



# Teachers' Problem-Solving Beliefs and Their Practices in Mathematics Classrooms: A Case of Grade 7 & 8 Primary School Teachers' in Bahir Dar Town

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## Author's contribution

*The sole author designed, analyzed and interpreted and prepared the manuscript.*

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## ABSTRACT

The major purpose of this study was to investigate teachers' beliefs about the role of problem solving in learning mathematics and their classroom practices of grade 7 and 8 mathematics teachers. Descriptive survey method was employed for the study. The data required for the study were collected from teachers using questionnaires. The findings of the study indicated that teachers have generally traditional beliefs about the role of problem solving in learning mathematics. In relation to problem solving approaches, there appeared to be more of a focus on teaching for problem solving rather than teaching through problem solving. Most of the teachers support the more traditional practices of presenting problems to students at the end of the topic after basic facts and procedures (algorithms) have been rehearsed. Consequently, teachers view the role of problem solving as the means to an end of finding the correct answer rather than viewing as a means of learning mathematics or a way of thinking. Teachers were more frequently employ the more traditional practices of giving exercises to students to practice their skills instead of focusing on

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problems. There exists a strong positive correlation between teachers' beliefs about the role of problem solving in learning mathematics and their classroom practice. Implication of the Study was to identify and clarify teachers' beliefs and their practice regarding problem solving approach of teaching. So that teacher education, curriculum developers, ongoing teacher development and teaching practice would be informed to address gaps in this regard. The study could be of some help to teachers, students, school principals, education officers, and regional education Bureau to be informed about the current practice of problem solving approach of teaching in mathematics classrooms so as to take corrective measures whenever possible. Finally, the research report might be used as a reference for further studies.

*Keywords: Teachers; problem-solving belief and practice; mathematics classroom and primary school.*

## 1. INTRODUCTION

Problem solving has existed since the first human being realized a need to find shelter and food or to escape from the predators Brown [1]. As human society developed and advanced, due to the unpredictable contingencies and dangerous uncertainties, new problems revealed and caused the need for new ways of solving problems. Meanwhile, mathematics evolved in response to these needs and the development of mathematics offered more opportunities to accomplish harder problems Brown [1]. That is why, for mathematicians, doing mathematics is considered as solving problems Schoenfeld [2] and those who were better able solve problems have been found more successful throughout history Jonassen [3].

Historically, learning mathematics and teaching it to all students at the school stage has been motivated by the belief that a study of mathematics helps students to learn to reason and apply such reasoning to everyday problems. It is believed that learning mathematics leads to learners' cognitive development. Thus, one of the important questions that all mathematics teachers must constantly ask themselves is: Does the mathematics that we teach (and that our students learn) lead to an enhancement of students' cognitive abilities Tripathi [4]? According to Tripathi, problem solving is used as a tool for cognitive development and used to effect a change in learners' attitudes and beliefs about mathematics so that they come to view mathematics as a discipline founded on reasoning. The cognitive development that comes through problem solving process is that most modern societies would like their citizens to develop.

Recent theories in teacher education and development suggest that a better understanding

of teachers' practices can be achieved by an understanding of the beliefs underlying those practices. The underlying assumption is that teachers' classroom decisions do not happen at random, but are guided by systems of beliefs which influence teachers' classroom decisions Bellalem [5].

Beliefs have a considerable effect on individuals' actions. Hersh [6] indicated that "one's conception of what mathematics is affecting one's conception of how it should be presented and one's manner of presenting it is an indication of what one believes to be the most essential in it". Therefore, teachers' beliefs play a crucial role in changing the ways teaching takes place. As teachers' beliefs determine the nature of the classroom environment that the teacher creates, that environment, in turn, shapes students' beliefs about the nature of mathematics Grouws, & Schoenfeld, [7,2]. Therefore, due to the fact that teachers' beliefs, knowledge and decisions have a close relation with students' beliefs, attitudes and performance in mathematics, it becomes highly important to know these beliefs and be aware of their effects on classroom practices.

Even though problem-solving approaches to teaching mathematics have been recommended in Ethiopian curriculum documents, but there has been limited classroom implementation in the Ethiopian mathematics classrooms MOE [8]. In Ethiopia, research has not been conducted about mathematics problem-solving, especially in relation to teachers' problem-solving beliefs and their practice in mathematics classrooms. Therefore, in order to make up the shortages in our education system and counteract negative dispositions, we need to examine the belief of our mathematics teachers, and start the changes by changing the negative or traditional beliefs teachers hold towards the role of problem solving

in learning mathematics. The goal of this study was to better understand the nature of teachers' beliefs about the role of problem solving in learning mathematics and the links between their beliefs and practices.

According to Stacey [9], problem-solving is recognized as an important life skill involving a range of processes including analyzing, interpreting, and reasoning, predicting, evaluating and reflecting. It is either an overarching goal or a fundamental component of the school mathematics curriculum in many countries. The aim of teaching through problem solving methodology is empowerment of the learner in such a way that he or she is confident and able to function in many contexts and provides students with the opportunities to develop their lifelong learning skills.

For some teachers, even it also seems easier to teach in traditional ways than to test contemporary approaches or to spend time examining their current practices and the impact of new approaches. So, it is anticipated that teachers have traditional belief about the role of problem solving in learning mathematics and teachers' classroom practices are directly influenced by their beliefs about teaching and learning. A study on teachers' mathematical problem solving beliefs may illuminate why they choose to use particular classroom practices and reject others. Therefore, the researchers are initiated to diagnosis teachers' problem solving beliefs and their practice in mathematics classroom of primary school of grade 7 and 8 in Bahir Dar town.

In general, the need to conduct a research in this area is: to examine teachers' beliefs about the role of problem solving in learning mathematics; to examine the extent and the ways teachers incorporate problem solving approaches in teaching of mathematics; to explore the relationship between teachers' problem solving beliefs and their practices and finally to recommend possible solutions to the identified gaps related to teachers' problem solving beliefs and their practice in mathematics classrooms.

To guide the study within the scope specified and make the intended objectives attainable, the study attempts to answer the following basic research questions.

- What is teachers' belief about the role of problem solving in learning mathematics?
- To what extent and in what ways do teachers incorporate problem solving approaches in teaching of mathematics?
- Is their relationship between teachers' problem solving beliefs and their practices in mathematics classrooms?

The general objective of this research was to explore teachers' problem solving beliefs and their practices in mathematics classrooms of grade 7 and 8 mathematics teachers in Bahir Dar town and then to propose possible solutions that can help to improve the practice of problem solving approach of teaching mathematics. Specifically, the study is carried out to assess teachers' belief about the role of problem solving in learning mathematics, to explore ways in which teachers incorporate problem solving approaches in teaching of mathematics and to identify the relationship between teachers' problem solving beliefs and their practices in mathematics classrooms.

## 2. MATERIALS AND METHODS

This research was conducted by making use of descriptive survey research approach that employed both a quantitative and qualitative data analysis techniques. This method is chosen since it is an appropriate design to describe what actually exist such as current conditions, beliefs, practices, situations, or any phenomena.

### 2.1 Population, Sample and Sampling Techniques of the Study

This survey was engaged in teachers teaching at Grade 7 & 8 as respondents. A total of 38 Primary schools having grade 7 and 8 functioning in Bahir Dar town in 2008 E.C was taken as the study setting. In the 38 schools, there were 87 teachers teaching at grade 7 and 8. Out of these 38 schools, 20 schools (52.6%) were selected by using simple random sampling method. In these 20 schools, there were 42 mathematics teachers teaching at grades 7 and 8. All the 42 Mathematics teachers found in the selected sample primary schools were taken as samples of the study purposively. As a result, 42 questionnaires were dispatched to all grade 7 & 8 mathematics teachers teaching in the 20 sample schools.

**Table 1. Sample sizes of schools and teachers taken from Bahir Dar town**

Total number of Schools having Gr. 7 & 8	Number of sample schools	Total number of math teachers teaching in Gr. 7 & 8			Number of respondents from sample schools		
		Male	Female	Total	Male	Female	Total
38	20	72	15	87	38	4	42

Source: Bahir Dar town education office

## 2.2 Sources of Data

The collection of information was carried out through primary and secondary sources. Primary data were collected from teacher respondents and classroom lesson observations. In the secondary data, relevant books, booklets, articles published in professional journals, unpublished theses and dissertations, educational progress reports related to teachers' problem-solving beliefs and practices in mathematics classrooms were reviewed in the literature part to support the findings of the study.

## 2.3 Data Collection

In data collection technique, both quantitative and qualitative procedures were used to strengthen the result. Each can complement the other by providing different information about the same phenomenon. Data from different sources can be compared for consistency. They can also be used to overcome potential weakness for particular methods. Thus, the data required for the study about teachers' mathematical problem-solving beliefs and their classroom practices, were collected from teachers using questionnaires (both close ended & open ended) and classroom lesson observations using unstructured observation checklist.

## 2.4 Methods of Data Analysis

A number of descriptive and inferential statistics were conducted by using SPSS software program. Data analyses were made with relevant headings and sub-headings which derived from the research questions. Quantitative method of data analysis was used to analyze the data. Descriptive statistics (such as *frequencies, percentages, mean and standard deviations*) and inferential statistics (such as *one sample t-test*) were used in analyzing quantitative data to explore teachers beliefs about the role of problem solving in learning mathematics and their reported classroom practices(i.e. for research question 1 & 2). The third basic question was to see the relationship between teachers' beliefs and their classroom practices. In doing so, Pearson- Product Moment

coefficient of correlation was employed to see the link between belief and practice. On the other hand, the data gathered through open- ended questionnaire was analyzed by using narrative description to triangulate with quantitative findings.

## 3. RESULTS

### 3.1 Teachers' Beliefs about the Role of Problem Solving in Learning Mathematics

*(Research Question 1: What is teachers' belief about the role of problem solving in learning mathematics?)*

As can be seen from Table 2, the teachers' responses for majority of the traditional belief items were statistically and significantly above the expected mean. From the total of 7 traditional view items, (items, 1, 2, 5, 7 and 12) were reasonably above the expected mean 3.

The data suggest that the majority of surveyed teachers 85.7% (with the mean of 3.31) believe that students should first learn basic facts and algorithms before they are assigned problem solving tasks (like application and unfamiliar problems) (Item 1). And almost 93% of the participants (with the mean of 3.31) believe that problem solving as a set of steps that can be mastered and practiced like any other skill in mathematics. This shows that most teachers have a high level of agreement on the idea that mathematics lessons should focus on practicing skills (Item 2). There was a high level of agreement (with a mean of 3.07) with the traditional view that some students have trouble of solving problems unless they know how to do the mathematics before they begin (Item 12). In addition, approximately three fourth of the participant teachers (with the mean of 2.98) indicated their belief that the best problems are those which relate directly to the number facts and algorithms the students have been practicing (Item 5). 66.7% of the participants (with the mean of 3.05) believe that application and unfamiliar problems are best left to the end of the topic in mathematics, the rest 16(38.1%) show their

disagreement (Item 7). This shows a spread of belief is observed in this statement. On the other hand, a more even spread of belief is observed for items 9 and 14. For instance, for item 9 that expressed the non-importance of understanding why a mathematical procedure works as long as it gives a correct answer, 45.2% of the participants (with a mean of 2.55) reported their agreement and the rest 54.8% of the participants reported their disagreement. Similarly, for item 14 that expressed the belief that problem solving takes too much time to include except maybe once a week or once every two weeks, 57.1% of the participants (with the mean of 2.67) reported their agreement and the rest 42.9% of the participants reported their disagreement. This shows that for these belief statements teachers had no strong belief such that their responses were distributed among agreement and disagreement showing differences in beliefs.

The overall agreement level of the teachers towards the traditional belief statements that view problem solving as an end in the teaching learning of mathematics were examined against the expected mean of this subcategory. As indicated in Table 3 above, the overall mean of the traditional belief statements was 20.88 (SD = 4.283), which is statistically and significantly higher than the expected mean ( $\mu = 17.50$ ). This shows that traditional approaches gained more support than contemporary views by teachers.

As can be seen from table 4 above, the teachers' responses for majority of the contemporary belief items was statistically and significantly below the expected mean. From the total of the 7 contemporary view items, teachers indicated their high level of disagreement in 3 of them (items 8, 10 and 13). For instance, the majority of the surveyed teachers (76.2%) rejected the contemporary view that all mathematics questions should challenge students to think about what mathematics they know and how they can use it and the remaining 23.8% of respondent teachers (with a mean of 2.12) show their agreement (item 8). Similarly, most teachers (76.2%) rejected the view that most mathematical lessons need to begin with a problem and the rest 23.8% of the teachers (with a mean of 2.10) show their agreement (item 13). The data obtained indicated also that 31.0% of the respondents (With the mean of 2.24) show their agreement about the view that students can learn most mathematical concepts by working out for themselves how to solve unfamiliar and

open-ended problems and the remaining majority (69%) show their disagreement (item 10).

In addition, encouraging students to explore their own methods of doing mathematics questions before being shown the teacher's methods were also rejected by 64.3% of the teachers and this view was supported by the remaining 35.7% of the respondent teachers with a mean of 2.31 (item 11). The importance of problem solving to enable students to become independent learners is supported by only 40.5% the teachers and rejected by the remaining 59.5% of the respondent teachers. On the other hand, the majority of the surveyed teachers (73.8%) (With the mean of 3.10) show their agreement with the view that problem solving helps students learn to reason logically and can see how one mathematical idea relates to another (Item 4). A more even spread of belief is also observed from the data collected in this subcategory of the questionnaire (contemporary belief statements) about teachers problem solving beliefs for items 3. For item 3 that expressed mathematics lessons should focus on problems rather than on practice of algorithms 42.9% of the participants (with the mean of 2.36) reported their agreement and the rest 57.1% of the participants reported their disagreement. This shows that for this contemporary belief statement teachers had no strong belief such that their responses were distributed among agreement and disagreement even though more than half of the teachers show their disagreement.

The overall agreement level of the teachers towards the contemporary belief statements that describe a view about teaching and learning mathematics via problem solving so that problem solving becomes a means to learning were examined against the expected mean of this subcategory. As indicated in Table 5, the overall mean of the contemporary belief statements was 16.59 (SD = 5.605), which is lower than the expected mean ( $\mu = 17.50$ ). This shows that contemporary views were not gained more support by teachers.

Overall, the results from data analysis of the closed-ended questionnaire designed to explore teachers' beliefs about the role of problem solving in learning mathematics indicates that traditional approach of teaching problem solving gained more support than contemporary views. Thus, teachers' beliefs about the role of problem solving in learning mathematics were found to be traditional.

**Table 2. Descriptive statistics and t-test values for teachers' responses to the traditional belief statements**

No.	Item	Strongly agree & Agree (%)	Strongly disagree & Disagree (%)	Mean*	Std. Dev.	t-test value	P-value
1	Students should learn basic facts and algorithms before they are assigned problem solving, like <i>application</i> and <i>unfamiliar problem</i> .	85.7	14.3	3.31	0.715	7.335	0.000
2	Problem solving is a set of steps that can be mastered and practiced like any other skill in mathematics. Thus Mathematics lessons should focus on practicing skills.	92.9	7.1	3.31	0.604	8.681	0.000
5	The best problems are those which relate directly to the number facts and algorithms the students have been practicing.	73.8	26.2	2.98	0.715	4.315	0.000
7	<i>Application</i> and <i>unfamiliar problems</i> are best left to the end of the topic in mathematics.	66.7	33.3	3.05	0.854	4.156	0.000
9	It is not important to understand why a mathematical procedure works as long as it gives a correct answer.	45.2	54.8	2.55	0.739	0.417	0.679
12	Some students have trouble solving problems unless they know how to do the mathematics before they begin.	85.7	14.3	3.07	0.745	4.968	0.000
14	Problem solving takes too much time to include except maybe once a week once every two weeks.	57.1	42.9	2.67	0.650	1.661	0.104
	Total	72.45	27.55	20.88	4.283	5.115	.000

\* Minimum possible mean value is 1; maximum possible mean value is 4

**Table 3. The overall agreement level of teachers towards traditional beliefs and t-test value**

Variable	Expected mean	Observed mean	Std. Dev.	t-test value	P-value
Traditional teaching approach belief on problem solving	17.50	20.88	4.28385	5.115	.000

**Table 4. Descriptive statistics and t-test values for teachers' responses to the contemporary belief statements**

No.	Item	Strongly agree & agree (%)	Strongly disagree & disagree (%)	Mean	Std. Dev.	t-test value	P-value
3	Mathematics lessons should focus on problems rather than on practice of algorithms.	42.9	57.1	2.36	0.821	-1.128	0.266
4	Problem solving helps students learn to reason logically and can see how one mathematical idea relates to another.	73.8	26.2	3.10	0.958	4.027	0.000
6	Problem solving enable students to become independent learners.	40.5	59.5	2.38	0.936	-0.824	0.414
8	All mathematics questions should challenge students to think about what mathematics they know and how they can use it.	23.8	76.2	2.12	0.593	-4.165	0.000
10	Students can learn most mathematical concepts by working out for themselves how to solve <i>unfamiliar and open-ended problems</i> .	31.0	69.0	2.24	0.850	-1.897	0.050
11	It is essential for students to explore their own methods of doing mathematics questions before being shown the teacher's methods.	35.7	64.3	2.31	1.000	-1.235	0.224
13	Most mathematics lessons need to begin with a problem.	23.8	76.2	2.10	0.821	-3.196	0.003
	Total	38.78	61.22	16.5952	5.60513	-1.046	.202

**Table 5. The overall agreement level of teachers towards contemporary beliefs and t-test value**

Variable	Expected mean	Observed mean	Std. Dev.	t-test value	P-value
Contemporary teaching approach belief on problem solving	17.50	16.5952	5.60513	-1.046	.202

### 3.2 The Extent and the Ways Teachers Incorporate Problem Solving Approaches in Teaching of Mathematics

*(Research Question 2:- To what extent and in what ways do teachers incorporate problem solving approaches in teaching of mathematics?)*

The data in Table 6 (See table 6 on page 24), indicated that some strategies seem to be used more frequently by a majority of teachers than other strategies. For example, encourage the students to work in small, cooperative groups is often or almost always used by 85.8% of the respondents (item 4). Also leading whole class discussion to share solutions and strategies to students at the end of a problem solving lesson is often or almost always used by 76.2% of the respondents (item 3). Besides, explaining in detail what the students have to do to solve problems is often or almost always used by 73.8% of the respondents (item 2). Setting routine exercises to allow students to practice their skills rather than focus on problems is often or almost always used by 71.4% of the respondents (item 12).

In contrast to this, most of the strategies are used relatively infrequently by a majority of teachers. These include presenting unfamiliar and open-ended problems with very little indication of how to solve them where 85.8% of teachers rarely or sometimes use this strategy (item 1). Also, 88.1% of the surveyed teachers rarely or only sometimes pose open-ended problems to allow the students explore mathematical situations for themselves (item 11). Similarly, 81% the surveyed teachers rarely or only sometimes pose unfamiliar problems (item 10). Over three fourth of the teachers (76.2%) reported that rarely or only sometimes use problems which arise from the school context or which relate to the students experiences (item 13). Furthermore, 71.4% of the teachers reported that rarely or only sometimes discuss problem solving process. Encourage students to record their own procedures and methods of solving problems are also rarely or only sometimes used

by 66.7% of the surveyed teachers. On the other hand, a spread of frequency of use of some strategies is also observed. These include presenting application problems which allow students to practice the skills they have just learnt and encouraging students to pose their own problems.

The overall practice levels (extent) of strategies that promote teaching through problem solving by teachers were examined against the expected mean. As indicated in Table 7, the overall mean of practice of strategies that promote teaching through problem solving by teachers was 30.28 (SD = 5.60), which is lower than the expected mean ( $\mu = 32.50$ ). This shows that strategies that promote teaching through problem solving (like the use of unfamiliar and open ended problems) are not preferred strategies by teachers in their classroom practice.

### 3.3 The Relationship between Problem Solving Beliefs and Practices

*(Research Question 3: Is their relationship between teachers' problem solving beliefs and their practices in mathematics classrooms?)*

The third basic question was to see the relationship between teachers' beliefs and their classroom practices. In doing so, Pearson-Product Moment coefficient of correlation was employed. The relationship between teachers' problem solving beliefs and their classroom practices were all in the predicted directions. The result in Table 8 shows that there exists strong positive relationship between teachers' beliefs about the role of problem solving in learning mathematics and their reported classroom practices.

The result in Table 8, is consistent with the previous findings shown in Table 3, & Table 5. That is, more traditional beliefs were associated with more infrequent use of problem solving teaching strategies in mathematics classrooms. For example, in the data analysis of *research question 1*, on teachers beliefs about the role of problem solving in learning mathematic, the



**Table 6. Descriptive statistics and t-test values for reported use of teaching strategies (N=42)**

No.	Item	Almost not (%)	Sometimes (%)	Often (%)	Almost always (%)	Mean	Std. Dev.	t-test value	P-value
1	You present <i>unfamiliar and open-ended problems</i> to the class with very little indication of how to solve them.	4.8	81.0	14.3	0.0	2.17	0.490	-4.411	0.000
2*	You explain in detail what the students have to do to solve problems	2.4	26.2	59.5	11.9	2.81	0.671	1.057	0.297
3	At the end of a problem solving lesson you lead a whole class discussion so that students can share solutions and strategies.	0.0	23.8	40.5	35.7	3.12	0.772	5.200	0.000
4	You encourage the students to work in small, cooperative groups.	0.0	14.3	54.8	31.0	3.17	0.660	6.551	0.000
5	You encourage students to record their own procedures and methods of solving problems.	14.3	52.4	19.0	14.3	2.33	0.902	-1.198	0.238
6	You encourage students to pose their own problems	7.1	50.0	35.7	7.1	2.43	0.737	-0.628	0.534
7	You present application problems which allow students to practice the skills they have just learnt	14.3	42.9	26.2	16.7	2.45	0.942	-0.328	0.745
8	You provide concrete materials for those students who need them	23.8	35.7	40.5	0.0	2.17	0.794	-2.721	0.009
9	You discuss problem solving process(i.e make a plan, carry out the plan, check the calculations)	11.9	59.5	21.4	7.1	2.24	0.759	-2.236	0.031
10	You use problems which arise from the school context or which relate to the students experiences	11.9	64.3	16.7	7.1	2.19	0.740	-2.709	0.010
11	You pose open-ended problems to allow the students explore mathematical situations for themselves.	31.0	50.0	11.9	7.1	1.95	0.854	-4.156	0.000
12*	You set routine exercises to allow students to practice their skills rather than focus on problems	0.0	28.6	45.2	26.2	3.00	0.765	4.235	0.000
13	You pose unfamiliar problems	35.7	52.4	11.9	0.0	1.76	0.656	-7.297	0.000
	Total	14.8	48.5	26.74	9.89	30.28	5.603	-1.03	0.103

\* The item is negatively stated (the item is not a problem solving strategy) and hence reversed in scoring

**Table 7. The overall practice level of strategies that promote teaching through problem solving by teachers and t-test value**

Variable	Expected mean	Observed mean	Std. Dev.	t-test value	P-value
Teachers practice of strategies that promote teaching through problem solving	32.50	30.28	5.603	-1.03	0.103

**Table 8. The correlation between teachers' problem-solving beliefs and their classroom practice**

	Teachers problem solving belief	Teachers classroom practice
Teachers problem solving belief	1.000	0.702**
Teachers classroom practice	0.702**	1.000

\*\* Correlation is significant at the 0.01 level (2-tailed)

results indicated that traditional views of teaching and learning with a belief in problem solving as an end gained more support than contemporary views (a belief in teaching mathematics via problem solving so that problem solving becomes a means to learning). In line with this finding, in the data analysis of *research question 2*, on teachers frequency and ways of using problem solving strategies on mathematics classrooms the result revealed that posing unfamiliar and open-ended problems to students, using problems which arise from the school context, encouraging students to pose their own problems were less frequently presented to students than routine exercises. This shows that traditional views which gain more support than the contemporary views of the surveyed teachers were accompanied by their infrequent use of problem solving strategies in the classrooms.

## 4. DISCUSSION

### 4.1 Teachers' Beliefs about the Role of Problem Solving in Learning Mathematics

The belief scores of the primary grade 7 and 8 mathematics teachers in this study indicated that their beliefs about the role of problem solving in learning mathematics were generally traditional, which is not in line with the new training and education policy of Ethiopia (MOE,1994). For instance, with this new mathematics curriculum, it was stated that problem solving is placed as an integral part of the mathematics program and students should develop critical thinking and creative thinking skills in the context of solving problems. Besides, the need for learners to become successful problem solvers is one goal

of the Education and Training Policy of Ethiopia MOE [10]. In the strategy document for improving mathematics and science education in Ethiopia MOE [8], it is stated that emphasis should be given to process learning rather than product learning where process learning is a way of action, a way of acquiring knowledge, a way of thinking about things and having order and direction rather than product learning which is merely a method of learning to achieve results.

When the research related to teachers' belief about the role of problem solving in learning mathematics were concerned, it was possible to reach only one related local research report summarizing the case in one zone. Bishaw [11] found that teachers have low level beliefs regarding the use of problem solving teaching method and it is found out that teachers are employing traditional teaching methods in teaching mathematics at grade nine and ten.

### 4.2 The Extent and the Ways Teachers Incorporate Problem Solving Approaches in Teaching of Mathematics

According to Clark [12], the teacher's role in teaching through problem-solving is crucial in providing for students an effective problem solving experience by functioning as a problem-solving facilitator in a problem-solving classroom with very little indication of how to solve them. Findings from the questionnaire items revealed that explaining in detail what the students have to do to solve problems was one of the most frequently used teaching strategy reported by teachers. This shows that teachers were practicing traditional approach of teaching. The

result obtained from the lesson observations indicated that traditional method of teaching were practiced. the findings show that the use of unfamiliar and open ended problems are not preferred strategies, and encouraging students to pose their own problems, discussing problem solving process, encourage students to record their own procedures and methods of solving problems and using problems which arise from the school context are not a commonly used approach by many of the teachers.

#### 4.3 The Relationship between Teachers' Problem Solving Beliefs and their Practices in Mathematics Classrooms

In order to see the relationship between teachers' beliefs and their classroom practice, Pearson- Product Moment coefficient of correlation was employed. The relationship between teachers' problem solving beliefs and their classroom practices were all in the predicted directions. The result shows that there exists a strong positive relationship between teachers' beliefs about the role of problem solving in learning mathematics and their classroom practice.

That is, teachers' problem solving beliefs have a strong influence on their classroom practice. It is observed that teachers may have a contemporary belief about the role of problem solving in learning mathematics and still their instructional practice may be traditional. The reason for this inconsistency is due to the many other factors which affect teachers' classroom practices other than their belief structure.

#### 5. MAJOR FINDINGS

- Problem solving was wrongly viewed by most teachers as if it is a set of steps that can be mastered and practiced like any other skill in mathematics. They show a high level of agreement for the traditional view that mathematics lessons should focus on practicing learnt procedures and methods rather than on problems.
- The finding of the study revealed that the overall agreement level of the teachers towards the traditional belief statements that view problem solving as an *end* in the learning of mathematics were examined against the expected mean. The overall calculated mean of the traditional belief statements was 20.88 (SD = 4.283), which

is statistically and significantly higher than the expected mean ( $\mu = 17.50$ ). This shows that traditional approaches gained more support than contemporary views by teachers.

- The result from this study suggested that teachers' beliefs influence their practice in relation to mathematical problem solving. The result shows that there exists a strong positive relationship between teachers' beliefs about the role of problem solving in learning mathematics and their classroom practice.

#### 6. CONCLUSIONS

Upper primary school (grade 7 & 8) mathematics teachers in this study have traditional beliefs about the role of problem solving in learning mathematics. In relation to problem solving approaches, there appeared to be more of a focus on teaching *for* problem solving rather than teaching *through* problem solving. Most of the teachers support the more traditional practices of presenting problems to students at the end of the topic after skills and procedures have been rehearsed. They believe that students should first learn basic facts and algorithms before they are assigned problem solving tasks (like application, open-ended and unfamiliar problems), and students should exercise learnt procedures and methods. Consequently, teachers view the role of problem solving as the means to an *end* of finding the correct answer rather than viewing as a *means* of learning mathematics or a way of thinking.

#### 7. RECOMMENDATIONS

1. Teachers should undertake professional development that focused on problem solving approaches of teaching to help teachers develop beliefs and dispositions that are consistent with current educational reform. For this purpose, they can also exploit the existing system, such as the school base CPD program and lesson study.
2. The concerned educational offices at different level should promote and arrange training workshops to mathematics teachers on how to incorporate problem solving approaches in to mathematics classrooms. These workshops would need to focus on: reflection and careful examination of teachers' current beliefs

and practices, identifying the sources of influence on such beliefs and practices, advice about planning and incorporating problem solving approaches into mathematics classrooms.

3. For some teachers, it seems easier to teach in traditional ways than to test contemporary approaches or to spend time examining their current practices and the impact of new approaches. Therefore, Teachers should be ready to change and regard problem solving as an important part of mathematics education and regularly engage in such activities. They must develop a problem-solving culture in classroom to make problem solving a regular and consistent part of one's classroom practice.
4. If a goal of pre-service mathematics teacher training programs is to promote beliefs that are consistent with the underlying current philosophy of mathematics education reform, then Teacher Training Institutes should include the problem-solving teaching method as a major component of the training rather than presented as a separate stand alone topic covered in a methods course.
5. Teachers should engage students in a variety of problem-solving activities such as presenting unfamiliar and open-ended problems, using problems which arise from the school context or which relate to the students experiences, discussing problem solving process and encourage students to record their own procedures and methods of solving problems.
6. As policy makers try to find effective ways and means to support high level learning for students, they need to take measures to change the traditional beliefs teachers hold towards the role of problem solving in learning mathematics and then provide necessary support and services to ensure the contemporary beliefs come into practice in primary mathematics classrooms as well as ensuring that teachers follow innovations and maintain their professional development in this regard.
7. *Recommendations for further research:* A further study related to this area can be carried out with a larger scope about *the factors that affect teachers problem solving beliefs and there practice in primary schools*, which might give a better chance

of understanding the place of problem solving in our mathematics education.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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