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Students' Responses to the Realistic Word Problems and Their Mathematics-Related Beliefs in Primary Education

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Annotation. The main purpose of this study is to investigate students' reactions when doing realistic word problems based on their implicit beliefs and based on their personal factors. Our study revealed that students tended to choose non-realistic responses by ignoring real-world knowledge and excluding realistic considerations when doing realistic mathematics tasks. There were no significant differences in students' reactions to word problems according to their attitude, grade, and gender.

Keywords: *realistic word problem, beliefs, mathematics, students.*

Introduction

Word problems (WPs) in mathematics have long been recognized as an essential technique for bridging the gap between real-life problems and classroom mathematics (Depaepe et al., 2010; Selter, 2000). Through WPs, students are expected to apply their mathematical knowledge in realistic contexts (Dewolf et al., 2015; Piel & Schuchart, 2014). WPs not only provide students the chance to learn the relationships among mathematics, language, and reasoning processes but also provide basic experiences in mathematical modeling (Reusser & Stebler, 1997). Mastering mathematics WPS would benefit students because they can solve real-life problems easier with mathematics.

In the last decade, mathematics education research addressed critics when discussing the gap between classroom WPs and real-life problems (Csíkos, 2011). Today, WPs have been thought not to promote a genuine interest in mathematical modeling where the text describes a real-world event that may be mathematically represented (Lave, 1992; Corte et al., 2000; Verschaffel, 2010; Verschaffel et al., 2020). Researchers and mathematics educators have attempted to promote a new concept of WPs more analogous to real-life problems. Problematic WP (P-item) is an example of a new conception of WPs, developed by Greer (1993) and Verschaffel et al. (1994), comprising actual situations and is more analogous to real-life problems. Rather than performing a routine operation, solving P-items requires realistic consideration and real-world knowledge. Using P-items for investigating students' performance, researchers revealed the hidden phenomenon of students' tendency to exclude real-world knowledge and realistic consideration.

According to prior research (Habók et al., 2020; Hidayatullah & Csíkos, 2022; 2023; Pongsakdi et al., 2020), students' tendency to solve the WPs in mathematics was closely associated with their beliefs. Beliefs influence how students learn mathematics and employ strategies in solving mathematics problems (Csíkos, 2016; Garofalo, 1989; Hidayatullah et al., 2023; Lave, 1992; Yin et al., 2020). An empirical study by Csíkos (2011) confirmed the association between students' tendency toward P-items and their implicit beliefs regarding mathematics. Researchers also assumed that students possibly hold implicit beliefs such as all.

WPs could be solved by applying routine procedures based on several numbers in the text information. However, most of the unrealistic WPs studies, such as a P-items study conducted in Western countries, implicated the lack of information on whether students in other cultures have a different tendency or not.

It is rare to find empirical studies that have addressed the students' implicit beliefs about unrealistic WPs in South Asian countries, such as Indonesia. There is no study about students' tendency to unrealistic mathematic WPs could lead to an uncomprehensive conclusion about students' performance in mathematics. Although the ministry has made many changes to education to improve the quality of education in Indonesia, the investigation by international surveys such as PISA (OECD, 2019) and TIMMS (Fenanlampir et al., 2019; Hidayatullah & Csíkos, 2022) showed students' performance in mathematics is very poor compared to other countries. Therefore, the investigation of students' responses to WPs would provide new insight to improve the quality of mathematics education in the Indonesian context.

To contribute to the existing gap, the purpose of this study is to explore students' responses to the realistic WPs that come from their implicit beliefs about WPs in mathematics learning, in the Indonesian context. Relevant factors such as students' gender, grade, and feelings about mathematics were also investigated. According to the prior studies (Oakley, 2004; Shafiq, 2013), students' demographic characteristics (e.g., gender, grade) were associated with students' performance in mathematics learning. For instance, a study by Shafiq (2013) found that there was a gap in mathematics performance based on gender differences in several Muslim countries, including Indonesia. As a result, this investigation described students' performance and their tendency on WPS in math with included the aforementioned variables.

Theoretical Framework

The Types of WPs and Students' Implicit Beliefs

WPs are verbal explanations of questions that can be answered using mathematical operations based on data or information in the text problems (Greer et al., 2003; Boonen et al., 2016). Verschaffel et al. (2020) stated that WPs have always been an integral feature of mathematics education globally. WPs always exist in elementary and secondary school textbooks and enable students to develop their mathematical abilities and equip them with tools for solving life problems (Csíkos et al., 2011).

In the literature review, students' reactions to WPs have been found to be the result of their implicit beliefs about mathematics (Greer et al., 2003; Hidayatullah & Csíkos, 2022; 2023; Kloosterman, 2003; Schommer-Aikins et al., 2005). According to Greer et al. (2003) and Garofalo (1989), there are several specific beliefs in WPs were held by students, for example:

1. The task can be solved by performing the familiar mathematical procedure.
2. Any word problem presented by the teacher and textbook is solvable and makes sense.
3. Almost all mathematical tasks can be solved by directly applying the facts, formulas, rules, and procedures as shown by the teacher and textbooks.

The implications of these beliefs for students' mathematics learning were significant. When students hold these beliefs, they tend to spend their time memorizing facts and various formulae and practicing routine procedures of the most applicable methods (Garofalo, 1989). On the basis of solvability, there are two types of WPs in a mathematics classroom. The first type may be solved using only arithmetic operations, and it does not comprise real-life problems. The second type comprises more complicated WPs closer to real-life WPs, and solving such WPs requires employing imageries and considering different aspects of situations described in the WPs rather than superficial operations (Csíkos, 2011; Csíkos et al., 2011).

Seminal studies have been conducted by Greer (1993), and Verschaffel et al. (1994) confirmed these beliefs. Through their empirical studies, the researchers proposed standard word problem-solving (S-items) and the problematic word problem-solving (P-items) to investigate students' responses to WPs. S-items are the first type of task, or solvable task with routine operation. P-items are the second type of WPs or unsolvable mathematics tasks (Csíkos et al., 2011).

Surprisingly, their study found that students tend to solve the P-items using numerical operations, even if the tasks are unsolvable. In comparison, students performed very well in S-items. Greer et al. (2003) argued that the ways students solved P-items or unrealistic WPs were governed by their beliefs in WPs. Therefore, in the present study, S-items and P-items were performed to investigate students' implicit beliefs about WPs. We assumed that students performed very well on S-items and they had poor performance on P-items because they held mistaken beliefs about the solvability of WPs in mathematics learning.

The Pattern of Students' Reactions to WPs

According to the metacognition theory (Veenman et al., 2006), those who can regulate their cognition process will succeed in academic performance. When students hold the belief that all WPs can be solved based on the information in the text, they solve all mathematical tasks based on these beliefs (Garofalo, 1989). The strategy to solve the mathematical task needs to involve the metacognitive process (Csikos, 2011). In fact, people sometimes use the metacognitive process only the first time when they encounter a certain task. They then use an automated approach to solve the problem. Logically, when students find the same or repeated task, they will perform better. However, a serious problem arises if students encounter different tasks at the same time, but they leave the metacognition knowledge. Their performance becomes poorer if they use the same strategy for different consecutive tasks. Lemaire & Lecacheur (2010) suggested that students tend to switch their strategies to solve different mathematical tasks at the consecutive time. The authors also called this phenomenon a switch-cost strategy, where students tend to use the same strategy over two consecutive problems. Therefore, the pattern of students' responses to P and S-items in the present is explored. Our study assumed that students use the same strategy for P and S-items, which come from their implicit beliefs about WPs.

Personal Background Factors

Students' personal background factors, such as attitudes toward mathematics, grade, and gender issues, have been found to influence their performance when solving WPs. Attitude toward mathematics is the like or dislike of mathematics as a subject, responding favorably or unfavorably to an object, a tendency to participate in or avoid mathematics tasks, etc. (Ajisuksmo & Saputri, 2017; Al-Mutawah & Fateel, 2018; Di Martino & Zan, 2011). Students with a high interest in mathematics would put effort into learning and solving mathematical tasks (Hidayatullah & Csíkos, 2023). We assumed that students who love mathematics would have higher marks in mathematics due to less pressure when solving P-items compared with other students.

The classroom grade is associated with students' age and cognition development. Cognition development is a mentally active process integrating rational thinking and logical reasoning (Taylor, 2016). Students develop their cognition through interaction in social life with themselves and mature individuals (Oakley, 2004). Older students have more school experience, and students' efficacy is influenced by their well-defined perceptions of their strengths and weaknesses (Pantziara, 2016), implying their understanding of WPs. Therefore, our study hypothesized that students with higher-level grades would perform better than lower-level grades (e.g., sixth grade and fifth grade) on WPs.

Gender differences are rooted in the social structure, inadequate educational opportunities, material shapes, and biased instructional methods (Leder, 2019) that imply on mathematics gap between boys and girls (Hyde & Mertz, 2009). Girls appear to have more negative attitudes toward mathematics than boys do, although these disparities can be narrow (Fennema, 2000). Shafiq (2013) proved that disparities in mathematics performance based on gender differences exist in several Muslim countries, such as Indonesia. The investigation of students' performance on WPs based on gender in this study would clarify whether the gap between boys and girls exists in the context of solving P-items in mathematics.

Research Hypotheses

The research objective in this study is based on several hypotheses as follows:

1. Students will have poor performance on P-items and perform very well on S-items. They will apply routine operations using the numbers elicited in a task (option *a*) for P-items.
2. Students who chose mathematics as their favorite subject outperform those who dislike mathematics in solving P-items.
3. There are significant differences between fifth- and sixth-grade students' performance on WPs.
4. There are significant differences in students' performance on WPs based on their gender.
5. Students tend to operate consistently and use the same strategies for different WPs.

Method

Participants

This study used a cross-sectional approach. Twenty-five classes were selected randomly from 9 elementary schools in Surabaya, Indonesia. 757 students (379 and 378 fifth- and sixth-grade students, respectively) participated in the present study. The data collection was conducted in the first semester. According to curriculum K13, fifth- and sixth-grade students spend 40 hours each semester. The model approach of the mathematics textbook of curriculum K13 emphasizes that students should use their reasoning for tasks typically based on real-life experience. The introduction of every chapter of the mathematics textbook always begins with problems relevant to students' daily lives. Therefore, students are familiar with WP solving in mathematics.

Instruments

Our study adapted 5 items of WPs from a list of 10 P-items from Verschaffel et al. (1994). The number of P-items was increased to 13 items, in line with the mathematics curriculum for the first semester in the Indonesian education context. For example: *"Runner" = John's optimal time to run 100 m is 17 s. How long will it take him to run 1 km?* And "*Mr. Aiman went sailing to catch some fish in the sea because the weather was good. In a day, he caught 10.5 kg of fish. So, how many kilograms did he catch in one week?"*.

4 the S-items were also administered to enable comparison. For example, "*Sailing*" = *Mr. Aiman went sailing to catch some fish in the sea. On a day, he catches approximately 5.5 kg of fish. How many kg of fish will Mr. Aiman catch for five days if he gets the same volume every day?"* As a result, our study administered 13 P-items (items 1–13) and 4 S-items (items 14–17). Each item has good reliability, the coefficient alpha ranges from .82 to .83 (for the P-items, and the coefficient alpha range from .63 to .67 (for S-items.

Our study adopted a multiple-choice format following the previous study in the Hungarian context (Csíkos et al., 2011). In other words, the answers are similar to the strategy that asked students how they would have solved the 17 WPs. Both P-items and S-items in this study have three options as follows.

a) Option *a* is a routine-based, non-realistic, precise, numerical response accompanied by a statement saying that this is unambiguously the correct answer.
b) Option *b* is a numerical response that considers realistic elements and considerations.
c) Option *c* is a realistic response that considers the situational complications of the problem but concludes that the problem is unsolvable.

Options *b* and option *c* were the correct answer for P-items. While option *a* was the correct answer only for S-items. Before these instruments were administered, the items of these instruments were reviewed by six experts (3 researchers and 3 mathematics teachers). Regarding students' attitudes, we asked two questions for students: *what your favorite subject is,* and *what is your unfavorite subject in school*? Then, we compared students who said mathematics was the most liked and mathematics was the most disliked subject on their performance over WPs. This test was administered to students using the Google form. Mathematics teachers and principals actively helped in collecting data. The collecting data process has taken place at the end of the semester in Indonesia.

Data Analysis

This study used a quantitative approach. Several methods were used to analysis of the data and to answer the hypotheses. The descriptive statistics of the data were used to analyze the first hypothesis. Both P-score and S-score are cumulative performance measures calculated from individual P- and S-item scores. We code the correct answer

1 and incorrect answer 0 for P- and S-item. To answer the second to fourth hypotheses, Mann Whitney test was performed. A coefficient contingency was performed to answer the fifth hypothesis.

Results

Students' reactions to WPs

The results presented in Table 1 supported the first hypothesis; students tended to employ a non-realistic approach for P-items. The frequency of the non-realistic approach in P-item 1 "Runner" was the highest; 86%, 12%, and 2% of students chose options *a*, *b*, and *c*, respectively. Meanwhile, the non-realistic approach was least prevalent in P-item 4, "Water"; 49%, 42%, and 9% of students chose options *a*, *b*, and *c*, respectively.

Table 1

Frequencies of P-Items and S-Items Response

No	Word Problem	Response options (%)		
		a	**b**	**c**
	P-Items			
1	Runner	86	12	2
2	Rope	70	26	4
3	School	77	16	7
4	Water	49	42	9
5	Friend	73	24	3
6	Cycling	63	30	7
7	Walk	75	21	4
8	Sailing	52	36	12
9	Doll	77	19	4
10	Ship	73	24	3
11	Run Park	72	25	4
12	Shoes	70	15	15
13	Playing	68	21	10
	S-items			
14	Cycling 2	72	22	6
15	Sailing 2	77	19	4
16	Shoes 2	82	15	3
17	Driving	75	21	4

Note: The names of tasks 1–5 was adapted from Verschaffel et al. (1994).

The number of students who chose option *b* was higher than the number of students who chose option *c*. A substantial numerical consideration influenced students' choice of option *b* over option *c*. However, the data also illustrated a significant difference from previous research, revealing that most students chose option *b* in several P-items. In this study, no numerical data indicated a majority response for options *b* or *c*. The data showed that most students chose option *a* for P-items (70% for option *a* and 30% for the combination of options *b* and *c*). The realistic answer of Indonesian students is lower than in previous studies, such as in the Hungarian context. In Hungary, 33.33% students chose options *b* and *c*. (Csaba, 2011),

The data in Table 1 also confirmed that students performed very well on S-items. As shown in the S-items data in Table 1, most students chose option *a* (77% for option *a,* and 23% for the combination of options *b* and *c*). The highest frequency of option *a* was 82%, i.e., S-item 16 "Shoes 2" S-item 14 "Cycling 2" had the lowest frequency of option *a*, i.e., 72%.

Students' Favorite Subject and Their Reactions on P-items

Students were asked about their favorite and least favorite subjects. 16.4% of students chose mathematics as their favorite subject, indicating that a small percentage of students like mathematics. In addition, mathematics is the least favorite subject, with 41.9% of 757 students. Table 2 compares students' responses based on their choice of mathematics as their favorite and least favorite subjects. Overall, the data showed that 70.38% of option *a* and 29.62% of option *b* - *c* had been chosen by students with mathematics as a favorite subject. While 70.86% of option *a* and 29.14 option *b* - *c* have been selected by students with mathematics as an unfavorite subject.

Table 2

Response on P-items Based on Students Feeling About Mathematics (%)

P-Items	Mathematics favorite (N = 124)			Mathematics least favorite (N = 317)		
	a	**b**	**c**	**a**	**b**	**c**
Runner	94	6	0	86	11	3
Rope	73	24	3	69	27	4
School	78	13	9	80	13	7
Water	46	45	9	54	37	9
Friend	73	25	2	75	22	4
Cycling	59	33	8	64	30	6
Walk	79	16	5	76	20	4
Sailing	52	33	15	55	35	10
Doll	79	17	4	75	22	3
Ship	78	20	2	74	22	4
Run Park	73	22	5	69	26	5
Shoes	64	14	22	75	13	12
Playing	67	19	14	70	22	8

For P-item 1, "Runner", almost 100% of students who like mathematics chose option *a*; almost 90% of students who dislike mathematics also chose option *a*. Meanwhile, for P-item 4, "Water", option *b* was the most frequently chosen by students who like mathematics (46% for option *a* and 54% for options *b* and *c*). The percentage of option *c* in both groups was almost identical for all P-items.

Grade, Gender, and Students' Reaction on WPs

In Table 3, using descriptive statistics, the data compare fifth- and sixth-grade students' responses to P-items to evaluate the fourth hypothesis: there are no significant differences between fifth- and sixth-grade students when solving P- and S-items. Overall, the data showed that the total percentages of fifth-grade students' responses for P-items are 70% for option *a* and 30% for options *b* and *c*. Meanwhile, the total percentages of sixth-grade students' responses for P-items are 61% for option *a* and 31% for options *b* and *c*.

Table 3

The Percentage of WPs Response Based on Students' Grade

Word Problems	Fifth-grade students' response			Sixth-grade students' response		
	a	b	c	a	b	c
P-items						
Runner	86	11	3	85	13	2
Rope	72	25	3	69	27	4
School	78	15	7	76	16	8
Water	48	44	8	51	40	9
Friend	77	20	3	67	29	4
Cycled	60	31	9	66	28	6
Walk	77	20	3	73	22	5
Sailing	51	36	13	52	36	11
Doll	79	17	3	74	22	4
Ship	75	21	4	72	26	2
Run Park	71	25	4	72	24	4
Shoes	69	13	18	70	17	13
Playing	68	20	12	68	23	9
S-items						
Cycled 2	71	23	6	73	21	6
Sailing 2	80	16	4	75	22	3
Shoes 2	82	14	4	82	16	2
Drive	75	20	5	76	21	3

Interestingly, sixth-grade students chose much more option *a* (51%) compared with fifth-grade students (44%) for P-item 4, "Water." Meanwhile, the frequencies of fifth-grade students who chose option *b* (44%) and option *c* (8%) were higher than those of sixth-grade students [option *b* (40%) and option *c* (9%)] for the same P-items.

We further examined whether or not there were significant differences in students' responses on P-items and S-items based on grades level and gender differences (See table 4). Since our study measures students' performance, our data can be considered as being ordinal scale. According to Mann Whitney test, no significant difference was found between fifth and sixth graders on P-items and S-items. We also didn't find significant differences between male and female students in P-items and S-items.

Table 4

T-test of WPS Based on Grades and Gender

Variables	P-score				S-score			
	Mean Rank	***Sum of ranks***	***U***	***p***	**Mean Rank**	***Sum of ranks***	***U***	***p***
Grade								
Fifth	374.16	141060.00	69807.00	.67	376.82	142059.50	70806.50	.67
Sixth	380.84	143575.00			378.18	142575.50		
Gender								
Boys	373.19	138081.50	69446. 50	.59	379.39	140375.50	70339.50	.79
Girls	381.65	146553.50			375.68	144259.50		

Note. *Significant p < 0.05, **significant p < .001.

The Pattern of Students' Reactions on WPs

Frequency, chi-square included coefficient contingency was employed to evaluate the fifth hypothesis; Students tend to operate consistently and use the same strategies for different WPs. Table 5 shows the percentage of association between responses on P-items and S-items.

Table 5 showed that students who failed on P-items, 96.8% of them had correct answers on all S-items. For students with at least 1 correct answer for P-items, 83.3% of them had correct answers for all S-items. Meanwhile, 70% of students who were correct for all of the P-items had no correct answer on S-items. The result from the contingency table indicated the association between P-items and S-items, *Chi-square* $(df = 52) = 500.08$, $p < .001$ ($CI = .65$, $p < .001$).

Table 5
The Pattern of Response Over P and S-items

Students' correct answers on P-items		Students' response on S-items (%)				
	0	1	2	3	4	
Total P-items	0	0	0.0	0.0	3.2	96.8
	1	0	2.2	1.1	13.3	83.3
	2	0	1.5	9.0	22.4	67.2
	3	0	6.5	14.5	29.0	50.0
	4	5.5	5.5	12.3	28.8	47.9
	5	3.0	11.9	20.9	35.8	28.4
	6	3.4	10.3	22.4	27.6	36.2
	7	5.2	29.3	29.3	15.5	20.7
	8	9.8	24.4	34.1	19.5	12.2
	9	11.8	35.3	29.4	5.9	17.6
	10	23.8	9.5	23.8	19.0	23.8
	11	23.1	15.4	38.5	23.1	0.0
	12	42.9	14.3	28.6	0.0	14.3
	13	70	10.0	0.0	10.0	10.0

Note. Coefficient Contingency (N =757) = .63, $p < .001$, Chi-square (df=52) = 500.08, $p < .001$.

This means the data showed students are good at P-items, but they will be bad at S-items because they switch or repeat the same strategy to a different task. Students who chose *options b* (realistic consideration) and *c* (realistic reaction) for the P-item were more favorable to repeating this option on S-items. Spearman correlation was performed to confirm the correlation of students' performance on P-and S-items. The total correlation between P- and S-score ($r = -.65$, $p < .001$) confirmed that students who succeed in P-items tend to fail in S-items.

Discussions

Our findings demonstrated that Indonesian students employ non-realistic approaches when solving WPs in mathematics, which is consistent with a similar study conducted in Hungary by Csíkos (2011), who found that most of the students ignore realistic considerations when answering P-items. This study revealed a similar phenomenon to the "*how old the Captain*" study by French and German researchers, where students solved this problem using arithmetical skills based on routine operations, although this task is irrational and unsolvable (Greer, 1997). The findings of this study revealed that Indonesian students tend to exclude real-world knowledge when they encounter unrealistic

WPs (Garofalo, 1989; Greer et al., 2003). This study also described Indonesian students' implicit beliefs regarding the solvability of WPs, demonstrating that they believe that they can solve all WPs using routine operations.

This study showed that almost half of the Indonesian students did not like mathematics as a subject. This phenomenon should alarm mathematics educators to be rethinking how to establish a comfortable and joyful mathematics learning environment since the teaching method has been recognized to influence students' attitudes (Tahar et al., 2010). Concerning students' attitudes and their relation to WP solving, this study revealed that students who like mathematics tend to use non-realistic approaches when solving P-items. P-items can be categorized according to whether they are understood and handled by students whose favorite school subject is mathematics.

Moreover, there was no significant difference between fifth- and sixth-grade students in relation to their performance on P- and S-items. Theoretically, sixth graders should outperform fifth graders on the same tasks because of the content of P-items in this study. Meanwhile, our findings elucidated that higher grades do not guarantee the use of realistic approaches for P-items. In this instance, we assume that the school mathematics WP has not served the aim of the WP, which is to develop thinking and practical mathematics in everyday life (Greer et al., 2003). According to Lampert (1990), students' beliefs regarding WPs are formed by their experience in school; doing mathematics was following the technique used by a teacher in solving mathematics tasks, whereas knowing mathematics was memorizing, remembering, and using correct rules for solving a given question.

Concerning the gender issue, our findings showed no significant differences in students' performance on P- and S-items. Boys' and girls' Indonesian students have had equal performance in WPs mathematics. This finding clarifies the previous study by Shafiq (2013), which revealed that male students outperformed female students in mathematics. Our discovery is also different from an earlier study that found male students solved WPs better than female students (Lailiyah, 2017). This could be because the educational system in Indonesia has changed from a traditional to a modern system, where there is the same opportunity to access education.

According to Fitzpatrick et al. (2020), students who are better at realistic consideration may have a higher ability to prevent an automatic or non-realistic approach. However, the findings of this study have shown the tendency for students who succeed in P-items are more favorable to fail in S-items. Maybe students involved the realistic consideration or real-world knowledge when they first-time encounter P-items. Afterward, they didn't involve realistic consideration for the next tasks (S-items), but they used the automatics mentality. In other words, students tend to repeat and switch the same strategy for different tasks. According to Lemaire and Lecacheur (2010), when switching strategies, students switch the same strategy from one task to another. The data in our findings revealed that students who had the highest score in P-items tended to fail in S-items because they repeated the same strategy on different tasks.

Limitation

Although this study provides a wealth of information, several limitations of this study should be noted. First, we used data from the East Java Province and fifth and sixth grades. Research with a larger sample and another grade should be conducted to validate our findings. Second, this study did not describe the relation of students' performance on P and S-item with other non-cognitive factors such as motivation, parents' education level, and their attitudes. For the next research, other non-cognitive factors should be investigated in further studies to provide more comprehensive data on students' performance on WPs in mathematics. Third, since this study used a cross-sectional approach, experimental research is necessary to find a solution to change the mistaken beliefs about the solvability of WPs in mathematics learning.

Conclusion and Implication

Our finding suggests that Indonesian students use a more non-realistic approach toward P-items in mathematics. Our study found no significant differences in the P-item context based on students' personal backgrounds, such as gender and grades. In the Indonesian context, students must change their beliefs regarding the solvability of WPs. This study also indicated that the role of WPs in schools did not encourage students to use their reasoning when solving mathematics problems.

The implication for education is mathematics educators need to design appropriate means to change students' beliefs. Mathematics educators should be reflecting on whether their concept of mathematical tasks supports the goal of WPs – to develop students' reasoning regarding mathematical structures through imaginative but frequently unreal narratives. Students' skills on WPs, particularly P-items, are significant parts of mathematics education that go beyond regular teaching. The learning process that encourages students to discuss and elaborate on their idea may change their beliefs regarding the solvability of WPs. Mathematics teachers also need to demonstrate how to involve the metacognition strategy skill in solving each WPs in mathematics learning.

Declaration of Competing Interest

No conflict of interest exists.

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Mokinių atsakymai sprendžiant tekstinius uždavinius ir su matematika susiję įsitikinimai pradinio ugdymo etape

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Santrauka

Šio tyrimo tikslas – atsižvelgiant į netiesioginius mokinių įsitikinimus ir asmeninius veiksnius ištirti mokinių atsakymus sprendžiant tekstinius uždavinius. Šiame tyrime dalyvavo 757 Indonezijos mokyklų penktos ir šeštos klasės mokiniai (373 berniukai, 378 mergaitės). Penki probleminių tekstinių uždavinių elementai (P-elementai) buvo adaptuoti iš Verschaffel ir kt. (1994). Aštuoni P elementai ir 4 standartiniai tekstiniai uždaviniai (S elementai) buvo sukurti pagal Indonezijos mokymo programą. Žodiniuose uždaviniuose buvo pateikti uždaro klausimo formato atsakymai su keliais atsakymų variantais: a variantas (netinkamas atsakymas), b variantas (tinkamas atsakymas) ir c variantas (teiginys „neišsprendžiama“). Teisingi probleminio žodinio uždavinio atsakymai buvo b ir c variantai, o a variantas buvo teisingas standartinio žodinio uždavinio atsakymas. Tyrimo rezultatai atskleidė, kad mokiniai buvo linkę rinktis netinkamus atsakymus, ignoruodami realias žinias ir atmesdami realias aplinkybes. Mokiniai netiesiogiai laikosi klaidingų įsitikinimų, kad visus žodinius uždavinius galima išspręsti naudojant įprastinius veiksmus. Reikšmingų skirtumų tarp mokinių, sprendžiančių šiuos uždavinius, pagal jų lytį ir mokymosi klasę nenustatyta. Indonezijos mokiniai linkę naudoti ir primygtinai taikyti tą pačią strategiją spręsdami skirtingus uždavinius, todėl matematikos rezultatai yra prasti. Šio tyrimo išvados prisideda prie pradinio ugdymo matematikos mokymo praktikos Indonezijoje.

Esminiai žodžiai: *tekstinis uždavinys, įsitikinimai, matematika, mokiniai.*

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