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DEVELOPING WRITING SKILLS BY FORMULATING MATHEMATICAL PROBLEMS

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Abstract. The aim of the paper is to examine one possible method in developing both mathematical and writing skills in mother tongue. The main research questions are: what is the connection of mathematical thinking and language fluency in students' formulations of mathematical problems, and does this type of demands have a potential of a successful method in developing writing skills. The research results which will be presented are based on testing 134 students of the final year in elementary school from two cities in central Serbia. Standard quantitative and qualitative methodological procedures were used. Main research results show that the students are absolutely aware of the main textual characteristics and genre features of mathematical problems and that they mostly copy the patterns they usually meet with. Also, the research implies that mother tongue fluency and correctness are not seen as important per se, but only as the school knowledge which is also to be evaluated.

Keywords: writing skills; mathematical skills; mathematical problems; grammar, orthography

Introduction

Different forms of learning and teaching demand and should activate compound mental processes which are the precondition of successful individual development. In this sense, mathematical problems that are posed need to represent students' developmental needs. Solving mathematical tasks students develop mathematical thinking and mathematical abilities, they develop their personality, the mathematical knowledge and skills are also checked as well (Dejic & Egeric, 2007). Besides the solving of the mathematical tasks it is of the great significance to formulate the task which, according to many, has the character of the creative activity and the extraordinary talent (Dejic et al., 2009; Silver, 1994). In this paper we will focus on the tasks' interpretation which are in this case called open ended tasks. Specifically, we will analyse tasks for which the starting conditions are already specified and the target situation opened for the divergent thinking in the sense of searching for the thinking in different perspectives (Sak & Maker, 2005). In the context of using the open ended tasks the aim of the paper is to examine one possible method in developing both mathematical and writing skills in mother tongue. The main research questions are: 1) what is, if any, connection of mathematical thinking and language fluency in students' formulations of mathematical problems, and 2) does this type of demands have a potential of a successful method in developing writing skills. In the practical sense, the paper should identify areas of teaching and learning which need improvement.

Research Methodology

The research results which will be presented are based on testing 134 students (67 male and 67 female pupils) of final year in elementary school (age 14) from two cities in central Serbia (Kragujevac and Jagodina). Students were specially selected so that there is a coherence between students genre and their achievement in mathematics (U=2212,5; Z=-0,150; p=.881) and achievement in mother tongue (Serbian for all the pupils) (U=1909,5; Z=-1,540; p=.124) at the end of the previous school year.

The data were gathered by using specially designed task-sheet containing 3 tasks which represent *open ended problems*. The students were asked to write a text following mathematical models which contained four arithmetical operations. The solving of problems begins with understanding and continues with a kind of analysis of mathematical model and constructing of appropriate textual model. This type of problems belongs to a broader concept of open approach and represents 7th subtype in the matrix of the problem continuum (Mihajlović, 2012)[1)].

The tasks were selected so that they include an average level of mathematical knowledge, so that the differences among pupils could not highly influence the adequacy (mathematical correctness), i.e. it was excluded as a variable. In addition, this is confirmed by the results of the second part of the task sheet (usual solving of textual mathematical problems).

The instrument was designed following the results of a series of recent studies which show that the *open ended problems*, which have more than one solution or lead to one correct solution via two or more methods, are less "open" than they should be. In determining the reasons for suspension of sense-making in mathematics problem solving, De Corte, Verschaffel and Greer (2000) stress that this "cannot be considered as a cognitive deficit in pupils, or a foolish and blind behaviour. To the contrary, as a result of schooling, their behaviour is pragmatically functional: it mostly leads to right and expected solutions".

As the process of writing in learning/teaching mathematics is seen as a challenge for the pupils (Mihajlović & Egerić, 2012: 26), the applied methodology is complex and includes statistical methods and qualitative analysis of the text at lexical, syntactic and orthography levels. The analysis of creative side of these texts comprises two different methods, as the text type itself does not imply creativity as its` inherent feature. Therefore, the texts will also be analysed from the aspects of register and genre on one side, and from the aspect of textual strategies, textual organization and lexical innovation, on the other side.

Results and Discussion

The results include the following characteristics of produced texts:

(1) Respecting textual norms of register and genre.

(2) Connecting the text to the reality.

(3) Normativity / Orthography.

(4) Variety of lexis and lexis-dependent syntactic features.

1. At the level of register and genre, the results show that the students are absolutely aware of the main textual characteristics and genre features of mathematical problems and that they mostly copy the patterns they usually meet with. The main goal of their texts is mathematically correct representation of the operations and numerical values, which makes the texts highly uniform and non-innovative.

Arithmetical textual problems belong to the scientific register, and are showing most of the features which are usual for textbook sub-register (Tošović, 2002: 266 – 273). These specific genre traits are conciseness, the presence of quantitative data and lexical items which correspond to mathematical operations, and obligatory demand for a numerical answer. They are very short and they have to provide some quantitative data as an input for calculating a numerical response (Verschaffel et al., 2000, Čutura & Vulović, 2013). Regarding the topic, they mostly describe situations which are directly connected with student‘s immediate experience (Gkoris et al., 2012).

In this research, it is confirmed that textual strategies are very well known to the pupils. The prevailing pattern (provisory named „textual mathematical task pattern" – TMTP) is extracted from students' texts:

(a) The person ($A_{\text{Personal Noun}}$) is in the possession of certain quantity (X_{Number}) of the object(s) (B_{Noun}).

(b) Depending on arithmetic operation, person A increases (C_{Verb}) or decreases (D_{Verb}) the amount of B [this is usually followed by certain context description]. The person A does that by including other persons ($E/F/G..._{\text{Personal Noun}}$) into the process

(c) Obligatory demand for a numerical answer (How much/many of B has the person A after the change?)

There are some variations in the texts, but not very often. For example, the amount can be defined via *container* which, besides a person who is in the possession of B (objects of quantification), can be a building, a field etc. („There are X people/trees/apples in the building/on the field/in the basket"). Specific kind of *container* is constructed for non-countable material, represented by a non-countable noun („There were 100 litres of water in a barrel", „There were 90 sacks of corn“). In those cases, the container itself functions as object of quantification (B) and further arithmetic operations usually refer to it.

2. It is well known that contemporary society demands towards educational systems are to prepare pupils for real life and that school itself should reflect the real life (Zachariou & Valanides, 2006: 187 – 188; Ellis, 2004). The relations between school knowledge and practical knowledge are very strong in mathematics (Baroody & Coslick, 1998: 2 – 11)[2)] and language skills. Both, seen as educational disciplines, should lead to a clear connection to real life, which again makes them complementary, as Gruenewald puts it: „Reading the world radically redefines conventional notions of print-based literacy and conventional school curriculum. For critical pedagogy, the `texts` students and teachers should `decode` are the images of their own concrete, situated experiences with the world. (…) [R]eading the world is not a retreat from reading the word. Instead, the two intertwined literacies reinforce each other“ (Gruenewald, 2003: 5).

Therefore, one of the crucial findings in this research refer to the real-world knowledge which students show in “translating” mathematical problems into texts. The results show that this connection depends on student`s achievement (measured by school mark) in mathematics, but that it does not correlate with their achievement in mother tongue. Moreover, the results show that tendency towards the non-realistic mathematical modelling is very strong, as shown in recent studies (Verschaffel et al., 2002). Although some aspects show some general connection to the real life (topics as paying bills, buying and selling), students often show that they are not informed about prices of most items and about the height of their parent`s incomes. On the other side, the pupils know much about prices of some other items, such as mobile phones, tablets, laptops etc., which shows the fields of their interests, but also the dominance of contemporary cultural patterns and consumer culture.[3)]

Other types of low connection to the real world are:

(a) over- or under-quantification (in comparison to “normal” quantity which is expected in real life):

(1) One boy owed 150 chocolate bars to his friend.

(2) The training fee increased 10 times. [The reason for such big increasing is not explained]

(3) Marko bought 1200 balloons and then he bought 1500 more and then his brother gave him ten times more. Ignoring real relations of earning and spending, e.g.

(4) Marko`s mother has monthly income of 12 000 Euros, and his father has a monthly salary of 15000 Euros. How much money will they have in 10 months *if they spend nothing*?

(b) Poor knowledge of some real-life aspects, e.g.

(5) There are 12 000 *pepper seedlings* and 15 000 *tomato seedlings* in one garden)[4)].

(6) There have been 1200 trees in the wood. The workers planted 1500 trees more. The owner of the wood then bought 10 times more *seeds* to plant more trees.

The result which is surprising is that even 38,98% of all students show low relations to the real life. This is, however, as stressed earlier, not explainable by a defect but by a sign of pragmatically functional behaviour (De Corte et al., 2000). More precisely, it is obvious that the students understand mathematical problems as purely *mathematical*, leading to arithmetically correct set of steps which lead to *one* numerically correct answer. Real-world knowledge is not important at all, because it is practically never evaluated. Only the "things" which are evaluated are much more important than the sense, and the text is seen as a "leftover" after the process of extraction of mathematically relevant information. This set of relevant information is underlined in the TMTP:

(a) The person ($A_{\text{Personal Noun}}$) is in the possession of certain quantity (X_{Number}) of the object(s) (B_{Noun}).

(b) Depending on arithmetic operation, person A increases (C_{Verb}) or decreases (D_{Verb}) the amount of B [this is usually followed by certain context description]. The person A does that by including other persons ($E/F/G..._{\text{Personal Noun}}$) into the process.

(c) Obligatory demand for a numerical answer (How much/many of B has the person A after the change?).

3. Similar to the previous finding, students seem to consider orthography (and other aspects of normativity, such as proper use of prepositions, case etc.) as not important in writing mathematical tasks. This is in accordance to the research results of Maričić & Purić (2011), which show that the students much more respect orthography at classes of mother tongue than in mathematic classes. The authors explain that the reason is, again, pragmatic behaviour which responds to the evaluation system. Namely, students try to respond to that system, i.e. to the task, and teachers' demand is to respect orthographic norms only in teaching mother tongue but not in Mathematics[5)].

Therefore, it is not surprising that this research confirms that the average mark in normativity (2.60) is in positive correlation with mark in the mother tongue (Table 1), but that it correlates much more with mark in Mathematics (Table 2).

Table 1. Correlation between mark in the mother tongue and average mark in normativity

Mark in mother tongue	Average normativity – research results
1	1,71
2	1,82
3	2,15
4	2,79
5	3,66

Table 2. Correlation between mark in the Mathematics and average mark in normativity

Mark in Mathe-matics	Average normativity – research results
1	1,40
2	1,98
3	2,73
4	3,00
5	4,40

4. The lexis is analysed mainly through the topics of the texts. The most prominent nouns are strongly connected to the "actors" of the task, objects of quantifying and measurements. The most frequent verbs are equivalent to arithmetical operations. Other lexical items are very selectively included into texts because of their low informative relevance, which is crucial in mathematic problems. Therefore, the topic of the task is relevant enough to show lexical variety and adequacy.

One of the main findings is that there is no statistically significant difference between girls and boys (χ^2=6,416, df=4, p=,170). The most frequent topics, represented by selection and naming of objects which are quantified, are money, food (other than sweets), sweets and marbles (Table 3).

Table 3. Frequency of topics by gender

	Money	Food	Sweets	Marbles
boys (%)	77,5	13,2	2,3	5,4
girls (%)	82,2	5,9	5,3	3,9
total (%)	80,1	9,3	3,9	4,6

The most dominant topic is the money (in 4/5 of total texts). This results in several nouns which appear very often: dinar (national currency), euro, coin and, rarely, dollar.

Originality in topic choice is not connected to school success neither in Mathematics nor in the mother tongue. There is no statistically significant difference between school marks in Mathematics and chosen topics (χ^2=17,416, df=16, p=,428), and the same is for the mother tongue (χ^2=16,641, df=16, p=,409). But, it is interesting to note that there are two main groups of students who are absolutely most uncreative in topic choice, i.e. who have chosen only money or food as general objects of quantification. Surprisingly, these two groups have opposite school achievements: the highest (5) or the lowest (1) school mark in Mathematics. The students who have marks 2 – 4 show broader choice of text topics (Table 4).

Table 4. Chosen topics grouped by mark in Mathematics

		School mark in Mathematics					Total
		1	2	3	4	5	
topic	candies (%)	0,0	3,9	5,7	4,7	1,6	3,9
	money (%)	81,8	82,4	81,4	72,9	85,9	80,1
	marbles (%)	0,0	2,0	4,3	8,2	3,1	4,6
	stickers (%)	0,0	0,0	1,4	3,5	3,1	2,1
	food (%)	18,2	11,8	7,1	10,6	6,2	9,3

Besides the topics, which strictly imply lexical choice of B-noun (object of quantification), the variety of lexis is also analysed in other sematic fields. Interpreted in terms of TMTP, the main fields are represented by following categories:

(1) nouns which denote person who is the main acter in the problem ($A_{\text{Personal Noun}}$) and other persons who are included in the process (E/F/G. $_{\text{Personal Noun}}$)

(2) nouns which denote containers and their content

(3) verbs which encode arithmetical operations, i.e. which denote actions of increasing or decreasing numerical value of the object of quantification (C_{Verb} and D_{Verb})

(4) facultative lexical items which are used only in description of the context.

In the first group, the most frequent are names or nicknames: Pavle, Petar, Vasa, Marko, Miloš, Maja, Stefan, Aca, Ana, Isidora, Mina, Marija, Nikola, Uroš, Miloš, Sofija, Jovana, Jana, Aleksa, Filip, Jelena, Ignjat, Luka, Sava, Matija, Tanja, Ivan, Milan, Uroš, Mladen, Sanja, Mirjana, Dejan, Mila, Lazar. The names are common in the Serbian culture.

Very rarely, the students use names of famous persons (Novak Djoković, Kareem Abdul-Jabbar) or the names of a song, film or book imaginary characters - Juca[6)], Ševket Ramadani[7)]. Students who use unusual personal nouns show much freedom in interpretation of the context, opposing the text to the real facts and creating a kind of playful oxymoron, e.g.:

(7) Abdul Kareem Jabbar had 12000 chickens and he got another 15000. One humanitarian action gave him ten times more than he had. How much chickens he has now?

Family names are used much less than names or nicknames, mostly when it is talked about paying bills, e.g.:

(8) Antic family monthly pays 1200 dinars for electricity;

(9) Petrovic family has monthly incomes of 150000 dinars. They spend…

Common nouns are much less frequent than personal nouns in denoting „the main actor“ of arithmetical operation, e.g.:

(10) A boy had 120 marbles;

(11) Mum and dad saved 1200 dinars;

(12) Fruit seller needs to divide 150 apples into 10 baskets;

(13) A man bought a shirt which costs 12000 dinars.

In this kind of tasks, there is absolutely no difference between using personal and common nouns. Personal names are “labels” whose semantic structure is “empty” (Kovačević, 2000: 78) and they function as pure denotations of the „place“ of source and goal quantification. That explains predominance of one noun (name or nickname) and extremely low number of „name + family name“ model. This finding is also valid for other *containers*, which normally have names and „contain“ people (less than 5%), e.g.:

(14) 1200 people lived in one street. In the next street, there were 1500 people.

(15) There are 500 pupils in one school. In the second school there are 350 pupils more than in the first. In the third school there were ten times more students than in the second...

Naming such kind of *containers* is extremely rare and, statistically speaking, can be treated as an exception, as well as naming people by both first and family name, e.g.:

(16) There are 1200 inhabitans in Vuka Mijatovića Street.

(17) Svetlana Petrović and her husband Miloš earn monthly 100000 dinars.

Choosing *containers* and their *content* is also very unified. Typical relations are shown in the Table 5.

Table 5. Relations between containers and content

Container	Content	Object of quantification	Measurement
Orchard	Fruit (apples, pears)	Container and content	Unit
Basket, crate		Container and content	(kilo)gram, tone
Pool, barrel	Water	Container and content	Unit, liter
Glass, bottle	Juice, beer	Container and content	Unit, liter
Box	Chocolate, (colour) pencils, marbles	Container and content	Unit
Bakery	Bread/pizza/croissant	Container and content	Unit
Shelves	Books	Container and content	Unit
Truck	Merchandise	Container	Unit
	Sacks Boxes	Container and content	Unit
Sack	Corn, wheat	Container and content	Unit, kilogram
Town/village or building (school, house)	People	Container and content	Unit
Bowl, can	Sugar, flour	Container and content	(kilo)gram
Factory	Chairs, tables	Container and content	Unit

This distribution is logical and properly related to noun classes. Most of countable nouns are used to denote objects which are then counted by unit, while uncountable nouns imply counting measurement units. In some cases there are mistakes of different kinds. The first type is caused by direct ignoring of the fact that the used noun is uncountable, e.g.:

(18) The laundry is washed in three laundry services. In the first one 1200 laundries were sold, in the second one 1500 laundries [were sold].

(19) Marko split his 120 dinars into 10 pieces in way that he and his friends have the same number of money.

The second type is similar, but it is probably caused by "pragmatic functional behaviour" and student`s understanding that linguistically correct writing is not important, as well as that the facts of realty are unimportant, e.g.:

(20) There are 12 000 and 15 000 water in the shop. Ten times more has been brought into the shop.

(21) Marko had 12000 and Stefan gave him 15000 more in order to play lotto game in which the award is 10 times bigger.

The fact that the student "forgets" to explicate the measurement unit (litre bottle in Example 20) clearly shows that the reduction of the TMTP model can be done in different ways, even so that the basic linguistic (morphological and semantic) features of words are ignored. In the next example (21) the object of quantification is completely omitted and can only be reconstructed in the context of lotto game. This is enabled by another simple fact – that this kind of TMTP reduction *does not influence correct solving of a mathematical problem*. Similar happens in a few cases of ignoring some features of objects:

(22) There were 1500 pieces of garbage. If one truck can drive away 120 pieces of garbage, how many trucks are needed to drive away all of them?

(23) Jovan bought a chocolate of 120 pieces (literarily: *bars*) and his mother later bought a chocolate of 150 pieces (*bars*).

The problem with the text (22) is the presupposition that garbage pieces are equal by dimensions, which implies that the truck can contain exactly 120 of them. The failure is based on low connection with real life or – if this presupposition is needed – in lack of proper context, i.e. explanation on why they are equal (e.g. pieces of garbage which are leftovers in some kind of production process). When intending to connect the choice of the object of quantification to the real life, students may try to adjust the measurement unit and to replace a common one by a less usual one (23).

The next group of obligatory lexical items, which denote obligatory elements of mathematical textual problems, are verbs which encode arithmetical operations, i.e. which denote actions of increasing or decreasing numerical value of the object of quantification (in TMTP: C_{Verb} and D_{Verb}).

The most frequent frame-situation, as shown in TMTP, is the situation of possessing. Such texts begin with a sentence (clause within the first sentence) with the verb *to have* and they end with an interrogative sentence with the same verb in the predicate (in present or perfect tense), e.g.:

(24) Juca has 1200 marbles. Her brother took 1500 from her, and her sister took away 10 times less. How many marbles does Juca have?

(25) Marija had 120 apples and she made a deal with Aca to give him 1/10 of her apples. Milica had 150 times more apples than Marija and Aca. How many apples all of them had?

The frame-situation is modified in several patterns: by a preceding introductory sentence which widens the frame, by using other verb, by using existential sentence or by skipping the information of possessing. Introductory sentence is a part of the narrative, but it has no role in arithmetical operations. It can only have the function of defining the main acter (A_{Noun}) and the object of quantification (B_{Noun}), as in the following example:

(26) Ana was collecting old bank notes. When she collected 120 her 5 friends came to take 2 bank notes each. Later, Ana got from her father and grandfather 75 each. How many bank notes does Ana have now?

The „other verb" belongs to a small set of verbs which denote the process of coming into possession of B-items. However, the process itself is not dynamically presented – it does not describe details (manner, duration or goal of the process), as in examples 27 – 29. The most frequent verbs in this set are: *to earn*, *to get*, *to buy* and *to collect*.

(27) Mother earns 12000 dinars monthly and the father earns 15000. How much money they earn together in 10 months' time?

(28) Sanja received her pension 12000 for January and for February 15000.

(29) Marko bought 15000 seedlings. Out of that number he has planted 1/10.

Skipping information on possession is not common. The only means for avoiding a verb is to express it by using a possessive pronoun which, actually, implies the same frame-situation, e.g.:

(30) Marko split his 120 dinars into 10 pieces.

The other type of modifying common pattern is completely different frame-situation: there is no person (A) who *has* something (B). The main semantic feature of A now is (Human–); the concept moves from possessor to a *container* (see Table 5) and the frame situation is changed. Grammatically, this type is mostly formed through existential sentences, as in following examples:

(31) In the flower shop there were 12000 pieces of flowers. Then, arrived 15000 more, and a little bit later arrived 10 times more. How many pieces of flower are there in the shop?

(32) One day, in one forest, there were 120 birds.

(33) In one beach there were 120 pebbles.

(34) In the science fair there were 1200 people.

(35) There are 120 times less apples than bananas.

(36) In one basket there were 1200 candies and in the other 1500.

Systematized through the types of mathematical operations, the verbs (C and D) are the following:

For denoting the operation of addition, there are two subgroups. In the first one, person A is the subject (agent) of the action. The verbs are: to take, to buy, to get, to receive. In the second subgroup, some other person (E, F, G) is the subject (who *gives* B to A) and A functions as an indirect object of the action, so it *becomes* more of B-items. Such verbs are to give, to give a present, to add. This subgroup functions also as an exponent of subtraction if A functions as the subject. The other verbs denoting subtraction are: to loan, to spend, to sell, to pay, and also the construction to decrease debt.

Although students use a very small number of verbs denoting addition and subtraction, the problem of finding proper verb is much bigger when they need to name operations of multiplication and division.[8)] The students mostly use the verb *to divide* (37 – 40) or split the amount into parts by using fraction or a noun derived from number (e.g. *one tenth*, examples 41 – 42). The third common way of expressing these two operations is the comparison (possessor or container A *has/contains* X times more/less than the possessor or container B, as in examples 43 – 45).

(37) Mother has 120 chocolates and she has to split them to her 10 sons. When she gave them chocolates, she found 150 more. How many chocolates did she have in the first place?

(38) Ana had 120 dinars which she split with her 10 friends and later she got 150 more from her parents. How much money does Ana possess now?

(39) Marko has 120 candies and he needs to split into 10 pieces. How many candies will he possess if he get 150 more after the split?

(40) Petar had 120 candies which he split to his 10 friends, and the next day, he gave to his friends 150 more.

(41) Ana got 1200 dinars from her parents. Her granny gave her 1500 dinars more. Then Ana went to the shopping mall and spent one-tenth of that money.

(42) The tax price for the house 1200 dinars and for the flat it is equal to 1/10 of 1500 dinars. How much is the house tax bigger than the flat tax?

(43) For the birthday party organisation the drink is 12000 dinars and the food is 15000. The family who celebrates the birthday owns 10 times more. How much money do they own?

(44) Milos has 12000 dinars. His mother gave him 15000 and his father 10 times more. How much money does Milos have?

(45) Jovan has 1200 marbles, his friend Marko has 1500 and their friend Dragan has 10 times less than Marko. How less marbles does Dragan have than Jovan?

It is clear that textual ways of formulating multiplication and division are much more restricted in the corpus than other operations. It is especially obvious in the texts where A "multiplies" the money or other objects, e.g.:

(46) A mother has 12000 dinars and her daughter has 15000 dinars. The mother and the daughter have put their money together and *multiplied it by 10*. Which number they have got?

(47) Nikola had 12000 dinars and he added 15000 dinars more. Than *he multiplied the sum by 10*. How much money does he have now?

(48) Saša had 1200 books, she got 1500 more. How many books does Saša have if she *multiplied all her books by 10*?

Besides that, there is one more problem with formulations of mathematical expressions ('arithmetic sentences') into text. This problem is connected to normativity and is especially frequent in formulating existential sentences (as in 36, where verb *to have* is used instead of *to be* and in Preposition + Noun constructions denoting indirect objects of division (more generally, of giving), as in examples 37 and 40.

Conclusion

Research results show that the students are absolutely aware of the main textual characteristics and genre features of mathematical problems and that they mostly copy the patterns they usually meet with. The main goal of their texts is mathematically correct representation of the operations and numerical values, which makes the texts highly uniform and non-innovative. Generally speaking, there are only two general logical frames – *possessing* and *containing* – and they are represented by several subtypes. Moreover, lexical analyses also show that there is a great predominance of only several groups of nouns which are used as the objects of quantification.

Normative evaluation indicates that this type of tasks contains typical problems (e.g. number + noun constructions, predicates in existential sentences), but also that the orthography evaluation is beyond mean mark in the mother tongue. This leads to the conclusion that the students do not consider grammatically and orthographically correct writing as important in on-going mathematical tasks. This conclusion is strongly supported by the type of errors (e.g. capital letter, punctuation marks at the end of the sentence).

In the methodology level, the research confirms that the qualitative approach in assessment of textual products "contributes to a more thorough description of the creative product than the quantitative measure […] This mix-methods research demonstrates that combining qualitative and quantitative methods allows for the conditions necessary for obtaining data which would not be accessible by using only one or the other approach" (Maksić & Ševkušić, 2012: 140).

In the practical area of teaching, the results also imply that the subject teaching is closed into the area of disciplines that are thought and that the students tend to fulfil only the demands of the discipline which are evaluated. This is not surprising because the prevailing concept in Serbian schools is still that the school mark is the goal of a learning process (Baucal & Pavlović-Babić, 2010). Moreover, the research implies that mother tongue fluency and correctness are not seen as important *per se* (as a vehicle of thinking, expressing, efficient communicating etc.), but only as the school knowledge which is also to be evaluated.

That is one of the reasons for introducing this kind of multidisciplinary tasks into teaching and because it has a potential of a successful method in developing writing skills and alternative modes of assessment.

NOTES

1. This type is a new one in developed (adjusted) Matrix of Problem Continuum (adaptation of Getzels & Csikszentmihalyi, see Gomes (2005), proposed in Maker (2005), Schiever & Maker (2010), Mihajlović (2012), Mihajlović & Egerić (2012)). Although researhers continuously complement this classification, they stress that this classification can not be exausting, but that it represents crucial points (subfileds) in the continuum (Sak & Maker, 2005: 254).
2. The problem is widely discussed, and it is clear that the solution is not simple: „Links between school mathematics and the real world will not be demonstrated by perfectly-phrased questions involving buses and cans or paint. These misleadingly suggest that similar problems with a comparable simplicity exist in the real world, rather than arising out of the learner's interaction with the environment" (Boaler, 1993: 17).
3. A very similar conclusion is made in the research conducted with ten-year old students (Čutura & Vulović, 2013).
4. Originally: U jednoj bašti ima 12000 stabala paprike i 15000 stabala paradajza.
5. The problems which occur in this research are already noted in oral and written language use in primary and secondary school students (e.g. Makimović et al., 2012): using the case system in phrases "number + Noun", mission of punctuation marks, incorrect use of capital letters.
6. Name of a character in children poetry by Jovan Jovanovic Zmaj.
7. Name of a character in very popular pop song by Zabranjeno pusenje.
8. See also Mišurac Zorica & Cindrić 2012.

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