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Junior High School Teachers and Students' Attitude toward Teaching and Learning Mathematics through Problem Solving: A Case Study from Mampong Municipality

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Abstract

Purpose: Effectiveness of education depends on factors which include teachers' instructional role associated with students' learning outcomes. Teachers' attitude is an enduring system of their beliefs, feelings and actions which invariably influence students' achievement in mathematics learning. This study sought to investigate into Junior High School (JHS) mathematics teachers and students' attitudes toward teaching and learning mathematics through problem-solving instructional strategy.

Methodology: A cross – sectional exploratory survey design was employed to obtain a snapshot of what pertained in the classrooms of the selected Junior High Schools. Questionnaires for measuring teachers and students' attitude were pilot tested to ensure scale reliability. Descriptive and inferential statistics were used for the data analysis. Spearman' rank correlation was calculated to establish the nature of relationship between teachers and students' attitude, at a fixed significance level of 0.05.

Findings: It was revealed that there existed positive but weak relationship between teachers and students' attitudes toward teaching and learning mathematics through problem solving. Findings from this study were not quite different from the studies reviewed in the literature that showed that teachers' attitude influence their choice of teaching strategy and the quality of teaching students receive. Format for conducting external examination, time available for teaching topics in the syllabus, and students' entry behaviour were found to be determining factors for teachers' choice of instructional strategy. It can be inferred that though students considered problem solving instructional approach as challenging, but they do not despise its use in mathematics learning.

Recommendations: From this study, subject-based workshops or professional development sessions must be organized by District Education Office at the beginning of every term for the JHS mathematics teachers. Students must equally be encouraged by teachers through specific assignments that involve the use of problem-solving strategies. During subject-based workshops, District Education Office should provide mathematics teachers with materials that will enable them to model mathematical concepts in classroom.

Keywords: *Attitude, problem solving instructional strategy, JHS mathematics teachers, JHS 2 students*

Introduction

Many people think of mathematics as an obsolete, dull and abstract subject, but mathematics is lively and keeps improving (Schleicher & Lackman, 2011). As a matter of fact, Mathematical knowledge, skills and values are useful in private and professional life. From the time of recorded history till now, mathematics has been used for measurement of quantities, counting flocks on a farm, finding relationships between two or more quantities, interpretation of data, communication of ideas and technological advancement (Roche & Clarke, 2014). Therefore, mathematics teachers need not only content knowledge to be able to develop students' meaningful understanding of mathematical concepts, but also effective pedagogical approaches. To deliver effective instructions in mathematics, teachers need to identify what students are capable of doing by themselves and what students need to know in order to pose a problem that pushes them to think in new ways (National Council of Teachers of Mathematics, NCTM, 2010). In the view of Sullivan, Borcek, Walker, and Rennie (2016) effective mathematics instruction must include; teaching for conceptual and procedural understanding through problem solving. As suggested by Bereiter (2016), Students need to be exposed to different solution methods.

According to Sullivan et al., (2016), when a teacher demonstrates the use of a method to students and then asks students to solve another problem following the modelled strategy, the students perform exceptionally well. Although this may make the students and teacher feel good about themselves, they have not solved any problem yet. However, when there is uncertainty in a task, problem solving occurs. The difficulty in recognizing the conditions in which a strategy can be employed effectively and choosing a specific strategy from among two or more choices is the most significant barrier to success during the planning and implementation stages. In the view of Lester and Cai (2016) teaching mathematics through problem solving is clearly seen when a teacher poses word problems that are accessible but challenging to students, enables students to struggle to find solutions, and then analyze the approaches students used. Through problem-solving, students' attention is drawn to concepts and sense-making which helps them to build mathematical skills.

A study developed by Kapur (2010) has shown that learning mathematics through problem-solving is helpful. Students' conceptual understanding may be effectively expanded when they work on difficult tasks before instruction. Kegan (2009) also believes that learning that may deepen students' knowledge fund, increase their stock of skills, or extend existing cognitive structures is all dependent on effective teaching. Russo and Hopkins (2019) have argued that effective mathematical instruction should include; making concepts understandable, developing students' procedural fluency and encouraging perceptive ability by means of meaningful problem-solving techniques. Instead of having students complete a long list of exercises that require routine knowledge of arithmetic. What really is understanding in mathematics learning? As pointed out by the Council of Chief State School Officers (CCSSO), (2010) comprehension of mathematics means more than just the accumulation of knowledge or facts. It entails the ability to think and act flexibly about a topic or concept. A student's ability to articulate why a particular mathematical claim, solution, or rule makes sense. Therefore, there is the need for teachers to assign tasks that allow students to experiment with new ideas and expand their creativity.

Teachers make many decisions during classroom instructions that can either encourage or discourage an effective mathematics learning environment. Some particular teacher behaviours matter in the teaching of mathematics. For supportive classroom environment, teacher should

accept students' differing viewpoints, encourage students to think thoroughly about the problems they are solving, and demand explanation for the solution students arrive at (NCTM, 2012). Questions teachers ask must prompt students to seek out ideas about mathematics and problem solving from their colleagues and themselves. Teachers may use students' errors as learning opportunities to address students' misconceptions (Stein, Engle, Smith, & Hughes, 2008). Students should be actively involved in doing mathematics rather than watching others perform it for them or in their presence. When at all possible, students should investigate important real-world examples.

Since mathematics is one of the pre-requisite subjects for many disciplines, a minimum score of 50% in a nationally recognized examination such as the Basic Education Certificate Examination (BECE), after completion of Junior High School (JHS) is considered as minimum mathematics content knowledge (Curriculum Research and Development Division (CRDD), 2012). In order to meet this requirement, the mathematics curriculums for primary and junior high schools (JHS) clearly state that problem solving must run through the teaching of all topics in the syllabuses. Therefore, teachers are expected to use problem-solving as one of the instructional strategies for developing students' mathematical competencies and thinking (CRDD, 2012). Therefore, solving challenging problems in classroom are meant to prepare students for real-world problems they are likely to encounter.

Equally, the National Council for Curriculum and Assessment (NaCCA, 2020) has stated that learning mathematics through problem-solving will develop students' self-trust in using mathematics to examine and solve problems in school and in real-life situations. However, most JHS students give up easily whenever they encounter mathematical problems to which they have no solution method. Such practice is seen as weakness at mathematics, and it will never serve students any good in their academic progression. Problem-solving is a major part of mathematical activities which creates the situation for students to acquire knowledge and skills. In teaching through problem solving, the target is to equip students to devise means of moving from initial state to a desired state using mathematical processes and operations. Through such interactions, students get to know mathematical ideas or procedures to choose whenever solution method is not readily apparent.

Problem solving strategies abound in mathematics education literature, and they have lots of commonalities. Ronning (2008) observed that after having students solve a problem through the use of problem-solving strategy, there is the need to give students opportunity to try it out purposefully perhaps with word problems. Results from the students' activities will strengthen their problem-solving skills. One effective way a teacher can teach mathematics through problem-solving, or develop students' problem-solving skills is by dividing the class into small groups of three and assign roles for each member in a group (Lein, Jitendra & Harwell, 2020). In that sense, provisional ideas that are put forward may be refined and justified. Teacher must restrain himself/herself not to give answers, but rather ask questions, give cues or have students talk out loud to focus attention, or organize their thoughts.

Statement of the Problem

Students' acquisition of problem-solving skills in mathematics, and ability to solve unfamiliar tasks need to begin early in school. Teachers have the responsibility to equip students with the ability to think critically and devise solution plans for solving non-routine problems. When

Students are given opportunities to work non-routine and open-ended tasks rather than memorizing a single correct method for solving problems similar to what they have encountered already, their critical thinking abilities are developed. Time must be spent to demonstrate how to use heuristic approaches, some of which may be general, or explicit to the example chosen. Many authors have said that problem solving is the fundamental objective of mathematics, therefore students should not be made to spend all their time on routine activities that do not challenge their ability (Schleicher & Lackman, 2011). Problem-solving promotes the development of mathematical knowledge, and offers opportunity to use previously acquired mathematical understanding. A substantial amount of human progress can be ascribed to the ingenuity of some people who solved everyday life problems.

However, it appears many teachers are aware of benefits that can be derived from teaching through problem-solving, yet they are not using that strategy. Teaching by going through rules, follow the rules with exemplifications, and giving exercises students already have solution methods in mind is prevalent. It may happen that tasks students go through do not prompt them to extend their thinking, because within the years (2011 – 2018), WAEC Ghana chief examiner's report on BECE mathematics had consistently reported about candidates' weaknesses in areas such as representing elements in a set on the Venn diagram, solving word problems involving fractions, writing numbers in standard forms, determining the rule of mapping, poor arithmetic computation, failure to apply BODMAS as expected, inability to read values accurately from graph, observing the convention of writing money in figures up to two decimal places. These weaknesses identified with BECE candidates indent the quality of mathematics achievement amongst JHS graduates nationwide. This calls for a concern or investigation into the kind of instructional methods commonly used for teaching mathematics to students in Junior High Schools in Ghana. It is against this background that writers of this paper are investigating into JHS mathematics teachers and students' attitudes toward teaching and learning through problem solving with particular evidence from selected junior high schools in Ashanti Region.

Objectives of the Study

The study focuses primarily on Junior High School Mathematics teachers and students' attitude toward teaching and learning through problem solving. Specific objectives are to identify:

JHS mathematics teachers' attitudes toward teaching through problem solving

1. JHS students' attitude toward learning mathematics through problem solving
2. Factors that influence JHS mathematics teachers' choice of problem-solving as an instructional method

Research Questions

1. What is the attitude of JHS mathematics teachers toward problem solving as an instructional method?
2. What is the attitude of JHS students toward learning mathematics through problem solving?
3. What factors influence JHS mathematics teachers' choice of problem-solving as an instructional strategy?

Research Hypothesis

H_0: There is no significant difference between attitudes of JHS Mathematics teachers and students toward problem solving as an instructional method.

Review of Related Literature

Recent Conceptualizations of Teaching Mathematics through Problem Solving

At any level of education, the goal of teaching is to change the behaviour of students. When it comes to transfer of knowledge, teachers may use teaching methods that best suit specific objectives and level of students. Watkins (2007) observes that a teacher may use talk-and-chalk method of teaching when he/she talks and asks questions while writing key points and students' responses on the chalkboard. However, mathematics teaching in mixed ability classrooms may not follow a "one size fits all" approach, but should take into consideration different learning styles and preferences of the students to ensure maximum growth of learners. Some students may have a firm grasp of newly treated mathematical concepts, while others may struggle to understand what has been taught (Algozzine & Anderson, 2007). Teaching mathematics through problem solving entails starting with the students where they are and then providing them with a problem that pushes them to think in new ways. Students may also be encouraged to learn mathematics through hands on activities. As described by Artzt, Armour-Thomas and Curcio (2008), when students learn mathematics by doing, or struggling with real-world problems, their understanding emerge from practical experiences and exploration. This promotes cognitive and affective growth of students.

As a matter of fact, problem-solving should be a core component of mathematics education, allowing students to use and integrate previously learned concepts. Students' ability to employ specific heuristics (e.g., looking for a pattern, or looking back) and other problem-solving methods (e.g., drawing a diagram, organizing data) to tackle different basic school mathematics need to be improved upon (Siegle, Rubenstein, & Mitchell, 2014). Since mathematics teaching and learning is never ending process, teachers need to inculcate confidence in learners as they develop mathematical or critical thinking skills through problem solving strategies. Senk and Thompson (2003) have argued that goals may be set for students, such as minimizing hastiness in reading for understanding or planning a solution method. Besides, there is a need to assist students in understanding the value of – and developing skills in information organization. As put forward by Sammons (2009), a teacher's goal should be to help students gain meaningful mathematical comprehension when planning to teach mathematics. This can be accomplished if students can use different representations for knowledge, perform mental calculations, and adjust their attitudes as their comprehension improves. They need to acquire diverse set of mathematical skills in order to solve a variety of real-world problems.

Attitudes of JHS Teachers towards Teaching Mathematics through Problem Solving

The attitudes and practices of teachers are important to enhance educational processes. Attitude is a psychological construct that refers to an object, or belief in a person. Attitude that reflects a person's approach to something or inclination of the mind may be positive, negative or neutral (Dowker, Bennett & Smith, 2012). The often-overlooked fact is that attitude is a key factor that affects the type of teaching methods chosen by teachers, either talk-and-chalk or problem solving. Attitudes can shape students' learning experiences. Students can and do sense their teachers'

moods or attitudes, according to Marsh (2016). As a result, the attitudes of teachers are usually passed on to the students through classroom instructions and social interactions (Barnyak & Paquette, 2010). Furthermore, human perception includes attitude as a behavioural tendency. It is a long-term characteristic of motivation, emotion, perception, and cognitive processes that influences a person's worldview. Cognitive, affective, and conative (behavioural) are the three primary components of an attitude. Moreover, attitude refers to a person's feelings or beliefs about a topic, and it is linked to previous learning experiences as well as anticipated challenges or difficulties (Kreitner & Kinicki, 2004). When these definitions are taken into consideration, then a teacher's thoughts about the use of problem solving in mathematics would undoubtedly influence his/her decision toward teaching of mathematics through problem solving.

A study developed by Niss (2015), explained that altering teachers' attitudes is the most effective way to modify their teaching methods, strategies, and practices. Teachers' attitudes regarding a certain method of instruction grow more unfavorable when they are unsure of the theory or philosophy underpinning it (Dowker, Bennett, & Smith (2012). Since students are weak at solving problems, there is the need for teachers to assist students in developing problem-solving abilities that are vital to their learning and development. To increase students' mathematical successes and prepare them for further education and vocations that largely depend on the use of mathematics, researchers must determine what instructional approaches teachers need to use for teaching mathematics. One major obstacle to the application of problem-solving methodologies in classroom could be inadequate training of teachers by teacher education institutions, for teaching mathematics through problem solving (National Center for Educational Achievement, NCEA, 2010).

Nonetheless, teaching and assessing students through problem solving instructional method is more time-consuming, it requires more instructional resources than talk-and-chalk method of teaching. As suggested by Bennett-Conroy (2012), a lesson through problem solving can be divided into three stages; before, during, and after. Get learners ready to work on the problem in the first stage; in the second stage, listen intently, provide hints without dictating how students should think about the problem, observe, and assess. Accept learner solutions without judging them, at the end of the lesson, have discussions with them as they justify and assess the outcomes and techniques employed. Russo and Minas (2020) have argued that some teachers do not make attempt to teach mathematics through problem solving because much time is needed to prepare for a lesson and assess students' learning.

Students' Attitudes toward Learning Mathematics through Problem Solving

In their study, Goldin, Roseken and Torner (2009) defined attitude as deep feelings that have an active influence on a person's behavior in situations in which that individual has been involved. Then, it appears students dislike for and weakness at mathematics could be attributed to negative attitudes. McGowan (2008) has pointed out that attitudes have a significant role in influencing students' motivation and participation in learning a subject. The findings of Kandemir and Gur (2009) which show a strong link between students' achievement and teachers' attitudes and instructional approaches are in accord with this. They further explained that since teachers are considered as role models, students take a bigger portion of their views toward a given discipline from their teachers (Kandemir & Gur, 2009). From this, one can infer that there appears to be a direct link between teachers' attitudes, teaching methods and students' attitudes. Therefore,

teachers who try to accommodate diversity of learners through the use of problem-solving strategy really help learners to build reasoning and communication skills when solving problems.

As explained by Russo and Hopkins (2017) in their study, one reason why students may have negative attitude is the level of challenges that students experience in terms of learning mathematics through problem solving. If students' attitudes toward learning mathematics through problem solving are bad, then teachers may find it difficult to change students' minds. However, a change in students' attitudes can be achieved by regularly influencing how they organize facts and concepts in solution methods. Siegle and Mitchell (2014) have proposed that while students discuss concepts, create images, defend their own solutions, and evaluate other solutions, the teacher gains insight into students' cognitive process and mathematical progresses. In keeping with this explanation, it can be argued that students' attitudes toward mathematics are influenced not only by teachers' instructional approaches, but also the environment in which learning occurs (Siegle & Mitchell, 2014).

Factors Influencing Teachers' Choice of Problem Solving As an Instructional Strategy in the Mathematics Classroom

Irrespective of the fact that teaching through problem solving tends to be beneficial in facilitating mathematics learning, some teachers remain hesitant to use that in their classrooms. There could be variety of reasons for this apprehension, including concerns about teachers' own mathematical or pedagogical content knowledge, as well as lack of sufficient resources or time to adopt that approach (Charalambous, 2008; Russo & Hopkins, 2019; Sullivan, Askew, Cheeseman, Clarke, Mornane 2015). But, one frequently cited explanation is because some teachers believe that if the class work becomes too difficult, students may become separated from the mathematics lesson, and that such activities are not appropriate for least performing students (Darragh, 2013; Leikin et al., 2006; Ingram et al., 2020; Russo et al., 2019; Sullivan et al., 2019). Surprisingly, the few studies that have looked at what it is like for students to acquire mathematical knowledge through problem solving have revealed that these anxieties are mostly unjustified (Russo & Hopkins, 2017; Sullivan & Mornane, 2014). As noted by Russo and Minas (2020), maybe the one that looked into this subject the most closely, the authors asked students who had recently studied mathematics through problem solving to comment on how they felt about doing so. A higher percentage of students responded positively, indicating a positive approach toward mathematics learning through problem solving. Some students also valued the opportunities to collaborate with others, to connect mathematics to the real world, the novelty associated with this learning approach, and noted that it built their confidence and ability to persist.

Teachers' choice of instructional approaches, on the other hand, may be influenced by their own educational experience, subject matter knowledge, large class size, and teaching culture that favors the chalk-and-talk method. Teachers may also be discouraged from using problem-solving as an instructional strategy due to national test systems. There is no universal agreement on how many students make up a large classroom. In some countries, a class of 30 to 45 students is considered a large class. As a result, teachers' perceptions of large classrooms may vary depending on the educational setting and the level (Maat, & Zakaria, 2010). When a teacher finds it difficult to address the needs of individual students due to the vast number of students in the classroom, then the class is large. According to Abioye (2010), when the teacher focuses on regulating the noise and students' disturbances instead of teaching and learning activities, the class size is large. As

Hennings and Kay (2010) pointed out, tests have an influence on the teaching strategies that teachers use and the students' learning outcomes. Because of impending test, high stakes tests determine teachers' preferences, content to be covered, and teaching/ learning activities. Teachers may decide to focus solely on teaching fundamental abilities, giving insufficient attention to more advanced skills made possible through problem solving (McKinney, Chppell, Shannan, Berry & Bythella, 2009). Because test results can build or decrease a teacher's or school's image, there may be negative implications, such as test anxiety, on a teacher's choice of teaching method (Hemmings & Kay, 2010). The teachers teach in classroom is influenced by their own traits

Theoretical Framework

Cognitive constructivism and sociocultural learning theories are the foundations of this research (Piaget, 1968; Vygotsky, 1978). The former stresses the need for an individual learner to construct knowledge using pre-existing cognitive structures, while the latter stresses that knowledge is not just built, but it is co-constructed and knowledge is a collaborative process (Blumberg, 2008). One fundamental concept is to offer a lesson in such a way that it builds on the students' prior knowledge. To make sense of new material, students apply their past mathematical expertise (existing schemas). Students require learning resources in the classroom environment, as well as the teacher's lesson structure, to create their own knowledge. Making use of tenets from these theories, Niemiec and Ryan (2009) pointed out that students' reflective mind, which is refined or strengthened through problem solving procedures and reasoning, is required to make connections between mathematical concepts and ideas.

As noted by Vygotsky (1987), the brain adjusts or replaces old schema in order for the new concepts to fit and make sense, resulting in a revision of cognition and a strengthening of students' comprehension. Students are not only actively seeking meaning during the mathematics learning process, but they might also benefit from collaborating with someone who is more knowledgeable (e.g., the teacher). Furthermore, each learner has a distinct zone of proximal development, which is a range of knowledge that is out of reach for a student to learn on his/her own, but accessible with the help of peers or more knowledgeable individuals. Classroom activities that are within a student's zone of proximal development provide the most effective learning for that student. Targeting that zone, as suggested by Niemiec and Ryan (2009), allows teachers to provide students with the appropriate level of challenge, while avoiding boredom on the one hand and anxiety on the other when the challenge exceeds the student's current ability. Authors of this paper believe that if teachers adopt a positive attitude toward problem-solving as an instructional technique, they would provide opportunities for students to deepen their understanding of mathematics, allowing them to apply it to real-world problems.

Conceptual Framework

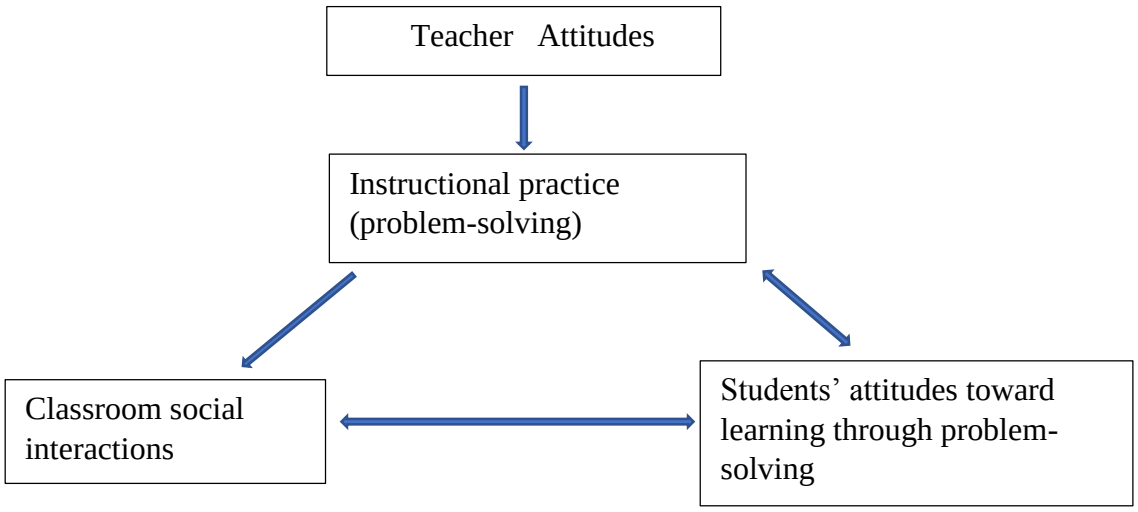

Figure 1: A framework showing how teachers' attitude toward teaching mathematics through problem solving influences students' attitude toward learning mathematics through problem solving (adapted from Vygotsky, 1987).

Summary of the Review

Mathematics teaching in mixed ability classrooms should take into consideration different learning styles and preferences of the students to ensure maximum growth of the learners. Teaching mathematics through problem solving entails starting with the students where they are and then provide them with a problem that pushes them to think in new ways. When students struggle with mathematical problems which reflect real-world issues, their understanding emerge from practical experiences. Teacher's goal should be to help students gain meaningful mathematical comprehension when planning to teach mathematics. Attitude is a long-term characteristic of motivation, emotion, perception and cognitive processes that influences a person's worldview. Attitude refers to a person's feelings or beliefs about a topic, and it is linked to previous learning experiences as well as anticipated challenges or difficulties. A study developed by Zan and Martino (2008) suggested that changing teachers' attitudes is the most effective way to modify their teaching methods, strategies and practices. In the light of current social needs, problem solving should be considered as one of the alternatives to producing graduates that are well suited to the workforce.

Methodology

The research design employed was cross-sectional exploratory survey design. Though it cannot show cause-and-effect, it can provide a clear picture of correlations that exist at a given time. The target population for this study was all JHS pupils and mathematics teachers in Asante Mampong Municipality, because they conform to specific criteria for this study. The population is heterogeneous in nature because it involves students and teachers from different socio-economic backgrounds or demographics, teachers who obtained their initial education and training through either regular college of education program, regular university program, or other modes. All the teachers possess required academic qualifications for teaching mathematics at the junior high school level. There are different sampling techniques available for use, but in this study,

convenience sampling technique was first used for selecting four junior high schools because of proximity and convenient for researchers to contact them. But within a given school, purposive sampling technique was used to select JHS 2 students and all mathematics teachers in the school for this study. Summary of the sample used is reported in table 1.

Table 1: Number of teachers and students

Gender	Teachers	Students
Male	8	78
Female	4	42
Total	**12**	**120**

In all, 132 respondents were used for the study, comprising 12 teachers and 120 students. The sample was thus considered appropriate for the study. Likert-item scale was used on the closed ended questionnaires designed and administered by the researchers themselves. The items on the questionnaire were aligned with problem solving as a pedagogical approach. The questionnaire for teachers was pilot tested on 8 teachers which yielded Cronbach's alpha based on standardized items of 0.603 as a measure of scale reliability. The questionnaire for students was pilot tested on 20 Junior High School form two students which yielded a reliability coefficient of 0.655. Since the questionnaire used Likert-item rating scale, it was coded as; strongly disagree = 1, disagree = 2, undecided = 3, agree = 4 and strongly agree = 5. Based on this coding system, responses from the questionnaire were gathered into these categories which generated primary data from their responses. The codes were loaded into SPSS version 25.0. Before data set was analyzed, all the negatively worded items were reversed by transforming them appropriately in the SPSS. Both descriptive and inferential statistics were computed as a mode of analyzing data obtained for the study. The descriptive statistics used in analysis included means and median scores. Spearman's rank correlation test was used to assess the relationship between teachers and students' attitude toward teaching and learning mathematics through problem solving as an instructional strategy.

Results and Discussion

The JHS Mathematics Teachers' Experience and Qualification As Obtained from the Questionnaire

Twelve teachers were sampled for this study. The highest academic qualification possessed by some of the teachers was first degree in programs other than mathematics, but they claimed mathematics was their major course. Majority of the teachers possess diploma in basic education obtained from Colleges of Education. The summary is reported in table 2.

Table 2: Teachers' professional qualification

Academic qualification	Number of teachers
Diploma in basic education (DBE)	8
First degree (B.Ed.)	4
Total	**12**

Source: Field data, 2019

Details of the mathematics teachers' teaching experience after their education and training were reported in table 3.

Table 3: Teaching experience of teachers

Years of teaching	Number of teachers
Less than one year	-
1 – 5	4
6 - 10	6
11 – 15	2
16 and above	-
Total	**12**

Source: Field data, 2019

This shows how long the teachers have been teaching mathematics at the JHS level. It is believed that experienced teachers understand the use of problem-solving teaching strategy better than inexperienced ones, but the correctness of such belief need to be studied in detail. Out of the 12 teachers sampled, 8 had taught mathematics at junior high school level for more than 5 years.

What Are JHS Teachers' Attitudes towards Problem Solving As an Instructional Strategy in Mathematics?

This was intended to find out attitudes' teachers have toward problem solving as an instructional strategy. Items which formed the subscale on questionnaire for measuring teachers' attitudes were presented in table 4.

Table 4: Item statistics

	Mean	Standard deviation	N
Problem solving instructional strategy is time consuming	3.0000	1.59545	12
I think only the highly intelligent students can study concepts better when problem solving strategy for used in teaching	2.7500	1.48477	12
I believe problem solving instructional strategy is worthwhile, it must be used at the JHS level	3.1667	1.69670	12
Problem solving strategy is appropriate for teaching every topic in the syllabus	3.2500	1.60255	12
I do ask students to explain more about their answers during lessons	3.0833	1.50504	12
Problem solving strategy requires much preparation on the part of the teacher	4.0000	.95346	12
I feel confident in my ability to teach mathematics through problem solving	3.4167	1.56428	12
I am willing to adopt problem solving strategy when other approaches fail	3.0833	1.37895	12
I accept that problem solving strategy leads students to relational learning of mathematical concepts	3.5000	1.44600	12
I believe problem solving instructional strategy is difficult to use	2.9167	1.50504	12
I do not like using problem solving strategy in teaching my students	3.6667	1.37069	12
It is not important teaching mathematics through problem solving, while other strategies are there	2.9167	1.62135	12

I do not think I could really teach my students mathematics through problem solving	3.2500	1.48477	12
I hardly use problem solving strategy in my lesson delivery	3.5833	1.37895	12
I don't think students prefer to learn mathematics through problem solving to other instructional strategies	3.0833	1.50504	12

Source: Field data, 2019

It can be seen from here that differences between the mean of items that measure teachers' attitudes is not widely spread, because standard deviations are small in sizes.

Table 5: Values of median from the sub scale measuring teachers' attitude

Statement	Median	Valid	Missing
I believe problem solving instructional strategy is difficult to use	3.0	12	12
problem solving instructional strategy is time consuming	3.0	12	12
I think only the highly intelligent students can study concepts better when problem solving strategy is used for teaching	2.50	12	12
I believe problem solving instructional strategy is worthwhile, it must be used at the JHS level	3.5	12	12
Problem solving strategy is appropriate for teaching every topic in the syllabus	3.5	12	12
I do ask students to explain more about their answers	3.0	12	12
Problem solving strategy requires much preparation on the part of the teacher	4.0	12	12
I feel confident in my ability to teach through problem solving	4.0	12	12
I am willing to adopt problem solving strategy when other approaches fail	3.0	12	12
I accept that problem solving strategy leads students to relational learning of mathematical concepts	3.0	12	12
I believe problem solving instructional strategy is difficult to use	3.0	12	12
I do not like using problem solving strategy in teaching my students	4.0	12	12
It is not important teaching mathematics through problem solving, while other strategies are there	2.5	12	12
I do not think I could really teach my students mathematics through problem solving	3.5	12	12
I hardly use problem solving strategy in my lesson delivery	4.0	12	12
I don't think students prefer to learn mathematics through problem solving to other instructional strategies	3.0	12	12

The median gives a clearer descriptive measure of teachers' attitude since the data is ordinal in nature. It further reveals the teachers' awareness of and usage of problem solving as an instructional strategy in mathematics. The median score for items; problem solving strategy

requires much preparation on the part of the teacher and I feel confident in my ability to teach through problem solving is 4 respectively. This points to the fact that the JHS teachers know the benefits of using that instructional strategy in their classrooms. Further, the fact that it is time consuming to prepare and deliver a lesson in this mode didn't change their attitude towards that instructional strategy. The statement which says; "I think only the highly intelligent students can study concepts better when problem solving strategy is used for teaching" recorded the least median score, 2.50. This implies that the mathematics teachers at the JHS think the instructional strategy is suitable mixed ability students.

What Are JHS Students' Attitude Towards Learning Mathematics Through Problem Solving Strategy?

The students' background information obtained from the questionnaire is relevant to this study. It includes; sex, age and class. They were all sampled from form two (JHS 2) class, age ranged between 12 and 15 years. Seventy – eight boys and forty-two girls participated in the study.

Table 6: Item statistics from students' questionnaire

	Mean	Standard Deviation	N
Lessons are interesting and engage students when taught through problem solving strategy	4.2917	.96490	120
I believe I can do well in mathematics test if I study through problem solving	4.3167	.46713	120
I believe I can improve on my critical thinking by learning through problem solving	4.3750	.48615	120
I am confident I can learn much concepts through problem solving	4.3083	.71943	120
Learning mathematics through problem solving is difficult to understand	4.2083	1.26953	120
I do not use problem solving strategy in my personal studies	2.5000	1.30287	120
Learning mathematics through problem solving doesn't bother me	2.6167	1.18947	120
Learning mathematics through problem solving is a waste of time	3.7750	1.14100	120
Time used to check why an answer to a mathematics question is correct is not necessary	3.5667	1.22806	120

Source: Field data, 2019

The items presented here are the ones targeted at measuring students' attitudes toward mathematics lessons delivered through problem solving strategy.

Table 7: Values of median measuring attitudes of students

	Median	Valid	Missing
Lessons are interesting and engage students when taught through problem solving strategy	4.50	120	1
I believe I can do well in mathematics test if I study through problem solving	4.00	120	1
I believe I can improve on my critical thinking by learning through problem solving	4.00	120	1
I am confident I can learn much concepts through problem solving	4.00	120	1
Learning mathematics through problem solving is difficult to understand	5.00	120	1
I do not use problem solving in my personal studies	2.00	120	1
Learning mathematics through problem solving doesn't bother me	2.00	120	1
Learning mathematics through problem solving is a waste of time	4.00	120	1
Time used to check why an answer to a question is correct is not necessary	4.00	120	1

Source: Field data, 2019

The median gives a clearer descriptive measure of students' attitudes since the data was measured on ordinal scale. It shows students' interest and confidence in learning mathematics through problem solving strategy. Concerning the item which says; "I believe I can do well in mathematics test if I study through problem solving" median score is 4.00 which is quite high. Though some students agreed to the fact that learning mathematics through problem solving instructional strategy makes the concepts difficult to understand. However, most students found that teaching strategy to be interesting. Irrespective of their learning style and preferences large number of students are of the view that learning mathematics through problem solving strategy will help them retain much concepts.

Factors That Influence JHS Mathematics Teachers Use of Problem-Solving Strategy in Their Lesson Delivery

In order to appreciate this better, an open-ended question was posed requiring teachers to write what factors they find as challenging to their choice of this instructional strategy. Here are some their responses;

Teacher 1: Not enough time to complete the syllabus.

Teacher 2: It is time consuming and usually frustrating to students.

Teacher 3: Nothing, I use it as and when I deem it necessary

Teacher 4: WAEC does not ask problem solving questions in exams, large class sizes, time constraints, emergency staff meetings and inadequate teaching learning resources.

Teacher 5: It requires more teaching learning resources and it is time consuming.

Teacher 6: Students are not ready to apply mathematical concepts in solving problems, they therefore do not like problem solving in mathematics lessons. It can be inferred from their responses that time spent on preparation and delivery of lessons through problem solving strategy is a key factor that influences teachers' use of that approach. Every teacher is determined to complete his / her syllabus on time.

Research Hypothesis

H_0: There is no significant relationship between the attitude of teachers and that of students toward problem solving as an instructional strategy in mathematics.

This hypothesis was stated to establish and describe the nature of relationship between the attitude of teachers and that of their students toward problem solving as an instructional strategy in mathematics. The Spearman's rank correlational analysis was carried out to ascertain whether relationship existed and how strong is that relationship. There was a positive but low correlation between the two variables, $\rho = 0.367$. This suggests that, there is a kind of relationship between the attitude of teachers and that of students toward problem solving as an instructional strategy, but very weak.

It can also mean that as teachers develop positive attitudes it may have some sort of impact on students' attitude. This relationship was found at a stated significance level of 0.05. This result can also change when sample size is increased or different sample is selected from the same municipality or elsewhere. This finding corroborates with a study conducted by Zan and Martino (2008) which showed that mathematics achievement is a function of numerous interconnected variables related to pupils, families, and schools. They suggested that when seeking to comprehend and explain variation in students' performance in mathematics, attitudes were seen as crucial aspect to be taken into consideration. The findings by Nicholaidou and Philippou (2003), which show a strong link between attitudes and performance, are consistent with this.

Key findings from the study include:

1. Teachers are of the view that problem solving is good to use as an instructional strategy in mathematics teaching. Though it takes much time for preparation and delivery of a lesson.
2. Teachers were of the view that students are much involved when problem solving strategy is used. All the teachers agreed that students' participation in a lesson is increased when problem solving strategy is used in teaching.
3. It was realized that some factors that influence teachers' use of problem-solving strategy include; much time is consumed in lesson preparation and delivery, and students were not ready to apply mathematical skills and concepts already learnt from other topics in solving problems.
4. The study also revealed that students' general attitude towards problem solving as an instructional strategy was positive.
5. Spearman's rank correlation between students' attitude and teachers' attitude was found to be positive but weak.

Conclusion

From this study, researchers have found out that the JHS mathematics teachers are aware of problem solving as an instructional strategy in mathematics. Their attitudes toward its use in classroom is positive and has the propensity to affect their students in the same direction. They

also stated the difficult nature of the strategy, as well as time to complete the teaching of topics in their syllabus as some of the factors that hinder their use of problem-solving approach.

Students' responses revealed that, while they find the problem-solving instructional approach as challenging, they do not despise it. They have a measure of positive attitude towards its use as a means of learning mathematics. Students accepted that whenever teachers use that mode of instruction lessons become interesting and participatory, because everyone is involved in its development. Furthermore, students indicated their preparedness to learn mathematics through problem solving strategy, since they see it as directly related to situations in real world. Teachers expressed their concern about teaching mathematics through problem solving instructional strategy in terms of, quality of students they teach, class size, availability of resources, examination format and time bound.

Recommendations

Based on findings from this study, subject-based workshops or professional development sessions must be organized by District Education Office for the mathematics teachers to update their knowledge and skills in the use of problem solving as an instructional strategy. This can be done at the beginning of every term. It is also recommended that mathematics teachers in junior high schools need to be encouraged by District Circuit Supervisors and Head Teachers, to use problem solving instructional strategy regularly in classroom delivery.

Students must equally be encouraged by teachers to take their study of mathematics through problem solving seriously. Teachers should give specific assignments to students that involve problem solving strategies which will help to develop their logical and critical thinking about a topic or concepts. Through subject-based workshops or professional development sessions, District Education Office should provide mathematics teachers with materials that will allow them to model concepts in classroom during lesson delivery.

This study was conducted in four Junior High Schools in Asante Mampong Municipality, in Ashanti Region. It is hereby suggested that the study may be replicated in other municipalities, or regions in order to find out what really exists in other Junior High Schools.

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