

Primary School Teachers' Conceptions and Perceived Practices of Problem-solving Method in Selected Schools in Bahir Dar

Haftu Hindeya
Email: haftu_hg@yahoo.com

Department of Teacher Education & Curriculum Studies
Faculty of Educational & Behavioral Sciences
Bahir Dar University

Abstract: This study examined teachers' problem-solving conceptions and their perceived classroom practices. Nine teachers were purposely selected from two primary schools. Data were collected through in-depth interview and open-ended questionnaire, and were thematically categorized and analyzed. Results showed that teachers associated the method with various issues often unrelated to it and their perceived practice was consistent with their conceptions though their conception was different from problem-solving method. Teachers confined their perceived classroom activities to discussion of factual ideas. They often equated problem-solving with use and production of teaching materials, with group discussion and as a mechanism to alleviate students' social problems. The results implied that though what teachers claimed as their perceived use of problem-solving method is in tune with their conception, neither their conception nor their perceived practice concord with procedures of problem-solving method. Finally, implications have been drawn on the basis of the findings.

Keywords: Teachers conception, instruction, classroom practice, Ethiopia

Introduction

Ethiopia has made diverse educational reforms over the last two decades grounded mainly on poor educational relevance, equity, efficiency and production of skilled human power (Ministry of Education, 1994). For instance, a new education policy was introduced in 1994 in order to promote students' inquisitive ability and raise their creativity in addition to fostering the problem-solving capacity of students and the society in general (MoE, 1994). The policy states that one of the aims of education in Ethiopia is "to strengthen the individuals' and society's problem-solving capacity, ability and culture starting from basic education and at all levels" (MoE, 1994, p. 1). The policy clearly stipulated "the development of problem-solving capacity and culture in the content of education, curriculum structure and approach focusing on the acquisition of scientific knowledge and practicum" (MoE, 1994, p. 4).

Problem-solving has multifaceted impacts on the future career and life of students. For instance, problem-posing, an element of problem-solving when conceived as a process (Garofola & Lester, 1985, as cited in Wilson et al., 1993) has an important contribution in making students promote their horizon of problem-solving. Indeed, Freire (1970, p. 32) has put problem-solving, as explained by problem posing, as an instrument for promoting

students' confidence and understanding. He noted:

Students, as they are increasingly posed with problems relating to themselves in the world, will feel increasingly challenged and obliged to that challenge. Because, they apprehend the challenge as interrelated to other problems within a total context, not as a theoretical question, the resulting comprehension tends to be increasingly critical and thus constantly less alienated. Their purpose to the challenge evokes new challenges, followed by new understandings; and gradually the students come to regard themselves as committed.

Research also shows that problem-solving can be taught at different levels of education. That is, problem-solving is not an advanced process that is reserved solely for adult learners. Indeed, people of all ages can and must be problem solvers.

It is widely agreed that primary education is a basis for further education or higher levels. To this end, all the activities made at this level have a direct and indirect impact on other levels of education and learner's life in the long run. This level of education entails students to build their problem-solving capacity. However, albeit widely held view on the fundamental value of problem-solving ability to students' life (Wilson et al., 1993), its implementation in the classrooms is challenging for teachers. Problem-solving demands best qualification of an extensive knowledge of the field of study and a good know-how of the pedagogical principles (Stones, 1994). According to Stones, the challenge for teachers is the delivery of the lessons in appropriate, attractive and thought provoking manner. In explaining the challenge of employing problem-solving by teachers, Stones (1994, p. 169) adds "Since each lesson is unique there is no question of using the notes from last year unless the teacher wishes to join the ranks of the partly living and not of the living teacher. Thus in every lesson the teacher will need to apply basic pedagogical principles in novel conditions".

Cognizant of the need of having competent teachers in accordance with the education policy, the MoE states that one of the general objective of teacher education in Ethiopia is "to prepare teachers who can confidently promote active learning and the development of problem-solving skills through a learner centered approach using a curriculum where content and methods are integrated" (MoE, 2003, p. 5). Unless teachers are well acquainted with contemporary theories of problem-solving, learning theories and the new changes in professional standards, it is unlikely that teachers promote the development of problem-solving capacity of students. With this in mind, since the introduction of the new education policy in 1994, the government of Ethiopia has been attempting to improve the quality of education at all levels despite gloomy views held by people on the streets and researchers on its viability and effectiveness (Tekeste, 1996; Seyoum, 1996).

Large scale reforms on upgrading the qualifications of teachers, short term training courses, and school improvement interventions have been mushrooming in the last decade. The success of attaining these reforms primarily depends up on what happens in the teaching learning process which in turn relies on the teachers' teaching conceptions and practices.

Teachers' conceptions of the teaching learning process in general and their conception about enhancing problem-solving skills in particular are critical. Along with this, Lam and Kember (2004) assert the conceptions teachers held are significant factors in influencing on how they teach their students. This study was then intended to examine teachers' conceptions and perceived practices of problem-solving as instructional strategy.

Literature Review

Problem-solving as an Instructional Strategy

As the definition of problem-solving depends on our conception of what problems are, an overview of the concept problem is crucial. Taking various definitions of a problem, Hoosain (n.d., p. 6) states a problem as "a task or experience which is being encountered by the individual for the very first time and, therefore, there is no known procedure for handling it." To Hoosain, the process of working towards solutions by the individual encountered the problem is problem-solving which involves trying out diverse solutions idiosyncratic to individuals. Hoosain is cautious about offering due attention to the process and not to the answer in the process of problem-solving. This scholar also contends, "a problem is relative to the individual; what may constitute a problem for one person may not be a problem for another because s/he might have encountered it before." On the other hand, Brownell (1946, cited in Hoosain, n.d. p. 5) explains, "A problem is not necessarily solved because the correct answer has been made. A problem is not truly solved unless the learner understands what he has solved unless the learner understands what he has done and knows why his actions were appropriate." Here, the process of problem-solving integrates understanding of the subject matter, procedures involved in the course of action, and the justifications for using the procedures in the process.

Recognizing problems as curriculum frameworks, Akalewold (2005, p. 91) states "solving a problem is an active process of trying to change the original state of a situation into a desired state. Hence, understanding the processes and knowledge involved in problem-solving has a practical importance for educational decision and training programs." To Akalewold, if these happen in the teaching and learning process, problems and problem-solving processes emerge to be the frameworks for curricular and instructional methodologies. Hence, problems could be considered as fundamental medium for problem-solving (Akalewold, 2005). However, in order for these problems to serve as basic media, they need to be well stated and offer students challenges so that students could learn how to transfer and confront new problems. Krutink and Rudnick (1987, as cited in Akalewold, 2005, p. 91), coined good problems to incorporate solution that involve 'understanding of a distinct concept or the use skill and it can be generalized or extended to a variety of situations.' They further explained problem as distinct from questions and exercises and as it requires thought and synthesis of previously learned knowledge to solve.

In his analysis of the various concepts related to problem-solving, Akalewold (2005) concludes the authenticity and meaningfulness of problem situation in providing students an

opportunity to link them with investigation and inquiry should be given credence. Newell and Simon (1972, as cited in Nickols, 2004, p.12) writes, "A person is confronted with a problem when he wants something and does not know immediately what series of actions he can perform to get it." In brief, what makes a problem a problem is uncertainty regarding action, having a goal, and not knowing how to achieve it. However, because of relativity of problems, McIntosh and Jarrett (2000) notes tasks should be carefully chosen so that they are at the correct level of difficulty for the students. Thus, problems are needed to be hard enough to present a challenge without being so difficult to be a total mystery.

Echoing this, Becker and Shimada (1997 as cited in McIntosh and Jarrett, 2000, p. 5) states 'Genuine problem-solving requires a problem that is just beyond the student's skill level so that she will not automatically know which solution method to use. The problem should be nonroutine, in that the student perceives the problem as challenging and unfamiliar, yet not insurmountable.'

In view of these explanations of a problem, it can be concluded that an individual's ability to explore and effectively use his/her understanding is essential. Thus, a teacher who uses problem-solving as a method is required to emphasize on developing students' thinking skills by focusing on teaching concepts rather than mere facts. This in turn requires teachers' unwavering commitment to use active learning methods in order to create opportunities for students' reflection and construction of knowledge.

Explaining that problem-solving is an important cognitive activity and relating problem-solving with the problem of our daily life, Bhutani, Ramachandran, Beena and Sen (1999, p.131) state, "In our everyday life we are mostly engaged in solving one or the other problem. Whenever we want to reach a certain goal and that goal is not readily available, we use problem-solving". In this regard, problem-solving involves situations which block the successful completion of a task. According to these scholars, a problem arises when a person tends to move from a given state or situation to a goal state without a direct way of getting there; hence, problem-solving is the process of moving from the given state to the goal state of a problem. To accomplish this task, the individual is expected to overtake several aspects of the problem which include: original state, goal state and rules. The original state is a situation at the beginning when we encounter the problem. The goal state refers to the situation which is reached when the problem is solved and rules are those procedural details which must be followed or taken into account while proceeding from original state to goal state. Similarly, Rusbult (2001, p.5) conceptualizes a problem as "any situation where you have an opportunity to make a difference, to make things better; and problem-solving is converting an actual current situation (the NOW-state) into a desired future situation (the GOAL-state). Whenever you are thinking creatively and critically about ways to increase the quality of life (or avoid a decrease in quality), you are actively involved in problem-solving." To Rusbult (2001), when a student is motivated, perhaps inspired by an effective teacher, s/he can adopt a problem-solving method to personal education by imagining the benefits of

improved personal knowledge and skill in the future, and being motivated to pursue this goal of self-improvement.

Collins (1992, as cited in Dawit, 2007) also defines problem-solving as a process of reducing or closing a perceived problem gap involving the transformation of partial form of knowledge into a full form. In a similar vein, Polya (1945, as cited in McIntosh and Jarrett, 2000) sees problem-solving as an act of discovery and has introduced the term “modern heuristics” (the art of inquiry and discovery) to describe the abilities needed to successfully investigate new problems. He encourages presenting mathematics not as a finished set of facts and rules, but as an experimental and inductive science. Hence, though problem-solving means many things to many people, many scholars agree that higher level thinking skills are involved, for some it includes an attitude or predisposition toward inquiry as well as the actual processes by which individuals attempt to gain knowledge. Usually, when teachers discuss problem-solving on the part of pupils, they anticipate pupils will become involved in the thinking operations of analysis, synthesis, and evaluation (Patricia, 1988).

Similarly Newmann (1992, p.106) states:

Higher order thinking occurs whenever students respond to nonroutine intellectual challenges. That is, when they are exposed to situations that engage them in interpretation, analysis, or manipulation of information to answer a question. In short, students must be faced with the challenge of how to use prior knowledge to gain new knowledge, rather than in a task that merely ask them to retrieve prior knowledge to meet the challenges successfully.

These definitions, when related to the classroom, imply that the teacher should explore the students’ previous knowledge and provide thought provoking problems to make students engage with higher order thinking in addition to identifying problems that hampered their effort to come up with solutions.

Problem-solving as an instructional strategy is defined by Polya (1945, as cited in McIntosh and Jarrett, 2000) as consisting of four phases: understanding the problem, devising a plan, carrying out the plan, and looking back. This definition is comprehensive in that it encompasses the vital element-looking back phase, which involves evaluating, and interpreting methods and results. The looking back phase includes activities such as verifying the result, checking for alternative methods of solution, determining the validity of an argument, applying the result or solution to other problems, interpreting the result, generalizing the solution, and generating new problems to be solved. This phase considered as essential part of teaching problem-solving as it provides students the chance to learn about problem-solving processes and how a problem is related to other problems (McIntosh & Jarrett, 2000). In addition, it involves development of self-awareness and reflection which are critical for improving problem-solving ability.

DeLuca (1991) describes problem-solving as a process of resolving a known difficulty. Anderson (1980, as cited in DeLuca, 1991) emphasizes the processes undertaken during the act of problem-solving by defining this behavior as goal directed sequence of operations-an organized sequence of mental steps. Good (1972, as cited in Azeb, 1995) explains it as a process employed by all people at all levels of maturity of discovering new relationships among things observed or sensed. The process includes conscious or subconscious assumption, or hypothesis, of a possible relationship within a simple or complex system of thought and understanding and means to test through experience the acceptability of the assumption (Azeb, 1995).

In line with this, Stanic and Kilpatrick (1989 as cited in McIntosh and Jarrett, 2000) identified three general themes that make problem-solving more comprehensive in its characteristics and roles. These are: problem-solving as context, problem-solving as skill, and problem-solving as art. Though the intention of their classification was entirely referring to mathematics, these roles go in line with the aforementioned definitions and can be applicable in all subjects as far as problem-solving is concerned. The authors divide problem-solving as a context for doing the problems into several subcategories. It can be used as justification for teaching to give rationale of the topic or make the concept more concrete relating it to the experience of students (when the teacher needs to strengthen skills and concepts that have been taught directly), to persuade students value the subject they are taught and its relation to real-world problem-solving experiences and to arouse motivation and interest of students' in a specific topic. To these educators, when problem-solving is used as context, due emphasis is given to finding interesting and engaging tasks or problems that help to clarify the subjects' concept or procedure.

McIntosh and Jarrett (2000) have tried to clarify how context plays a great role in problem-solving by providing an experience of a math teacher who needs to teach about fractions. A teacher might present the concept of fractions, for example, assigning groups of students, the problem of dividing two pieces of licorice so that each gets an equal share. In doing so, the teacher creates opportunities for students to make discoveries about the concepts using a familiar and desirable medium (motivation), helps them make the concepts more concrete (practice), and gives basis for learning about the concepts (justification). Worth considering in the process of problem-solving is also the pre-requisite knowledge-creating the required schemata needed by the students to understand the problem and specification of what to do at each stage of problem-solving.

On the other hand, when we see the role of problem-solving as a skill, it will have a separate topic in the curriculum, rather than throughout as a means for developing conceptual understanding and basic skills. They teach students a set of general procedures (or rules of thumb) for solving problems such as drawing a picture, working backwards, or making a list and giving them practice in using these procedures to solve routine problems (McIntosh & Jarrett, 2000). When problem-solving is viewed as a collection of skills, however, the skills are often placed in a hierarchy in which students are expected to first master the ability to

solve routine problems before attempting nonroutine problems. Thus, problem-solving when viewed as a skill integrates both teaching problem-solving as a separate skill and infusing problem-solving throughout the curriculum to develop conceptual understanding as well as basic skills.

After reviewing various studies on problem-solving, Suydam (1987, as cited in Wilson et al., 1993, p. 9) concludes, 'If problem solving is treated as "apply the procedure," then the students try to follow the rules in subsequent problems. If you teach problem solving as a method, where you must think and can apply anything that works, then students are likely to be less rigid.'

This conclusion goes in line with those writers who contend that problem-solving can also be viewed as art. For example, McIntosh and Jarrett (2000, p. 8) state that the aim of teaching problem-solving as art is, "to develop students' abilities to become skillful and enthusiastic problem solvers, to be independent thinkers who are capable of dealing with open-ended, ill-defined problems." Similarly, the value component of problem-solving education aims at developing a good attitude towards problem-solving and enhances their reasoning ability (McIntosh and Jarrett, 2000).

In sum, it can be said that problem-solving is higher order thinking and involves diverse thinking processes ranging from simple awareness to creative thinking of students. In addition, students have an opportunity to look for and examine what they have found out.

Roles of Students and Teachers in Problem-solving Classroom

Teachers play an important role in developing students' problem-solving dispositions. They must choose problems that engage students. They need to create an environment that encourages students to explore, take risks, share failures and successes, and question one another. In such supportive environments, students develop the confidence they need to explore problems and the ability to make adjustments in their problem-solving strategies (National Council of Teachers of Mathematics, 2004). As an active learning methodology, problem-solving method, both students and teachers roles are vital though they may vary on the type of the problem carried out in classrooms. For instance, in the open-ended problem-solving as the problem will have multiple possible answers that can be derived by multiple solution methods and as the focus is not on the answer to the problem, rather on the methods for arriving at an answer the role of the teacher and the student are many and have various tasks (McIntosh & Jarrett, 2000).

Various scholars have identified various roles of the student in a problem-solving classroom. For instance, McIntosh and Jarrett (2000, p.5) put the diverse roles of the student when the problem is open-ended as:

To decide which method, or procedure, to undertake to solve an open-ended problem, a student will draw on her previous knowledge and experience with

related problems. She might construct her own procedure, trying this and that, before arriving at a solution. She will then reflect on and explain to others her problem-solving experience, tracing her thinking process and reviewing the strategies she attempted, determining why some worked and others didn't.

To McIntosh and Jarrett, the way the student reflects ideas and the entire thinking process towards the problem depends on the understanding of the problem. On the other hand, one of the teacher's typical responsibilities is selecting and providing the students with "good" problem activities that enable him/her to create suitable learning environment and engage students in meaningful problem-solving (McIntosh & Jarrett, 2000). These scholars further elaborated the specific tasks of the teacher in a problem-solving classroom. These include:

- Be open-ended, in that it presents multiple solution methods and answers
- Address important concepts
- Challenge and interest students
- Connect to students' previous learning

The teachers involved in teaching problem-solving have also the responsibility to create conducive classroom climate for students learning. As many writers try to indicate teachers have roles which are instrumental for students to promote their thinking ability. Hiebert et al. (1997) argues that the teacher in a problem-solving classroom should focus on selecting and sequencing appropriate problems, sharing information, and enhancing classroom culture in which students work on novel problems. They mentioned that the teacher should refrain from acting as source of information and from being primary evaluator of correctness. In so doing, the teacher can initiate students to engage in reflection and real problem-solving activities.

As the teacher and students' role in the classroom invariably influence each other, the teachers' intervention without interfering students' when they construct their own knowledge and understanding will always be an aspect of teaching, especially when using problem-solving method (McIntosh & Jarrett, 2000). Thus, teachers' way of intervention to stimulate and push students' thinking forward and promote students' autonomy should revolve around the following among others:

- Selecting tasks with goals in mind (knowledge of the subject taught and understanding of students' thinking are essential to selecting appropriate tasks)
- Providing relevant information
- Guiding the development of classroom culture (McIntosh & Jarrett, 2000).

Kilpatrick (2001, as cited in Chapman, 2005, p. 225) explained '...problem-solving ability is enhanced when students have opportunities to solve problems themselves and to see problems being solved. Further, problem-solving can provide the site for learning new concepts and for practicing learned skills.'

In problem-solving classrooms, students are expected to exhibit commitment to make argument and bring evidence rather than emotions and surface meanings. Stacey (1990, as cited in McIntosh and Jarrett, 2000) contended that good problem solvers need to be resourceful, flexible, confident and willing to explore. They also must learn persistence and ability to tolerate a certain amount of frustration. To develop these abilities, students need to experience frustration and exhilaration of struggling with and overcoming a daunting intellectual obstacle (McIntosh & Jarrett, 2000; Azeb, 1995).

Many researchers in the area of problem-solving consistently stress that students should grapple with challenging and unfamiliar problems and hence teachers have to have the necessary skills in selecting 'good' problems (McIntosh & Jarrett, 2000; Schoenfeld, 1985, Hiebert et al., 1997). Choosing good problems is a key to effective problem-solving instruction, but teachers are often confused about what constitutes a good problem (McIntosh & Jarrett, 2000).

Ragan (1963, as cited in Azeb, 1995) is cautious about the roles teachers play in creating exciting experience on students in their efforts to discover and search for answers. It was claimed that teachers should make students use powers of observation and thinking that can have a sense of satisfaction. For this reason, this scholar advises teachers to create the habit of hypothesizing, searching for evidence and evaluating evidence, and the ability of generalizing and discovering truth on students so that they can change or modify their prior conceptions.

From the foregoing discussions, it can be said that there are specific roles of teachers and students in problem-solving classrooms. It was attested by many scholars that the role of the teacher is very essential in creating conducive environment for students and providing them with possible challenges.

Statement of the Problem

As mentioned above, the Education and Training Policy of Ethiopia pays due attention to the development of problem-solving capacity and culture in the content of education, curriculum structure, and approach (MoE, 1994). The policy seems specific at indicating the level at which the development of problem-solving could be realized among others. One of the major objectives of the policy article 2.1.1 states "develop the physical and mental potential and the problem-solving capacity of individuals by expanding education and in particular by providing basic education for all" (MoE, 1994, p.7). However, though inclusion of problem-solving is repeatedly expressed as vital element in the policy, some argue that there are no chains to realize this lofty goal of the policy into practice. For instance, Akalewold (2005, p. 1) argued that "though current education and training policy advocates problem-solving method in secondary school curriculum, no subsequent document is available to translate experiences into a material that develops such skills."

Existing evidence on how such aims of the policy are translated into the school level appears to be limited. Only few studies have been conducted on the adequacy of curricular materials

to foster problem-solving capacity and implementation of problem-solving as instructional strategy in schools. For instance, Bogale (1983), Mequanint (1992), Solomon (2001), and Akalewold (2001), all cited in Akalewold (2005), are concerned whether the activities in textbooks help students foster problem-solving ability. These scholars concluded the existence of difficulty of transferring problem-solving skills into students' real life situations. Dawit (2007) also scrutinized the evolution of policy aims into curricular materials in second cycle primary school. He concluded textbooks were poorly aligned with curricula requirements for developing problem-solving capacity. All these studies concluded that students had limited opportunity to develop their problem-solving capacity. Dawit (2001) and Tilaye (2001) also explored teachers' and students' views on the impacts of the newly implemented curricula and the general progress in the implementation of problem-solving method in the primary schools respectively. The results indicated the existence of problems on the conceptualization of new demands on teachers' roles to implement newly designed textbooks and the implementation of problem-solving method in classrooms respectively.

Neither the aforementioned studies nor other studies have addressed teachers' conceptions of problem-solving in Ethiopia albeit presence of firm evidence that classroom practices and teachers' conceptions are vital in determining the success of educational reforms (Fullan, 1993; Fullan & Hargreaves, 1991). Research indicates that teachers bring a range of their conceptions about teaching to their classroom practices (Buchanan, 1987; Kesler, 1985; Thompson, 1982; Karaagac & Threlfall, 2004; Lam & Kember, 2004). These conceptions are perhaps the most important factors teachers face while teaching. Thus, it is of paramount importance to understand how teachers conceive and practice problem-solving method. The absence of evidence on this issue initiated this research. To do so, the following questions were forwarded:

- How do teachers conceptualize problem-solving as instructional method?
- How do teachers describe their own and their students' roles in problem-solving method?
- How do teachers describe their perceived practices of problem-solving method in classrooms?

Accounts of the research can benefit other teachers and students for the reason that the descriptions and themes could serve as important sources of information to support teachers in the effort towards helping teachers get acquainted with pertinent teaching and learning methods. In addition, it will provide concerned bodies interested in primary school curriculum with relevant information on the status of problem-solving method in the selected schools. Though the research has no aim of generalization, it will also contribute to the understanding of teachers' conceptions and perceived practices of the method.

Methodology

The design of this study is qualitative. The setting for this study was made to be in two selected primary schools situated in Bahir Dar city. Purposive sampling was employed to select participants who have experience in using problem-solving method. In line with Creswell's (1998) recommendation, a maximum of ten participants were selected. Detailed interview was made with the participants. In addition, open-ended questionnaire was used to elicit additional information. In-depth interview was made to collect data on teachers' conceptions and their perceived classroom practices of problem-solving method. The interview, semi-structured, was made in Amharic, and was audio recorded. In order to get additional information skipped during interview, the researcher also gave an opportunity to participants to freely write their experiences.

To maintain credibility of the instruments, the researcher made an effort confirming whether the guiding interview questions would answer the leading questions proposed or not. Consequently, the interview guide items which were 21 at the beginning were merged to 12 items, and some were taken out after a discussion had been made with experts. Moreover, the transcribed data was checked with the translated text to enhance credibility of the data. The researcher also attempted to create smooth relation with participants including making them know the purpose of the research. Confidentiality was also kept through the use of pseudonyms in the research reporting, and the participants were informed in advance to enhance the credibility of the data. In addition, to maintain dependability and conformability, English version of the data attached with the transcribed data was checked by people who have specialization in language, in addition to close and critical review by the researcher and other expert colleagues.

After coding the data, analysis was made using themes developed from the thick descriptions emerged. Three themes were developed in line with the research questions. Based on the themes, categories were developed for teachers' conceptions about problem-solving method. In so doing, it appeared that a single participant could have response sets that can fall to different categories. Research on teachers' conceptions and practices also indicate that teachers could have mixed conceptions on teaching (Simmons et al., 1999). So, the categories developed for each theme are not meant for showing explicit conceptions of individual teachers rather they show the diverse conceptions teachers have about problem-solving. Each category was supported by using excerpts emerged from the detailed interview and open-ended questionnaire.

Results

Three themes were identified for the purpose of analysis. These are teachers' conceptions about problem-solving, teachers' conceptions about their own and their students' roles in problem-solving classroom, and teachers' perceived practices of problem-solving method. Categories were built based on the collected data for the first theme and the second and third themes were analyzed as they are (without developing further category). Under the first

theme, teachers' conceptions of problem-solving method, three categories were developed: teachers' conceptions of equating problem-solving with use and production of teaching materials, with group discussion and as a mechanism alleviate students' academic and disciplinary problems.

Teachers' Conceptions of problem-solving Method

Conception of teachers with regard to nature and characteristics of problem-solving method was connected to different meanings that show a wide range of conceptual disparities. Often some participants equated the concept narrowly with solving students' daily problems. Following are the discussions regarding participants' conception of problem-solving.

Equating Problem-solving with Use and Production of Teaching Material

Some respondents described and equated problem-solving method with teaching materials to support classroom instruction. For instance, Netsanet, in indicating how problem-solving is distinct from other methods, stated:

... I will put each activity to be performed in class with my students. They will do projects, prepare maps, etc. Besides, I indicate the teaching aid to be used. And, my students are engaged in producing teaching aids when I use the method. The time my students produce this materials, they get an opportunity to solve their problems by themselves.

Associated with this, Hirut shared the above view and said:

...The reason that made students participation a reality is the teacher should always link the method with teaching aids. If you do not do this, one cannot call it problem-solving.

Another participant, Simon, in answering the question, "What were your duties in the classroom in fostering problem-solving ability of students?" related students' involvement in producing teaching materials similar to the above view.

As the very nature of problem-solving is the preparation of teaching materials, I ordered students to prepare an appropriate teaching material that suits their topic of presentation and I help students relate their lessons with the teaching materials they produced. I also create an opportunity for students to present what they have discussed.

He also reaffirmed congruence of his connection of problem-solving method with teaching materials.

..., if there are situations where teaching aids are not available, even though the topic entails employment of problem-solving method, I simply use other methods.

In particular, Netsanet's repetition of the phrase "production of teaching materials" throughout the interview would seem to indicate that she connected problem-solving method to involvement of students in producing teaching materials. Underlying the claims offered by another participant too, she concluded the presence of strong alliance between problem-solving and teaching aids. She posited to the impossibility of using problem-solving method without teaching materials. On the other hand, Netsanet's view of equating problem-solving method with students' engagement in the production of teaching materials illustrates her understanding and use of problem-solving with use and production of teaching materials. In expressing her view about the subjects that suit to use of problem-solving (as she has been teaching math, geography and civics), Netsanet opted geography as suitable compared to the other subjects where her reasons seem to strengthen the above views.

Relatively, I feel comfortable with geography because the subject invites to do something practically; next, math is also good, I can make students produce mathematical figures. But, the problem is while I teach civics as students discuss only ideas.

She continues to say,

In Geography, I select contents which enable to use their experiences and to do some practical activities or task where I mostly focus on contents that require the use of maps, graphs, charts, etc.

Netsanet also reflected her connection of problem-solving method to production of teaching materials, when she reflected her use of problem-solving method in class.

Since teaching materials incur cost, I used to order students to prepare maps, globes, etc by themselves. Students simply use thrown papers that have no cost; they prepare different designs like globes with minimum cost and effort. This by itself is problem-solving for it is produced cost efficiently from materials in their environment.

Another respondent, Mesfin, took the above position partly though he reflected confusions in his conception of problem-solving method. This was observed when he reflected how he was applying problem-solving method taking specific math content. He said,

Well, the teacher should decide whether the content demands teaching materials and goes in consistence with the annual plan.

These reflections of teachers show their tendency to equate problem-solving method with use and production of teaching materials. In the participant's view, teaching materials were placed as preconditions whether to use problem-solving method or not. However, these conceptions of problem-solving method are not only wrong but they are also misleading in practicing it. Teachers' general tendency is inclined and limited towards use of problem-solving method in the presence of teaching materials and engagement of their students in the production of materials.

Equating Problem-solving with Discussion Method

As it has been discussed, problem-solving method is one of the student centered methods with its own distinct techniques and strategies that give students an opportunity to be actively involved in their learning. For instance, one of the participants, Hirut, conceptualized problem-solving method as:

Problem-solving method is used at all times because the classroom environment is student centered all the time. There is always question and answer and then students are grouped to discuss on the identified topics/questions written on the blackboard. I will let the students discuss for about 20 minutes and the students will report to all students.

Though the use of same method to teach different contents all time appears to be unrealistic, Hirut seems to believe that because she employed questions and answers in her classroom, problem-solving teaching method is employed.

Another participant, Asrat, asked about the roles he has in problem-solving classroom, appeared to equate problem-solving method with discussion method or group work. This was reflected when he stated:

Well, in the previous times, the lecture method was largely used. But now there are plenty of methods like group discussion.... I used this method to improve students' performance and problem-solving method is all about using such methods.

Tsehaye described how he was implementing problem-solving method in his classrooms as follows:

...I form groups for discussion and I give them a problem to discuss and solve. At last, the leader or secretary will present what has been discussed to the class. At this time, the student will develop his speaking skill and confidence. Thus, everyone will understand the issue.

Another participant, Simon, reflected his conception of using problem-solving method. His explanation on what the method implies in classrooms remains very much aligned with group discussion rather than proper problem-solving. When asked "how were you utilizing problem-solving method in teaching Physics?", Simon indicated:

...I taught in classes where the number of students is large. So I have been using the lecture method. But now I have changed the method. First I will assign students in groups and then ordered them to be prepared on the exercises given on the texts. Finally, the students will be made to present their solutions via their representative. Questions unanswered by the students will be discussed together; finally, I will provide brief summary of the students' presentations.

Legesse's view of teaching through problem-solving is also similar to Tsehaye and Simon's use of the method. He described his experience of the method as follows:

In teaching by problem-solving method, students are made to sit in a group having six members and the groups will be provided with issues for discussion and they will then report via their group presenter.

However, Legesse did not indicate any technique or strategy, which in fact is the problem of all the participants, in his use of the method. In Legesse's utilization of the method, students were made to solve the problems in the absence of procedural steps.

Equating Problem-solving with Solving Students' Social Problems

The response below can be examples that show participants' congruence of problem-solving with solving students' day-to-day problems. Tsehaye states that he chooses problem-solving method over other methods to deal with real problems of students. Asked about what he meant by "real problems", he replied:

... For example, some students drop out from school... therefore, to solve this problem a teacher has to select and decide a teaching method that will enable him to clearly identify the reasons for the problem. The appropriate method for this is problem-solving.

Though providing students with demanding problems enables students to promote their understanding, Tsehaye tends to narrowly consider application of problem-solving method with problems students face in classroom or social life, in this case the dropout of students.

Another participant, Legesse, described problem-solving method as:

Problem-solving method could be many things. First it is solving the students' problems when they are faced with problems. Secondly, it is making those students who are lagging behind to cope with the outstanding ones. In general, it is the method that needs commitment of teachers to support those students who are poor in their achievement through tutorials and other ways.

Legesse consistently held that problem-solving method has to be conducted by grouping students. Asked to elaborate the distinction of the method with group discussion, he said,

... in problem-solving students are mixed based on their ability and made to discuss together so that the slow learners could be helped by those who are very active. So this makes problem-solving method unique.

This conception of the teacher in problem-solving was also manifested when he replied to the questions "How were you planning when you need to use problem-solving method? What makes it particular from other methods?" Legesse summarized his practice of planning and uniqueness of the method as follows,

The plans are the same whenever I am using student centered methods but what makes it special in problem-solving is the students who are poor in their performance are made to get support unlike to the fast learners. In addition, in this method, I identify these students and tutor them at weekends so as to minimize the pressures of the faster ones. Hence, to me, problem-solving plans are not different. However, problem-solving planning relies on the effort of the teacher in providing students with supplementary classes such as tutorials.

Here Legesse's explanation of the method is a manifestation of his misconception. These responses tend to indicate that problem-solving is related to teachers' interventions to alleviate social problems students face in schools. In view of these, the participants seem to believe that the provision of tutorial classes and the application of group work in classrooms help to solve students' problems.

Teachers Conceptualizations of their own and their Students' Roles in Problem-solving Classroom

The teachers involved in teaching problem-solving have many responsibilities. Considering these roles, teachers were asked to reflect on their own and their students' roles in problem-solving classrooms.

Asked about the roles his students had when using problem-solving method, Asrat expressed:

The students' major job is to do the activities given by the teacher, for example if there is a group work, students will discuss on issues and come up with an agreed upon idea and solution. After that, the teacher gives correction and assistance to get into to the answer. So, it is the student who does most of the activities in the classroom.

Asrat's conceptions of the roles students have in problem-solving seems partly true though their roles are limited to discussing the issue provided and offering answers to the questions. Nevertheless, the correction of students' mistakes seems to be made entirely by him. Another participant, Hirut, reflected her role as follows:

The teacher should be punctual, planned, collaborative in solving students' problems with other teachers, parents, etc. The teacher should be diligent and should not feel fatigue in solving students' challenges. It is the person who can create difference even faced with lack of resources. In addition, when students are on a project work, the teacher should control whether they have been using the materials properly, and monitor their work etc but as compared to the other teacher centered methods, problem-solving method gives the chance to have ample time for rest.

Though some of the descriptions appear to be consistent with teachers' roles in problem-solving, some of them have very little to do with implementing problem-solving. In fact, punctuality, preparation of teaching materials, diligence, and planning are not as such special

attributes of problem-solving. As it has been the case in the conceptualization of problem-solving method, teachers' characterization of roles of teachers in problem-solving appears to be dominated by concepts and roles which have very little to do with teachers' expected roles in problem-solving method.

Strengthening this argument, Legesse described his experience in problem-solving classroom as:

My role as a teacher includes informing students what should they perform when I am not available, orienting group members what to do in group discussion, and how to help the slow learners.

Another participant appears to have better conceptualization of the roles expected from teachers and students. For example, Netsanet stated:

the role of teacher should be to totally involve students, make them participate and do by themselves; besides, facilitating and following-up and then if necessary giving some clarifications about unclear issues.

It seems that she gives due attention to the process of learning in her problem-solving classroom and she seems to have a good conception of the roles she and her students have.

On the other hand, Mesfin stated,

I do have many roles as problem-solving teacher. First, I will handle the classroom in a proper way. Second, I facilitate students' discussion and help them minimize the obstacles they confront. For instance, supporting with materials, helping them get support from different organizations, etc.

In problem-solving method both students' and teachers' roles are crucial though it varies on the type of the problem used in classrooms. Nonetheless, though almost all the participants agreed the student to be the center of learning, they were not able to denote each role of the students at different stages of problem-solving method. Their understanding of the roles students have appears to be superficial that reveals their failure to understand the quintessence of problem-solving as instructional method.

Teachers Reflections of their Perceived Practices of Problem-solving Method

Now let us see how teachers perceived their practice of problem-solving in their effort towards fostering problem-solving behavior of students. The aim of this section is to assess use of the method as perceived by participants. In so doing, teachers were asked to use cases to describe their classroom practices. To begin with, Hirut, asked to explain her practice of problem-solving method in the classroom from her experience, reflected:

In problem-solving classroom, I am not expected to show them a kind of sketch rather I will tell students what to do because they should not be reliant on me and when they are engaged in work, the teacher should monitor the students. For instance, when the topic is about how to use the geographical instruments, I should let students bring the materials from the center and use them by themselves but when the students are committing mistakes, I should correct their errors. Otherwise, everything is performed by the students. The distinct characteristic of problem-solving classroom is the engagement of the teacher and the students in question and answer.

Another participant, Asrat, a science teacher, was asked to solicit his practice taking a specific content. He said,

Let me take one title-*characteristics of bees*. I ask students questions like what Do you know what a bee is? Have you ever seen a bee in your surrounding environment? Questions like these will be raised for the students. The students work will be to answer the types of bees, how they reproduce, and the advantages of bees. Then I will tell them about the reproduction system of bees.

Elaborating the use of his method in other contents, in addition to the above example, Asrat added:

...if the topic of my teaching is *animal reproduction systems*, students will describe the importance of reproduction, they will list and explain the types of reproduction, explain about the reproduction system and life cycle of different insects, they will do tasks like this.

As can be observed from the reflections of the experiences of the participant in using problem-solving method, it can be said that he was unable to employ the techniques and strategies of the method. His improper practice of the method was also seen in his provision and framing of the questions, of which most can be categorized as lower levels cognitive outcomes, which have little use to enhance students' higher ordered thinking skills. As can be seen from the reflections, making students involve in group discussion and promoting their full participation are taken as use of problem-solving method.

Legesse's experience of using the method reads:

When I teach my students about Amhara region, first I will make my students know the region that we are living in is Amhara. Next, I will tell them the number of zones, woredas, kebeles, etc listing from the top to the bottom. Having made students know all these things, I will show them the map for Amhara region. In this way, I can say I am using problem-solving method.

It is very obvious to understand the conception of Legesse with which he associated the method to simply informing students about the topic. Mesfin's utilization of the method also reads,

I first introduce students what they will learn. I start by revising the main ideas of the previous lesson by asking and involving the students themselves. I will introduce them with the new topic and identify and provide issues for discussion and inform them arrive at a specified solution. Then the students will be made to report to the class through their group presenters.

The experience of another participant in reflecting his practice is put as follows:

Well, there may be problems students are/are not aware. So, when we say solving a problem like overpopulation, you will ask students to state the problem, elaborate it in their own experiences. For example a student may say when I was kid, we were two and we eat one bread together and sleep in a single bed. But, now, we are four, we eat one bread together; some of us sleep on the ground. So, this is a practical experience. Based on their background, you will ask them the cause for this and its solution so that they will be able to integrate their experiences in the lesson.

This reflection appeared to encourage students to draw their experiences along with the topics and tried to help students recognize their practical experiences which may offer students opportunities to share their experiences and engage in exploratory thinking. Unlike the reflections made by other teachers, this teacher seems to include some of the strategies of problem-solving method in his practice.

Discussion

Recognizing conception of teachers as one of the significant challenges in the area of teacher education, this study examined teachers' problem-solving conceptions and their perceived classroom practices. The study tried to address issues such as problem-solving conception of teachers, their conceptions about their and their students' roles in classrooms and their perceived practice in utilizing the method.

In this study, it was revealed that teachers' conception has an effect on their practices as their conception of the method and their perceived instructional practices in classrooms were found consistent. Previous studies have also affirmed that conception of teachers was instrumental in shaping their practices. For instance, it was pointed out by many educators that the conceptions teachers have about their instruction have a direct influence on their instructional practices (Warfield, Wood & Lehman, 2005; Pajares, 1992; Cronin-Jones, 1991; Pearson, 1985; Thompson, 1984).

With regard to the nature and characteristics of problem-solving method, teachers connected the method to different issues that show a wide range of disparities. Often some of the participants narrowly equated the concept of problem-solving with solving students' daily problems.

In addition, teachers were seen equating problem-solving method with use and production of teaching materials, group discussion method and as a mechanism to alleviate students' social

problems. In the participant's view, teaching materials were seen as preconditions to use problem-solving method. Teachers' general tendency is inclined and limited towards use of problem-solving method in the presence of teaching materials and engagement of their students in its production. Such conceptions do not only seem to suggest that the role of problem-solving is conceptualized in terms of intervention mechanism to alleviate problems but also dwindle the role of teaching and learning in developing problem-solving ability of students. It was also revealed from the participants' reflection that problem-solving method was jumbled with solving all students' problems. This seems to be dominant conception as those participants who were even trying to explain some features of problem-solving method were swaying to equate problem-solving with students' disciplinary problems and punctuality. Such conceptions of problem-solving method are not only erroneous but also misleading to use it as a method in classrooms. For instance, though it is not uncommon to use several teaching methods when implementing problem-solving activities (Nickerson, Perkins, & Smith, 1985), the participants' equation of their entire use of problem-solving method with discussion method and as a coping mechanism for students' social problems asserts their misconception of the method.

It is known that the teaching methods employed in classrooms have decisive roles to develop students' behaviors to the desired goal. In this regard, problem-solving method is a student centered method with its own distinct techniques and strategies, and it gives students an opportunity to be actively involved in their learning. Teachers and students have unique roles in problem-solving method compared to other student methods. It is because teachers who use problem-solving method have diverse responsibilities such as creating conducive classroom for students' learning, challenging and arousing students interests by presenting situations that stimulate problem-solving thinking, providing generative problems, engaging students on novel problems individually and interactively, and utilizing procedures that improve students' abilities in solving problems (Azeb, 1995; McIntosh & Jarrett, 2000; Hiebert et al., 1997). Unlike such demands, reflections of perceived practices of teachers did not remain in line with these strategies. For instance, teachers reported that they were entirely correcting students' mistakes by themselves instead of providing students the opportunity to do so.

Previous studies also revealed that teachers in problem-solving classroom should create an environment that make students engage in novel situation in group or individually rather than acting as chief evaluator and source of information (Hiebert et al., 1997). As far as problem-solving method is concerned, students should get an opportunity to learn from their mistakes so that they could develop confidence and raise their engagement in learning. Consistent with this, Azeb (1995, p. 83) claimed problem-solving to involve "...the willingness to explore, to make guesses, to tryout an idea, to make mistakes, to back up from a mistake and start over again..." rather than expecting and making students find the correct answer. Nevertheless, teachers' reported roles were confined to asking questions that require students give specific answers. However, unlike to this, problem-solving entails questions that demand students to go beyond their skill levels where the problems become challenging and enable them to find

solutions to problems whenever confronted (Becker & Shimada, 1997). Likewise, Newmann (1992) contended that higher order thinking such as problem-solving occurs only when students are faced with questions or tasks that demand analysis, interpretation, or manipulation of information. In spite of these facts, little indication was made in teachers' reflection to engage students to discuss strategies for solving problems and resolving consequential disagreements among themselves. On the other hand, in their small scale study, Shannon and Zawojewski (1995) reported the difficulty of presenting problem-solving tasks without providing hints and procedural steps to students. This problem was observed from some of the participants' utilization of the method where students were made to solve problems in the absence of procedural steps. In general, teachers' perceived practices fail to integrate challenging and unfamiliar problems despite such problems are considered as integral component of problem-solving by many educators (McIntosh & Jarrett, 2000; Schoenfeld, 1985; Hiebert et al., 1997). Interestingly, teachers' conceptualization of what a problem-solving student seems to be shaped by contextual factors rather than viewing problem as a concept or idea which students have to deal with in the teaching-learning process.

From the cases reflected by teachers to describe their perceived use of problem-solving method, it was acclaimed that problem-solving cases were entirely confined to presenting students factual contents. Such contents and activities have little contribution to develop problem-solving ability of students as teachers' had propensity towards using content and questions that automatically put students in much lower thinking skills. Teachers' reflections of their perceived practices were far from encouraging students to draw their experiences along with the topics. Participants in their reflection of their perceived practices did not recognize offering opportunities to students so as to allow them share their experiences and engage in exploratory thinking. This view resonates with the ideas postulated by educators in the area of problem-solving (Hiebert et al. 1997; McIntosh & Jarrett, 2000).

On the other hand, though teachers' conceptions of problem-solving and their perceived practices appear to reveal that much remains to be done, some of the teachers' reflections seem to show their lack of proper understanding and skills of problem-solving method that might be attributed to lack of prior knowledge. Previous studies have also contended that teachers with limited knowledge of a subject matter and low competence in teaching skills face difficulties to manage problem-solving classrooms as they fail to understand different strategies (Burkhardt, 1988). Stones (1994) also affirmed that teachers who use problem-solving method may confront the biggest challenge as successful problem-solving requires extensive knowledge of the subject taught and procedures used. In fact, teachers' malpractices of the method might be attributed to such factors.

Teachers in this study were confident in expressing their use of problem-solving method though it was similar with group discussion. Teachers did not use the steps or procedures that any problem-solving method should constitute. This portrays that teachers' held conceptions should be re-conceptualized. In this regard, Cobb et al. (1990) cited in Warfield, Wood, Lehman (2005) found that teachers change their practices only when they realize that their

previous practice were problematic and only when they are provided evidences that their students had not learned. Thus, teachers need to get opportunity to revisit and revitalize their conceptions and perceived practices.

Conclusions and Implication

Conclusions

This study tried to examine teachers' problem-solving conceptions and perceived classroom practices. The analysis was classified into three themes that include teachers' conception of problem-solving, teachers' reflections of their own and their students' roles in problem-solving classroom, and teachers' reflections of their perceived practices. Under the first theme, three categories were developed.

Results showed that teachers associated the method with different issues often unrelated to problem-solving and their perceived practice was consistent with their conceptions though their conception was different from the quintessence of problem-solving as instructional strategy. Teachers confined their perceived classroom activities to discussion of factual ideas. Teachers often equated problem-solving with use and production of teaching materials and use of group discussion. They also held a belief that it is as a mechanism to improve students' disciplinary problems.

Lack of clear conception among participants resulted in variety of conceptions about a problem-solving student. In this regard, teachers' conception of a problem-solving student was found different where majority of them do not go in line with what the existing literature claims it to be. The participants were narrowly equating problem-solving with solving students' daily economic and academic problems such as dropout, disciplinary problems and supporting one's study.

In circumstances which teachers contend to have knowledge and skill to implement a certain method of teaching, in this case problem-solving, it happened that their analysis and judgment is based on the misconception that led to malpractice. This is the underlying point unveiled in the study. The participants contended that they know how to use problem-solving method and perceive that they are using problem-solving method in the classrooms. However, though what they claimed as using problem-solving method is in tune with their conception, neither their conception nor their perceived practice of the method concord with the procedures of problem-solving method.

Implication

From the selected teachers, conceptions about problem-solving method were found to be constraint in their teaching. Although it is difficult to generalize from a sample of nine teachers and is not the intent of this study, it may be important for teacher educators to re-

conceptualize their conceptions regarding the method and update their knowledge to meet the changing needs of their students, the subject they are teaching, and the pertinent pedagogical knowledge they need to have to use the method. Most educators in the area of problem-solving maintained that students do not acquire thinking skills simply by involving in problem-solving rather the activities must be implemented with careful planning to ensure attainment of the proposed outcomes. If this is to be done, it is necessary to involve teachers in discourses to challenge their conceptions. Teachers should be supported to know the method so that they could consider it as pertinent method in their professional career.

This study displayed differences among the participants in conceptualizing a problem solver student and elements of problem-solving method. Previous studies have shown that teachers' change in conception about their practices leads to changes in their instructional practices. The diverse conceptions teachers have about problem-solving student and method should necessitate a re-conceptualization of their conceptions. In this regard, their conceptions and practices should be challenged.

Furthermore, this study revealed differences among participants in conceptualizing elements of problem-solving method as they were hardly visible even when teachers claimed that they were employing problem-solving method. In order to meet diverse conceptions teachers have about problem-solving student and re-conceptualize their held conceptions of students, techniques, and strategies utilized, integrating issues of inquiry and reflection in their professional development scheme seem imperative.

Needless to mention, the study also disclosed that teachers might presume that they are practicing instructional methods without having proper know-how and conception. If so, what has been reported and viewed by teachers may at times depend on their conception and in turn if there is a problem in their conception, what is reported by teachers and what is being practiced may all be in the wrong direction. Hence, it may be worth investigating using large sample, whether some of the critical findings can be replicated under a different setting and respondents. Research that looks whether teachers' conceptions about other methods are restraining or enhancing their teaching needs closer scrutiny. In addition, how the provision of continuous professional development practices in schools are contributing in fostering problem-solving ability of students, and enhancing the teachers conceptions of methods may be considered for further study.

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