathematics
Familiar lesson	Number of underlined words	terms	-.200**	-.117
		General lexical system	-.063	.027
		Totally	-.113	-.010
	Number of underlined syntagms	Terminology system	-.208**	-.146*
		General lexical system	-.110	-.044
		Totally	-.175*	-.099
	Number of underlined sentences		-.259**	-.225**
Unfamiliar lesson	Number of underlined words	terms	.037	.053
		General lexical system	.010	.115
		Totally	.024	.104
	Number of underlined syntagms	Terminology system	.087	.102
		General lexical system	.082	.074
		Totally	.096	.107
	Number of underlined sentences		-.241**	-.191**

* Statistically significant at level .05

** Statistically significant at level .01

Grade in mathematics statistically significantly negatively correlates with the number of underlined sentences in both familiar and unfamiliar lessons. Therefore, the students with higher grade in mathematics underline fewer sentences in both familiar and unfamiliar lesson. Moreover, the students with better general achievement underline fewer syntagms from terminology system in a familiar lesson.

The students' success in acquiring knowledge in mathematics is undoubtedly influenced by various factors. The researches often confirm the correlation between the success in acquiring knowledge and the achievement (grade) in mathematics and a textbook content (Törnroos, 2001; 2005). Our intention is to emphasise that understanding the language of mathematics textbooks can also be an important factor in students' achievement (grade) in mathematics. Therefore, we outline the fact that there are not nearly enough researches on this issue in our country. Moreover, international studies have paid insufficient attention to the correlation between understanding the mathematics textbook language and students' achievement in this school subject.

Students' estimation regarding the frequency of textbook use and possible difficulties they could have in understanding the language of mathematics textbook

The survey data regarding frequency of use and difficulty of the fifth-grade primary school mathematics textbook, in the students' opinion, indicate that majority of them (51.7%) often use the textbook, less than a third of students (25.8%) do this sometimes, only 20.1% of students do it always, while negligible number of students (2.4%) never use the textbook. By applying T-test for independent samples, it is established that there is a difference regarding frequency of mathematics textbook use vis-à-vis the students' gender $t(207) = -2.412$, $p = .017$. The mathematics textbook is significantly more used by girls ($M = 3.02$; $SD = .70$) than by boys ($M = 2.77$; $SD = .76$). No statistically significant correlation between the frequency of mathematics textbook use and overall school achievement and the grade in mathematics has been established. The estimation regarding difficulty of studying from the textbook (from the aspect of the textbook language) indicate that more than a half of students (54.5%) regard the mathematics textbook as not much difficult, 24.9% of students regard it as not difficult at all, 17.7% that it is difficult to some extent, and negligibly small number of students – 2.9% regard it as extremely difficult. The students' estimation regarding difficulty of studying from the textbook is in negative correlation of weak intensity with the students' grade in mathematics ($r = -.378$; $p < .001$). Therefore, the students who have not a very good grade in mathematics estimate the textbook as more difficult. However, the sample is dominated by the students with a good grade in mathematics. Concerning the estimation of the textbook difficulty, no

differences related to gender have been established. The students[9] state the following as the most common reasons for difficulties they have when studying from the textbook: explanations are not completely clear (44.6%), the lessons contain lots of foreign words and expressions (41.4%), the lessons contain incomprehensible words and expressions (28.0%), and the text of a lesson is often not clear (19.5%).

Despite being quite weak, the correlation between the frequency of textbook use and estimation of the textbook difficulty, and understanding linguistic units in familiar and unfamiliar lesson is established. The students who claim to use the textbook often, underline fewer words from general lexical system in familiar lesson (r = -.187, p = .007), while in unfamiliar lesson they underline less terms (r = -.151, p = .029), the syntagms from terminology system (r = -.183, p = .008), as well as the syntagms from the general lexical system (r = -.143, p = .039). Concerning the estimation of difficulty of studying from the textbook, statistically significant positive correlations of weak intensity exist with the number of underlined terms (r = .138, p = .007) and the syntagms from terminology system (r = .169, p = .007) in familiar lesson. Therefore, the students who estimate learning from the textbook as not difficult, underline fewer terms and syntagms from terminology system in familiar lesson.

CONCLUSION

Language is a basic means for learning and teaching, as well as for encouraging and improving overall intellectual development of children/students (Kersaint, Thompson & Petkova, 2013). The role of language in everyday teaching practice cannot be neglected, as knowledge from most of the subjects, mathematics included, is spread and created through language. Actually, if the language-related challenges in teaching mathematics are not detected and analysed, we cannot definitely say whether unsatisfactory achievement is a reflection of insufficiently developed linguistic competence of a student or it is consequence of inadequate understanding of mathematical terms and concepts, i.e. lower level of the student's mathematical literacy (Adoniou & Qing, 2014).

Upon the presented results of the study, focused on understanding of mathematics textbook language form the perspective of the fifth-grade primary school students, it is perceived that students understand the language of a familiar lesson much better than that of an unfamiliar lesson. Therefore, it can be claimed that they would not be able to master the knowledge from these textbooks individually, without instructions, and teacher's assistance. In view of the analysed linguistic units

[9] Out of total number of students who indicated that the textbook is not much, to some extent or extremely difficult (N = 157). The students could pick more answers.

which students identified as unclear, it can be concluded that, in a familiar lesson, a greater number of students do not understand words and syntagms belonging to general lexical system of Serbian language; while in an unfamiliar lesson, most students do not understand meaning of the sentences. Moreover, in an unfamiliar lesson, almost half of the students have marked as unclear the words from the general lexical system. In addition, we would like to point at the fact that the students with better grade in mathematics marked fewer unclear sentences in both familiar and unfamiliar lesson, which confirms correlation between the grade in mathematics and understanding of the textbook language. Almost identical correlation is established with regard to the general school achievement of students.

Even though we cannot generalize the obtained results because of the limitations arising from the sample size, textbook corpus (two textbooks) and the fact that the research was not conveyed in a wider area of our country, we believe that size of the sample in this research is sufficient for drawing preliminary conclusions regarding the problems that students have in understanding the language of primary school mathematics textbooks. Therefore, we expect the presented data can be comparable with the potential results of future studies which would involve a significantly greater number of respondents (students), and which would analyse the language of mathematics textbooks by all publishers, as this is almost unexplored field in our country. Moreover, bearing in mind the mentioned limitations, we think that conducted analysis of textbook language quality can be useful guideline to the authors and publishers of mathematics textbooks when creating and structuring mathematical texts (lessons).

The result of this research – which refers to the fact that the number of students who do not understand words and syntagms belonging to the general lexical system of Serbian language is not negligible – can be incitement for improving lexical and semantical level of students' language, i.e. linguistic competence of students as whole. With this regard, from the beginning of education, we should constantly apply various lexical and semantical exercises which would help students create a habit of seeking "the best linguistic expression for what they want to say" (Ilić, 1998: 555). Through such exercises, the students develop a sense for shades of meaning in words and sentences, "see different possibilities for building words, their synonyms, polysemy and thematic grouping, and discover associative connections" (Nikolić, 1983: 59) between lexemes and their meaning. Moreover, by encouraging development of linguistic abilities in students, their cognitive abilities are improved, as the connection between language and thinking is indisputable.

The analysis of the language in the selected mathematics textbooks implies that abstract lexemes are to be avoided. It is extremely important that students understand and learn that they should not memorize a great number of words, but be able to combine what they already have in their vocabulary, connect it into meaningful units and groups of words, and interpret new words based on this lexical fund (Bromley,

2007). Furthermore, the presented data indicate that it is important to ensure for sentences to be as short and simple as possible, naturally, depending on age and individual capabilities of students. Therefore, the teaching material in mathematics textbooks should be drawn closer to existing knowledge and experience of students and made more interesting. Nonetheless, there should not be oversimplification of information and deformation of scientific reality (Pešić, 2005).

Furthermore, the results indicate, among other things, that one of competences for teaching profession within *Standards of competences for the profession of a teacher and their professional development* should be related to estimation of the textbook quality, particularly the textbook language, as well as to the competence relating to the textbook selection. Afterwards, when creating the mathematics (and also other subjects) textbooks, an expert from the field of linguistics/philology should collaborate. They would assist the authors in making language of the textbook they are writing more understandable to majority of students for whom the textbook is intended.[10] Actually, their role would primarily concern linguistic shaping of a textbook: relations between elements of communicative and explicative language, i.e. between conversational and scientific functional style. Moreover, when assessing the quality of mathematics textbook manuscript, which is under jurisdiction of the relevant ministry, an expert from the field of linguistics/philology should definitely be a part of team (committee), as the data indicate that regulations[11] concerning the textbook quality standards have not been fully complied with (Standard 4: the textbook language is appropriate and functional).

[10] In lectures, teachers can overcome the usual practice of automatically repeating and, consequently, learning by heart certain facts. However, textbook authors should not rely on the abilities of certain teachers and certain students, but textbooks should be a support and a guide to all teachers and all students, meeting all the necessary criteria. Unfortunately, textbooks are not always understandable because they use abstract language, they do not animate students (Ivić, 1976a), they do not motivate them enough and they are not fully adapted to their prior knowledge and interests, which is why they do not always represent an adequate support for teachers.

[11] Rulebook on standards of textbook quality and instruction on their use (Official Gazette RS, No. 42/2016 and 45/2018).

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Received 15.01.2022; Accepted for publishing 20.06.2022.