



## The attitude of class nine and ten students towards solving mathematical word problems

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### ARTICLE INFO

o-ISSN: 2528-2026  
p-ISSN: 2528-2468  
Vol. 7, No. 1, June 2022  
URL: <http://doi.org/10.31327/jme.v7i1.1723>

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### Abstract

The study was conducted to understand the attitude towards solving mathematical word problems of 483 class nine and ten students. The quantitative method was used with purposive sampling, including all the students. Survey questionnaires with a five-point Likert scale were validated through pilot testing with 20 students and obtained a Cronbach's alpha of 0.88. Views of students on attitude towards solving word problems, motivation of students, and implication of language in solving word problems were collected. MS Excel's data analysis tool was used to analyze data using percentages, frequencies, descriptive analysis, and correlation. Two-sample t-test for the sample mean was used to see the significance of gender difference. The findings revealed a high positive attitude towards solving word problems. Students were motivated to solving word problems, the teacher is rated as the source of motivation. There was a high positive correlation between language and their love for solving mathematical word problems. There was no significant gender difference observed in attitude and motivation but gender difference was significant in the importance of language in solving word problems. Male students had a stronger belief than a female that language plays a vital role in one's efficacy in solving mathematical word problems. Recommendations are suggested to the subject teachers to enable them to develop better instructions based on reflection.

**Keywords:** attitude, gender, language, mathematical, problem solving, word problem

## A. Introduction

Logical thinking is one of the fundamental prospects of life which must be instilled in every human being. Logical thinking must first start from a very early age, while implementation of a curriculum is one way of instilling logical reasoning (Căprioară, 2015), and critical and creative thinking (Corte et al., 2000) in our youth. Learning mathematics is also one of the ways of enhancing students' cognitive skills, developing logical thinking, and many more analytical attributes (Marchiş, n.d.).

Mathematics is not just about learning numerical but the comprehension of fundamentally processed logic problems behind word problems. In other words, such skills are not restricted only to mathematics but beyond it. A child is given constant training on how to apply analytical skills in their life through the execution of mathematical word problems practiced in schools and colleges. Mathematical word problems play a vital role in keeping our minds elastic and nimble, improving our comprehensive skills, memory, and our creativity. Word problems are necessary to enhance mental skills but it has been proven that for students' word problem is another factor that leads to disinterest in learning mathematics.

During tests and exams, students often attempt most of the direct questions correctly where they just have to remember the formula and apply it. When they are asked to apply the same formula in word problems, they simply skip it even if the questions are not that difficult. During the class activities it is observed that when students are asked to solve word problems, they either start asking their friends or wait for the teachers to explain the questions. There could be several reasons behind the lack of confidence in the students. One could be their interest in the subject, it's our inner drive to learn that propels one to try and learn new things. The second factor could be the lack of motivation to encourage them to solve mathematics word problems and the third could be the language. English being a second language in Bhutan and mathematical language being more technical, students must be facing difficulties in interpreting the problems.

This study is conducted to study the attitude of students and their perceptions towards solving word problems. The survey questionnaires are designed based on three areas, the first set of questions to study their attitudes towards solving word problems, the second set of questions to understand their motivation towards word problems, and finally to get their perceptions on the impact of language in solving mathematical word problems. The study will be useful to the researchers who are mathematics teachers to understand the gap between the prescribed curriculum and the interest of students. This will provide insight into designing better lessons to teach mathematics, especially word problems.

It was necessary to conduct the study as there is not much research being done in the country related to mathematical word problems and is the first study of this kind in our school.

## B. Literature Review

As the underlying fact about attitude is affirmed by (Oroujlou & Vahedi, 2011), where an attitude can be defined as an enduring set of beliefs in and around a situation or anything particular which persuade one to respond in some favorable manner. The statement was further broken down into three characteristics; a) a mental state- conscious or unconscious, b) a value, belief, or feeling; and c) a predisposition to behavior or action (Altmann, 2008). Accordingly, mathematical concepts of attitude are said to be a change in behavior aroused by the learners' beliefs and experiences towards mathematics learning (Mata et al., 2012). It was found that attitude and beliefs of learners correlated with the problem-solving performance and resulted in success when learners portrayed positive attitudes as per the findings in the research paper (Sturm & Bohndick, 2021). It was found that with raise in grades from 5th to 8th grade, the attitude towards problem-solving was found to decrease (Arslan et al., 2014). It can be understood that to have a positive attitude means good performance in problem-solving as stated earlier and as verified (Mata et al., 2012), composing their problem helps in familiarizing with the mathematical terminology and further developing a positive attitude towards the problem. However, it was found only 11.8% out of 51 students liked to compose their problems not having many learners interested in composing their problems, (Khoshaim, 2020) highlighted one of the factors for negative attitude toward problem-solving is the fear of failure

which was agreed by 70% of 18 mathematics teachers. Despite proving that students' attitudes correlate with the performance of problem-solving, (WEKESA, 2013) asserted that teachers' attitude toward mathematics influences students' attitudes toward learning and it was shown by significant agreement of 67.7% of 60 teacher respondents. Even from his finding, 51% of students (N=450) were fond of disliking the idea of learning activities that involved problem-solving. Ultimately, the baseline attitude of students must be changed for them to start liking problem-solving.

Attitude is not the only factor that hinders the performance of mathematical problem solving, motivation can be another important factor. The term motivation is very difficult to define because it can sometimes be described as passion or regarded as learning a second language as per their finding (Oroujlou & Vahedi, 2011). They explained the term by dividing it into two types; Integrative motivation and Instrumental motivation where integrative motivation is believed to assist learners in developing some language proficiency and instrumental motivation is some desire to obtain something practical or concrete. As per a research paper (Txabarri & Villamor, 2014), the ways required in solving word problems affected the motivation of the learners, such as students who solve problems algebraically show a higher motivation compared to the mixed resolution group (Arithmetic and Algebraic) and those with no resolution the learners were found with less motivation. 51% out of 450 students supported that a crucial factor that motivates learners in their performance of the subject is the good conduct of the teachers (WEKESA, 2013). In learners to see whether they are strongly motivated or not, was found predictable (Simamora et al., 2018) through self-efficacy. Interaction between students and teachers in problem-solving activities or giving feedback was found to increase self-efficacy beliefs in learners in their findings which proved to motivate learners. Furthermore, some researchers put forward their findings; that mathematics self-efficacy and mathematics achievement were positively related (Liu et al., 2009). Learners who were confident of their performance in mathematics were found to end up with higher achievements. Learners are motivated to learn further if they perform well.

Language is another factor that contributes to the self-efficacy of students in problem-solving. Mathematics is also a language that helps in communication through the expression of concepts, terms, symbols, and grammar (Gürefe, 2018). The reason for mathematics to be a language is because it draws from many different alphabets and includes symbols along with equations to form a sentence that has a noun and verb like a sentence in a spoken language. Mathematical language and spoken language are used for the same purpose which is to communicate but what makes them different is the spoken language that is used daily in life whereas mathematic language can be learned in school but tends not to apply in daily conversations. The proficiency of language must be instilled in every mathematics student, (Khoshaim, 2020) in one of the studies it claimed that more than 80% of the teachers think a student's language proficiency is one of the obstacles to solving word-problem tasks. Similarly, (*Students Learning without Understanding / Kuensel Online*, n.d.) A lack of reading literacy led to poor mathematics performance. Moreover, (Boonen et al., 2016) found that reading comprehension skills should be given an important role during word problem-solving. From the above findings, it can be affirmed that many researchers find language proficiency has a prominent role in bringing better results in problem-solving tasks.

The attitude of gender could impact differently the performance of Mathematical problem solving but then, (Arslan et al., 2014) found no significant difference in the attitude based on gender towards problem problem-solving the class size and setting were found not a hindrance to applying the problem solving as per the teacher respondents (Khoshaim, 2020). According to (Jupri & Drijvers, 2016), the main problem was identified when students encounter word problems with a context concerning real-life situations and try to comprehend the problem by formulating it in the mathematical context. The researchers stated that the integration of local culture in the Mathematics curriculum brought an improvement in the word problem-solving skills (Simamora et al., 2018). In learning, the teacher is the fundamental backbone, and even in learning mathematics teachers with good communication skills and well-prepared lessons register a higher performance for the learners in problem-solving (Gichuru et al., 2016).

Mathematics is the fundamental skill to be instilled in every learner and to make it successful the learners should have a good attitude in word problem-solving tasks. The factors such as fear of failure and not being familiar with the problem should be waived off to bring about a

positive attitude towards mathematical learning. Since it has been clearly stated by many researchers there is a strong positive correlation between attitude toward mathematical learning and the performance in mathematical problem-solving. Eventually, to bring a positive attitude, the learners should be motivated with different approaches because without motivation the learners would never take interest in solving word problems tasks.

### **C. Methodology**

#### *1. Research Method and Design*

The researchers used a quantitative research method for the study as the nature of the study demands interpretation and analysis of numerical data. A set of questionnaires containing 20 questions on 5 points Likert scale was used as the research design.

#### *2. Research Instruments*

A set of 21 questionnaires were constructed based on the theme of the study. Pilot testing was done involving 20 students selected randomly. Cronbach's alpha of 0.88 was obtained, which signifies a good internal consistency. A question on which respondents gave feedback was reframed. One of the items with the highest variance that was not well aligned with the theme was removed. The three researchers further deliberated on the remaining questions/statements and restructured where ever needed and finalized 20 questionnaires.

#### *3. Data collection and Analysis*

The finalized questionnaires were developed using Google Forms for the survey to collect the data.

After all the responses were collected, the excel sheet containing the data was used for data analysis. Data cleaning was done before the analysis of the result where none of the responses obtained got rejected. Frequency and percentages were used to represent the demographic information while descriptive analysis and sample t-test with two samples for mean were used to summarize the data obtained from the questionnaire.

#### *4. Sampling*

Purposive sampling was used as the study was conducted to understand the attitudes of students taught by the researchers towards solving mathematical word problems, for modification of their teaching strategies to better deliver the lessons. Leaving a few students behind would cause the risk of losing valuable data. All the students of classes nine and ten were involved as research participants to have a high confidence level of 98% with an error of 0.02.

There were a total of 483 students ranging from age 13 to 21 years old responding to the questionnaires, 242 (50.1%) were from class nine and 241 (49.9%) from class ten. 286 (59.2%) of them were female and 197 (40.8%) of them were male.

#### *5. Ethical Clearance*

The researchers firstly wrote an application to the school administration seeking permission to conduct a study with the students they teach. Consent from each individual was also sought before collecting data. The participants were also assured that no sensitive information will be collected at the same time information collected from them will be kept confidential.

#### *6. Research questions*

- i. What is the attitude of students towards solving mathematical word problems?
- ii. What is the level of motivation of students toward solving mathematical word problems?
- iii. What is the perception of the impact of language in solving mathematical word problems?

## D. Findings and Discussion

### 1. Findings

**Table 1. Attitude towards mathematical word problems**

Variables	Mean	SD
I love solving mathematical word problems	3.17	1.09
I spend more time analyzing word problems	3.14	1.04
Word problems increase my critical thinking skills	3.32	1.03
If we practice well, word problems are easy to solve	3.81	1.09
It is important to solve word problems	3.60	1.09
Average	3.41	1.07

Table 1 above shows the attitude of students towards mathematical word problems. At an age, the students had a high positive attitude toward word problems ( $M = 3.41$ ,  $SD = 1.07$ ). There were five items under this section where students agreed with the highest mean ( $M=3.81$ ,  $SD=1.09$ ) to the statement that if we practice well, word problems are easy to solve, followed by the statement 'it is important to solve word problems with ( $M=3.6$ ,  $SD= 1.09$ ). The respondents moderately agreed with the rest of the statements as, I love solving mathematical problems with ( $M=3.17$ ,  $SD=1.09$ ), and I spend more time analyzing word problems with ( $M=3.14$ ,  $SD=1.04$ ), and word problems increase my critical thinking skills with ( $M=3.32$ ,  $SD= 1.03$ ). The research findings contradict their performance in tests and exams.

Table 2 consists of eight items related to motivation toward solving mathematics. In general, the student respondents have high positive motivation with ( $M=3.44$ ,  $SD=1.1$ ) towards mathematics. The students agree ( $M=4.17$ ,  $SD=1.05$ ) that their teachers help them solve mathematical problems when they face difficulties. That shows the teacher is the greatest source of motivation for the children. There was the second-highest mean of ( $M=3.98$ ,  $SD=1.03$ ) stated that they seek help from their friends when they do not get the right answer. They agree ( $M=3.81$ ,  $SD=1.04$ ) that those who are good at mathematics will have better career choices in the future.

**Table 2. Motivation towards mathematics**

Variables	Mean	SD
I love solving challenging questions	3.21	1.08
I am motivated to take Math related courses in the future	3.12	1.13
Students who are good at mathematics have a better career choice	3.81	1.04
When I do not get the right answers, I get help from friends	3.98	1.03
I fear solving mathematical word problems	3.06	1.20
I usually skip word problems in my mathematics exams	2.61	1.18
I feel encouraged to solve word problems when my teacher explains it	3.58	1.05

My teacher helps me in solving when I face difficulty solving questions	4.17	1.05
Average	3.44	1.10

The students responded with ( $M=3.58$ ,  $SD=1.05$ ) stating that they get encouraged to solve mathematical word problems when the questions are explained to them by the teacher. One can conclude from this statement that students face difficulties interpreting the questions. The respondents moderately agree ( $M=3.21$ ,  $SD=1.08$ ) that they love solving challenging questions. That shows only a handful of students love to solve challenging questions. Few students are motivated to take up mathematics-related courses in the future ( $M=3.12$ ,  $SD=1.13$ ). There are a considerable number of students who fear solving mathematical word problems ( $M=3.06$ ,  $SD=1.2$ ). In the pool of motivated students, there are sections of students who fear word problems too. The student participants also moderately agree with ( $M=2.61$ ,  $SD=1.18$ ) that they skip word problems in the exams. In conclusion, students are motivated to solve word problems in the presence of teachers, and when the questions are explained to them by the teacher. When they have to face word problems independently, they do not have enough confidence to solve them. The teacher is playing the role of motivator in instilling the interest of students toward solving mathematical word problems.

Table 3 represents the views of the students on the importance of language in solving word problems. The students responded with the highest mean ( $M=3.82$ ,  $SD=1.03$ ) stating that if they understand the questions well, solving them is not that difficult. The response correlates with the statement in table 2 that they enjoy mathematical word problems when questions are explained by the teacher.

**Table 3. Language and mathematical word problems**

Variables	Mean	SD
Those who are good at the English language will solve word problems easily.	3.42	1.10
We need to be good in language to understand word problems	3.59	1.05
Word problems are mostly related to my day to day experience	3.24	0.99
If we understand the question well, word problems are easy to solve.	3.82	1.03
I can easily interpret questions related to word problems	3.09	0.89
Word problems are confusing	3.32	1.10
After I read the word problem, I know exactly which process is to be used.	3.20	1.02
<b>Average</b>	<b>3.38</b>	<b>1.02</b>

They agree with ( $M=3.42$ ,  $SD=1.1$ ) that those who are good at the English language can solve word problems easily. They also agree ( $M=3.59$ ,  $SD=1.05$ ) that they have to be good in language to understand the word problems. They moderately agree with ( $M=3.24$ ,  $SD=0.99$ ) that word problems are mostly related to day-to-day experiences. The students moderately agree ( $M=3.09$ ,  $SD=0.89$ ) that they can easily interpret word problems. This signifies that the majority of them face difficulties in interpreting the question. The respondents moderately agree with ( $M=3.32$ ,  $SD=1.02$ ) that word problems are confusing. Students also moderately agreed with ( $M=3.2$ ,  $SD=1.02$ ) that after they read word problems, they exactly know the process of calculating. The data signifies that students strongly believe that language is an important factor in understanding word problems. Those who are good at the English language can easily understand the questions and once they understand the questions, they know how to solve them.

The correlation coefficient was calculated for the set of data where a mixture of positive and negative correlations was obtained. The statement "those who are good in language will solve word problems easily" was significantly correlated with a coefficient of  $r = 0.65$  to the statement "We need to be good in language to understand word problems". I love solving challenging questions and was significantly correlated with  $r=0.63$  to the statement I am motivated to take up mathematics-related courses in the future. There was a linear relationship between language and their confidence level in solving mathematical word problems. I usually skip word problems in exams, and confusing word problems were negatively correlated ( $r= -0.097$ ,  $r=0.022$ ) to the statement, I love solving mathematical word problems.

**Table 4. Gender difference (t-Test: two samples for Means)**

	Gender	Mean	P-value	t- critical
<b>Attitude</b>	Male	3.5	0.124	2.77
	Female	3.3		
<b>Motivation</b>	Male	3.5	0.87	2.36
	Female	3.4		
<b>Language</b>	Male	3.5	0.007	2.4
	Female	3.3		

Table 4 represents the result of the t-test for two sample for mean scores between males and females for attitude towards solving word problems, motivation towards word problems, and perception of language as detrimental factors in solving mathematical word problems. There was no significant difference observed between males and females with ( $P=0.124$ ),  $P>0.05$  in attitude towards solving word problems. Similarly, no significant gender difference was observed with ( $P=0.87$ ),  $P> 0.05$ . There was a significant gender difference seen with ( $P=0.007$ ),  $P<0.05$  in their perception that language impacts their efficacy to solve mathematical word problems.

## 2. Discussion

The findings from Table 1 reveal the positive attitude of students toward mathematics problems similar to the findings in the study by (Arslan et al., 2014; Sturm & Bohndick, 2021) which was contradicting the findings of Emanuel et al. (2021) carried in an Indonesian school. It was found negative attitudes in students and they found difficulties in solving word problems and also stated that only one-third of students have a positive attitude towards mathematics word problems (Marchiş, n.d.). Although the students had positive attitudes toward word problems, the majority of the students have not performed well in their trial and annual examinations 2021. Students of class nine scored the mean mark of 38.5 in their annual examinations conducted out of 100 marks while class ten had a mean score of 35.3 in their 2021 trial exam tested out of 100. Although there were students who scored the highest marks of 96 out of 100, there were also students scoring as low as 07 out of 100.

When challenging tasks are assigned to the high achievers, they might derive joy after solving the problems that will lead to the development of positive attitudes towards mathematics, conversely, giving challenging problems to the low performers could further their self-esteem generating negative attitudes towards solving mathematical word problems (Mata et al., 2012). Khoshaim (2020) also found attitude to be a crucial factor in mathematics achievement.

The study found significantly high motivation among the students of Phuentshothang School towards mathematical word problems contradicting few findings (Emanuel et al., 2021; Marchiş, n.d.). Motivation can be seen as crucial for the students to perform better in problem-solving (Mata et al., 2012). There is always a fine line separating two types of students; one who hates mathematics and the other who loves solving mathematics problems, what sets them apart from each other is their mindset. With the new research, motivation in math is regarded

to do with the mindset – specifically, the growth mentality. The growth mindset refers to the belief that students can improve on their intelligence, ability, and performance, as opposed to the fixed mindset, which refers to the ideology that one's talents are already set in stone. To excel in math, teachers should encourage a growth mentality in students so that they can be motivated to solve math problems as students find teachers to be the source of motivation (Wekesa, 2013).

Participants responded with ( $M=3.38$ ,  $SD=1.02$ ) that English is necessary for one to be good at solving mathematical word problems. The finding is similar to that of Emanuel et al. (2021). To be good in the English language is found to be a necessary tool in comprehending the context of word problems. On the contrary, Yonson and Yonson (2017) argued that language is not the sole conclusive factor that helps in the understanding of the problem. Mathematical language being technical, there can also be other factors contributing to one being good at solving word problems.

In learning mathematics, the gender differences might show a different angle of learning approach and also to some extent the varied performances as Ajai and Imoko (2015) suggested on the bases of gender; girls' performance in mathematics is found to be dependent on rote learning, hard work, and perseverance rather than natural talent, flexibility, and risk-taking which are the learning styles of boys. Even in most parts of the world, boys and girls are conditioned to a belief that learning mathematics is meant for boys, which might have lowered the motivation of girls. On the contrary, although there is a slightly higher mean score for boys, there is no significant difference in attitude and motivation between boys and girls towards solving mathematical word problems. The findings of the study are similar to the findings of Ajai and Imoko (2015); Arslan et al. (2014).

## **E. Limitations**

This study is limited to the 483 students of classes nine and ten of Phuentshothang School, under Punakha district, Bhutan. The views on attitude and motivation of students towards solving word problems are being generalized from 483 students of a single school.

## **F. Recommendations**

- i. Based on the findings, the researchers recommend the subject teachers continue with explaining questions and providing hints to solve mathematical word problems but give them enough time to try out independently or in collaboration with their mates first. Although the students are well motivated, and they showed a lack of confidence in solving the problems, giving them enough guided learning would increase their confidence.
- ii. Use a variety of strategies for the delivery of instructions especially when the topic is related to the solving of mathematical word problems.
- iii. Teach children how to interpret word problems and use the formula. Understanding mathematical language would help them interpret easily so that they build their confidence.
- iv. Find out the reason for students to skip word problems as a significant number of them have mentioned that they skip difficult problems, and design a strategy to help them solve word problems.

Since students have a strong belief that the teacher is the source of motivation for them in terms of solving word problems, teachers can keep up the same strategy of motivating and helping them build their confidence which will gradually build their self-efficacy.

## **G. Conclusion**

The study concludes based on findings that students of classes nine and ten of Phuentshothang School, Punakha have a significantly high positive attitude towards solving mathematical word problems. The statement 'if we practice well, word problems are easy to solve' scored the highest mean among five statements under attitude towards mathematical word problems. While students rated the lowest mean stating that they do not spend enough time analyzing word problems.

There were seven items under motivation factors towards solving mathematical word problems where 'My teacher helps me in solving the problems when I face difficulty' was rated

highest. On the other hand, 'I usually skip word problems in my mathematics exams' scored the lowest, which shows that students do not ignore or skip word problems.

Under the impact of language in solving mathematical word problems, students strongly believe that language has a strong correlation with their ability to solve mathematical word problems. The majority of the participants felt that if we practice well, word problems will be easy at the same time "I can easily interpret questions related to word problems," was rated lowest, stating that they had some problems interpreting word problems.

There was no significant gender difference in attitude and motivation towards solving word problems but a significant gender difference was observed in language and mathematical word problems. Male students had a higher mean agreeing with the factors compared to females.

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