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THE USE OF PROBLEM SOLVING APPROACH IN LINKING CLASSROOM MATHEMATICS TO REAL-LIFE ACTIVITIES AT BEKWAI SDA SHS

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ABSTRACT

The motive of this research was to use the Problem-solving Approach as an instructional strategy with constructivist notion to create a link between classroom mathematics and real life in order to make sense of the world through mathematical perspective. A purposive sample of 20 teachers were used for the study. The out SPSS output of the analysis of the Questionnaires revealed that most teachers shun the problem-solving approach due to its associate difficulties like; large class size, pressure to complete syllabus, difficulty in getting real life examples among others. The researcher recommends that; teachers should endeavour to read around each topic to get enough practical examples for every topic before they teach, teachers must ensure that their lessons are linked to real life activities, teachers must provide opportunity for all learners to learn and the Head of Department should ensure that teachers have access to resources and materials for smooth lesson delivery.

INTRODUCTION

The study focused on how the Problem-Solving Approach in teaching mathematics could be used to link classroom mathematics to daily life activities. This is to help bridge the gap between classroom mathematics and real-life activities. The importance of mathematics in the development of our nation and the world as a whole cannot be stretched enough. Since mathematics has become the backbone of every country and also permeates every aspect of our lives, it is necessary to train the secondary school learners to be able to think and reason mathematically. Mathematics is a compulsory subject in Ghanaian schools from primary school up to the senior high school (SHS) level. It is also a necessary requirement for admission into higher Institutions in Ghana as a result of its usefulness in the career development of the young ones.

According to a report by Ina, Mullis, Michael, Martin and Tom (2016), a lot of research works are being carried out worldwide to help improve the teaching and learning of mathematics in various countries in this digital era. Regular assessment and rankings of mathematics achievements of various countries internationally by institutions such as IEA and OECD among others have made mathematics teaching and learning very attractive, competitive and adventurous. As the world is moving at a faster pace in terms of technological advancement, there is the need to find a pedagogical approach in teaching that could make learners innovative, creative, critical thinkers and problem solvers. The poor problem-solving skills exhibited by Ghanaian learners in local and international assessments according to Anamoah–Mensah and Mereku, (2005) has been a source of worry to the stakeholders of education in Ghana (MOE, ESA report 2018). Hence, the need to do a study of this nature to find lasting solution to the canker. The content that students need to learn at the secondary school level in Ghana is spelled out in the Core Mathematics syllabus (Ministry of Education, 2010, 2012, 2017). Out of

School Mathematical Activities are the daily life activities that require the application of the knowledge of mathematics. Boaler, (2015) posited that mathematical understanding helps the individual to develop oral communication skills and mathematical thinking skills. It is the knowledge of mathematics that is used in modelling real-life phenomena; predict disaster, philosophy, medicine, digital encryption, communication among others.

Ghana Government over the years have implemented periodic curriculum reforms, ranging from updates to full-scale revisions. (Mereku, 2010; Mereku, 2019; Akyeampong, 2010; Adu-Gyamfi, Donkoh & Addo, 2016). Teacher Education, instructional time, and the fuse of technology in education have been at the heart of these reforms in Ghana's educational systems just to improve on teaching and learning in Ghanaian schools; particularly in the area of science, Technology, Engineering, and Mathematics (STEM). Besides the innovations, incentive packages like full scholarships and study leave are available to learners who pursue STEM at the higher level to take advantage. Among these are GNPC Foundation scholarship, Ghana scholarship secretariat, GETfund Scholarship, District Assembly Scholarship and some cooperate institutions like MTN Ghana and Tallow Ghana.

However, examination results available at both national and international examination Bodies like the West Africa Examination Council (WAEC) and Trends in Mathematics and Science Study (TIMSS) show that Ghana's performance in mathematics needs attention. It is evident that Ghana's performance in mathematics has not been encouraging. A report released by the Organization for Economic Cooperation and Development (OECD), Education at Glance (EAG), ranked Ghana last but one in mathematics, science, and English test (OECD, 2019). Locally the statistics of the West Africa Senior High School Certificate Examination (WASSCE) results in Core Mathematics available at the West African Examination Council (WAEC) from 2012 to 2018 show that less than half of the candidates are able to obtain grade A1- C6 in the WASSCE (MOE, ESPR, 2015). This has been a source of worry not only to parents but the government as well (MOE, ESA report 2018). As a teacher at the Bekwai SDA SHS, I have observed that the difficulty that learners face in learning mathematics is not different from the national challenge. WASSCE results and the School-Based Assessment (SBA) at SDA SHS Bekwai for the past five years show that learners are not doing well in mathematics as expected. The condition has partly been attributed to learners' lack of interest in the subject as a result of the traditional method of teaching mathematics in the school as opposed to the PSA.

Secondary education is now free and accessible to every Ghanaian child (MOE, MTRF for 2017-2019). Consequently, the strong mathematical competencies developed at the SHS level are necessary requirements for those continuing into tertiary education and beyond as well as those who will exit formal education to venture into other professions and vocations. Mathematics as a core subject at this level has a serious implication to occupy such a spot. This has been categorically highlighted in the Ghana education service (GES) mathematics curriculum that; to attain any meaningful development in life as a country, mathematical knowledge is pivotal. It goes on to state that mathematical knowledge and skills would provide the young Ghanaian with prerequisite expertise needed to be successful in their future careers (Ministry of Education, 2010, 2012

The ability of learners to grasp concepts, to generate knowledge and solve problems is the mark of their level of competency in thinking skills. Students may have vast potential, however, if we are not able to do away with bottlenecks of time constraints, misconceptions, and over-emphasis on examination, it would not be fully explored (Zaharin, Sharif & Marianppa, 2018). There is, therefore, the need for teachers to developed learners' competent thinking skills to equip them with this challenging digital era. This can only be achieved through the use of questions that demand higher-order thinking skills. According to Nabie, Akayuure, and Sofo (2013), problem solving and investigations embedded in the SHS Mathematics curriculum of GES are as a result of paradigm shift from the behaviourist to the constructivist notions. This is based on the internationally recognition that the problem-solving approach in teaching is vital to developing skills and personal construction of mathematical knowledge. Nabie et al. (2013), recommend that Ghana should make problem-solving and investigations in mathematics essential part of in-service professional development and teacher education programs. This will equip the teachers to teach mathematics at all levels using the Problem-Solving Approach.

The Theological Framework

Theoretical framework according to Osanloo and Grant (2016), is derived from an existing theory (or theories) in the literature that undergirds your thinking with regards to how you understand and plan to research your topic, as well as the concepts and definitions from that theory that are relevant to your topic.

The constructivist approach to learning and Polya's Problem Solving Approach are the main theories for this research. Tambychik and Meerah (2010), describe problem-solving as a complex mental process, involving visualization, abstraction and association. George Polya (1887-1985), a Hungarian mathematician defined it as a process of finding a solution to a problem to achieve a goal that seems difficult (Polya, as cited in Arfiana & Wijaya, 2018). Even though there is no clear-cut definition, Problem-solving can be described as a process of finding a mathematical formulation that can be used to predict real-life phenomenon. One of the primary reasons people have trouble solving mathematical problems is that there is no single procedure that works all the time. Every problem is slightly different. Furthermore, problem-solving requires practical knowledge of the specific situation. It is expected that students will apply and integrate a lot of mathematical skills and make decisions.

Constructivism also is the synthesis of multiple learning theories diffuse in one form Knapp (2019). Constructivism is about the ability of teachers to identify their learners' learning capabilities to provide the necessary conditions and materials to help the learners put their knowledge to practice. In constructivist classroom, the learners construct their own knowledge and understanding based on the conditions provided by the facilitator. It is therefore, a way of promoting learners' motivation and critical thinking and encouraging them to learn independently. Learners are encouraged to explore and learn through problem-solving, which involve the process of using representations, communication, reasoning and connections. In social constructivist theory, the emphasis is placed upon interaction between the learner and peers or adults. Social constructivism places high priority on language in the process of intellectual development according to researchers Saxe and Sussman (2019). Language in this discourse becomes the vehicle by which mathematical concepts, ideas and skills are

developed. At the senior High School level, allowing learners to work in groups has the tendency to offer them the opportunity to discuss and communicate mathematically as established by Werhane, Hartman, Moberg, Englehardt, Pritchard and Parmar (2019).

In the Problem-Solving Approach to teaching, learners are resourced enough to acquire the skills that would help them apply and adapt a variety of appropriate strategies to solve problems either on their own or with little assistance (Greeno, 2017; Surya & Putri, 2017). Learners can apply various strategies including looking for patterns, the use of diagrams, guessing, paraphrasing or breaking down challenging problems into solvable units among others to find solution to problems. The problem-solving approach, according to Eduafo (2014) is very crucial in mathematics education, since it goes beyond the classroom mathematics. By developing problem-solving skills, learners are equipped with mastery of; how to tackle mathematics problems as well as how to logically navigate their way through any new situations they may face.

The traditional method of teaching mathematics only helps the learner to solve problems that he or she has encountered before, but fail to solve problem he or she has never come across. However, teaching mathematics using PSA helps the learner to invent methods, tools, strategies and models to solve contextual problems. Teaching using the PSA ensures that the learners are provided with a learning environment for them to explore and invent ways to solve problems on their own. The proponents of teaching mathematics through problem solving observed that learners who encounter problematic situations use their existing knowledge to solve those problems, and in by so doing, they construct new knowledge and new understanding (D"Ambrosio as cited in Eduafo, 2014; Kara, 2019).

The constructivist learning theory has categorized learners thinking ability to solve problems into three; activities the child can perform without assistance, activities the child can perform with assistance and activities the child cannot perform even with assistance (Siyepu, 2013). This is what is termed as the Zone of Proximal Development (ZPD). The ZPD is the difference between what a learner can do without help and what a learner can do with help. Vygotsky, as cited in Siyepu (2013) defines ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers". Learning should be facilitated by means of activities, classroom discussions and exercises that are done during and after classroom instructions. Teachers must design learning activities to start from what the learners can do independently based on their prior competencies by means of helping the learners to construct their own knowledge and understanding. In this regard, teachers should base their classroom instructions on learners' relevant previous knowledge taking into consideration, the activities that are of interest to the learners in terms of their background and culture.

Linking learners' background experience to the classroom turns the mathematics lessons to creative art which has the power to develop mathematics thinking skills among learners. It has been grounded in research that, the cultural background of learners has a direct impact in their understanding of mathematical concepts. For instance, Baba, Ueda, Ninomiya and Hino (2018), posited that cultural factors play important role in Japanese mathematics Education. Butakar (2018) also reveals that in Ghana the home environment has a role to play in the teaching and learning of mathematics. Cai and Wang (2010), in their work reveals, that cultural factors must be taken in to consideration in the teaching and learning of mathematics. In China as

posited by Cai and Wang (2010), most of the examples used in mathematics classrooms are based on learners' daily life activities. This encourages learners in different ways to approach calculations in a skilful manner. It is therefore imperative for the mathematics teacher to always bring the real world into classroom Surya and Putri (2017).

The ZPD emanating from the social constructivist theory implies that at a certain stage in development, learners need assistance before they can solve certain problems but once the learner's problem-solving activities have been internalized he or she can now perform those activities independently and it goes on and on. The teacher as a facilitator now becomes like a scaffold for the learner to climb in the process of learning. Siyepu (2013) opines that, given the appropriate activities with the needed resources, conditions and materials interspersed with guidance, the learner can now solve previously difficult problems and extend to new situations where hitherto was a no-go area.

According to Sinay and Nahornick (2016), many learners think mathematics is ''boring, mostly irrelevant and unrewarding', however, variety of teaching techniques can be applied to the teaching and learning of mathematics in a conducive environment to make it more of a fun and activity oriented. Mathematics games, role play, brainstorming and other educational apps can be used in the teaching of mathematics to make it more interactive and game-like. A short field trip during lessons can also help the students to think and appreciate the environment mathematically according to research (Suurtamm, Quigley & Lazarus, 2015; McKie, Suurtamm &Lazarus, 2017; Dobbins, Gagnon & Ulrich, 2014). Wells (2019) revealed that there are other modern pedagogies that mathematics teachers can apply in their teaching. For instance; Gamification, Flipped Classroom, Mobile learning, Project Based learning among others. These are technology based, activity oriented and problem solving focused aimed at linking classroom mathematics to real life activities.

The Conceptual Framework

The conceptual framework as elaborated by Osanloo and Grant (2016), offers a logical structure of connected concepts that help provide a picture or visual display of how ideas in a study relate to one another within the theoretical framework. Various Researchers have brought different approaches whereby mathematics problem especially, context-based problems could be effectively solved. Sullivan (2011) identifies five strands of desirable mathematical actions for students as conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, productive disposition and strategic competence. Polya's process in problem solving approach are as follows;

1. Understanding the problem
2. Devising a plan
3. Carrying out the plan
4. Looking back.

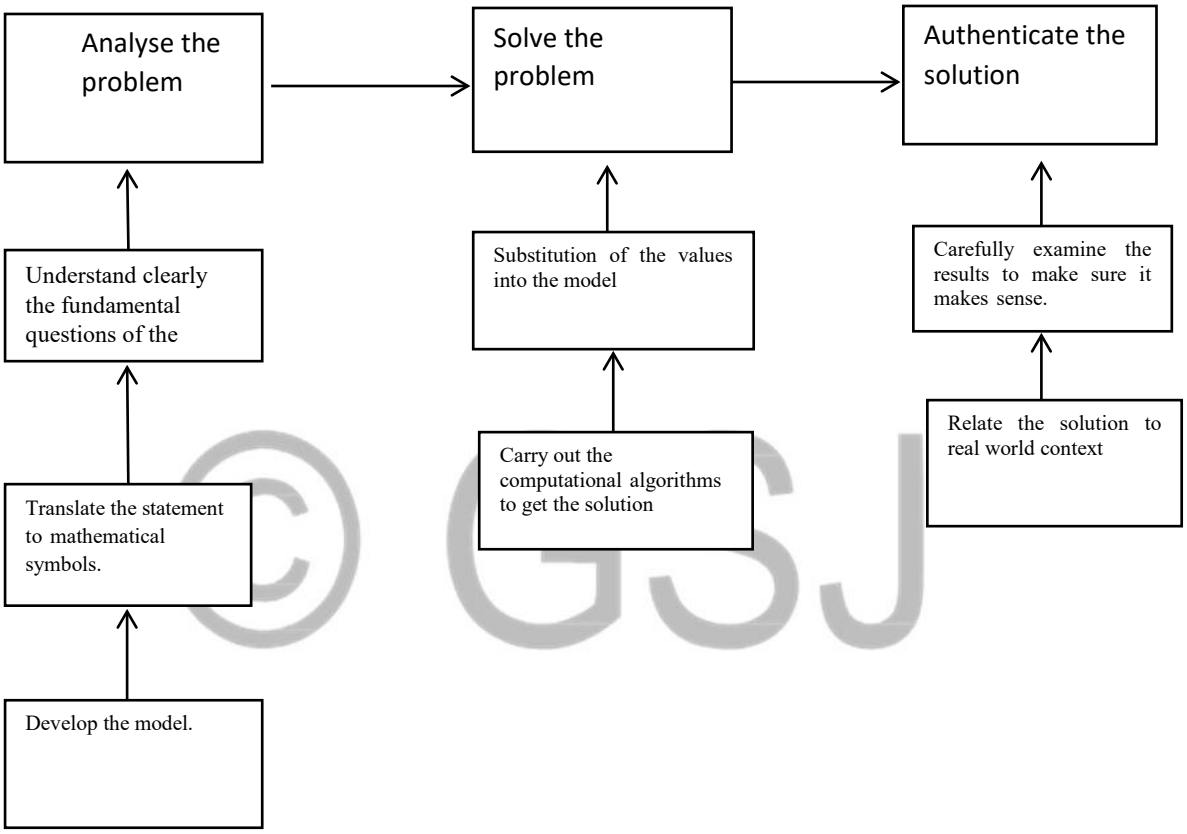
Wijaya et al., (2015), also developed four stages of problem developed the following steps:

1. Understanding the problem situated in reality.
2. transforming the real-world problem into a mathematical problem
3. solving the mathematical problem
4. Interpreting the mathematical solution in terms of the real situation.

The research therefore adopts the following three-stage problem solving approach;

1. analyze the problem
2. solve the problem
3. authenticate the solution.

Table 2.1: the three-stage Problem solving process



For any mathematical problem to be solved using this approach, the first step is to;

- understand clearly the fundamental questions of the problem.
- translate the statement to mathematical symbols.
- develop the model.
- solving the problem
- substitution of the values into the model
- carry out the computational algorithms to get the solution
- carefully examine the results to make sure it makes sense.
- relate the solution to real world context

Related Literature

The role of the teacher in the classroom cannot be overemphasised, since they are at the heart of effective mathematics education as posited by Clarkson, Seah and Pang (2019). In Canada, Bengo (2016) explored ways that mathematics teachers can be offered coaching in order to deliver meaningful mathematics to learners. Baah-Duodu, Osei-Buabeng, Cornelius, Hegan and Nabie (2020) observed that Mathematics ought to be taught using hands-on and minds-on approaches which learners will find as fun and adopt as a culture. Thus, learners are eager and willing to learn mathematics due to its implications in life however, if teachers fail to handle the subject with tact, its learning becomes so difficult, uninspiring and boring. More importantly, if teachers present less-challenging problems in class, it limits the learners in their thinking and reasoning. As indicated by Giardini (2016), there are three forms of engagements that teachers of mathematics should take learners through if we want to create real world, relevant and purposeful learning experiences for learners. These are cognitive, operative and affective. Giardini (2016) is of the view that enabling students to engage cognitively, operatively and affectively with mathematics in and outsides the classroom, enhances their ability to have a m ore practical and relational understanding. These are vital ingredients to assist learners move beyond the common attitude towards mathematics as difficult, boring or irrelevant as observed by (Prendergast, Breen, Bray, A., Faulkner, Carroll, Quinn, D & Carr 2018; Siswono, Kohar & Hartono, 2017).

In their work, Arthur, Asiedu-Addo and Assuah, (2017), observed that students' perception in mathematics is directly linked to their interest and motivation. Arthur et el. (2017) recommended that teachers should tailor their classroom mathematics in a manner that would motivate students to learn. If a lot of practical activities and teaching aids are applied in the classroom it makes the lesson very interesting and real. In Problem solving, according to Hiebert, Carpenter, Fennema, Fuson, Human and Wearne (1996), teachers should take time to engage learners in group work and language work to help build their mathematics thinking skills and to be able to communicate mathematically. In their report the committee of experts that reviewed Basic Science and Mathematics education in Ghana under the chairmanship of Prof. Jophus Anamuah-Mensah recommended among other things that; Teachers need to use inquiry approach to teaching by making their teaching practical through the use of teaching and learning materials and guiding students to make their own generalizations instead of always giving them formulas to adopt and definitions to memorize (MOE, 2014). It therefore confirms the problem-solving approach as a medium to link classroom mathematics to the out-of-school mathematical activities as against the computational algorithms which demands memorization. In problem solving approach to teaching, the teacher becomes a curator of learning as he or she directs students to the source of information rather than providing ready-made mathematics to some passive learners. Arthur et al. (2017) hinted that the traditional mode of mathematical instruction in Ghana has been widely criticized, since the methods employed do not place emphasis on c onceptual understanding, but rather rote and memorization (instrumental understanding). They argue that teachers focus more on completing the syllabus thereby limiting the teaching to solving of Textbook questions which is more of computations instead of using the process skills such as inquiry based and problem solving that would develop learners' interest and critical thinking skills.

Meanwhile, most of the textbook questions are readymade and teachers only try to supply learners with formulae such as Area of a ci rcle is $A = \pi r^2$. This type of

teaching does not place the Learners at the centre of learning. Since they are not involved in the process to make inference, conjectures and generalization to understand strategies used to derive the formula. Freudenthal, as cited in Kothari, (2004) refers to this cookbook approach of providing formulae, where learners have no idea where the formulae came from, as an "*Educational and Mathematical Sin"*. Conversely, teachers as opined by Amponsah-Tawiah, (2020) are expected to position themselves in a manner that they play the role of the learners. In this regard, teachers can understand how it feels like to be a learner so that they can tailor their methods to rouse learners' interest. To enable learners to come out with their own thinking about a concept and to solve non-routine problems. Hatch (2018) also admonishes teachers to minimize giving of explanation of concepts, but rather use why, what and how questions. Hatch, (2018) states that teachers should create projects in which concepts become apparent as students work through real-world challenges.

There should therefore be conscious effort to deal with concepts by deliberately guiding learners through the procedure on how to arrive at mathematical rules, laws and formulae. In order not to deliver a monotonous mathematical diet to students. Suurtamm et al. (2015), suggest that teachers should incorporate a range of different activities and a variety of positive learning experiences. This approach however challenging it ma y be, teachers must strive to provide real-life examples for mathematics. It is through practical activities and real-life examples that put mathematics learning in a context and bring the real world into the classroom. Giving learner centred mathematical instruction through problem solving approach enable learners to problem solve by: making various mathematical computations, exercising estimation skills, using a multitude of mathematical terminology and having enriched mathematical discussions (Giardini, 2016).

An article by IJTSRD (2019), revealed that teacher expertise has been consistently and repeatedly supported through research and still remains the single most important factor in facilitating learners' mathematical achievement. It goes on to say that those teachers who have taken more courses where they acquire the necessary pedagogical content knowledge (PCK) are more successful in promoting learner engagement and improving learning. However, it cautions that the typical/traditional didactic strategies must be replace with the type of learning that provides hands-on activities. It states categorically that the search for new and effective way of schooling has become necessary and urgent. This is because the World economies, international connections, rapid continuous technological changes, the explosion of available information, threats to national security, and a plethora of other pressures are all forcing education to rethink how teaching and learning take place in the current educational system.

From all indications it is evident that the traditional methods of teaching mathematics need to be replaced with the problem-solving approach to create a link between the classroom and the world of work. To develop learners' competencies and skills for a functional life, Nabie, Akayuure and Sofo (2013) argues that even though problem solving is not a stand-alone topic in the Ghanaian mathematics curriculum, teachers must incorporate it in every mathematics lesson. It therefore makes it binding that every topic needs to be taught using the problem-solving approach if we intend to deliver meaningful mathematics, hence the need for this research.

Attitudes, ideas and concepts needed in everyday life and workplaces such as confidence, perseverance, communication skills, creative thinking, versatility, loyalty

among others (TIMSS 2015 Encyclopedia), are mostly not taught or de-emphasized as a result of impoverished curriculum and over-reliance on solving routine questions in the textbooks.

Meanwhile, it is the word problems that help students to apply formal mathematical knowledge and skills to real-world situations (Swanson, Lussier & Orosco, 2015). It is obvious that teaching for meaning has a positive impact on learners and it also has the tendency to accelerate knowledge retention and transfer. Teachers must, therefore, strive to make an explicit connection between mathematics and other subjects and its real sense. This can be achieved by linking the new ideas and skills to students' previous knowledge and background experience. The Chief Examiner's Reports (WAEC, 2012-2018) have been cautioning teachers to take the necessary steps to make the teaching of mathematics more practical and relevant to life. The recommendations are that teachers should stop specializing in teaching some topics which they are familiar with but, they should give holistic mathematics education to the young ones.

Many Ghanaian SHS students have difficulty in mathematics mainly because they lack reasoning and problem-solving skills which may be blamed partly on teachers' approach to teaching. Nabie et al. (2013) observed that some of the few teachers who are able to integrate problem-solving in their teaching fail to access students accordingly. These teachers still use the traditional assessment tools which lack the capacity to develop the desired skills outlined in the curriculum.

Researchers recommend that teachers should create supportive and enabling environment and also present ideas in interdisciplinary manner, thereby, linking mathematics to other fields (subjects), (Suurtamm, Quigley, & Lazarus 2015; Ontario Ministry of Education, 2015; Butakar 2018; Barwell, 2011). Wilder, Lang and Monegan, (2015) also believe that, integrating mathematics with various disciplines can produce meaningful and authentic teaching and learning environment for learners to be able to connect more deeply with learning material since they would have the opportunity to associate their relevant previous knowledge with new learning. This integration has the tendency to allow learners to see the relationship between the disciplines and their lives. They further observed that the integration supports the retention of information in learners' long-term memory and it facilitates application and transfer of knowledge.

In total, there should be an authentic connection and real-life connections. The concerns of Rittle-Johnson and Schneider (2015), about teaching reasoning skills in a form of identifying differences and similarities, size or shape among others to promote problem-solving. Teaching learners to be creative in mathematics lessons provides an inquiry environment and create an opportunity for learners to discover mathematics beyond just skills and procedures. Suurtamm et al. (2015), suggest that the teacher must be a curator of learning to guide learners to discover solutions to problems through multi-variety means. This affirms the notion that when mathematics is taught at the SHS level using practical approaches, the disconnection between the classroom and real life is minimised if not completely removed.

More so, Roschelle, Rafanan, Bhanot, Estrella, Penuel, Nussbaum and Claro, (2010) encourage the integration of technology in teaching mathematics for effective assimilation of mathematical concepts. Roschelle et al. (2010) advocates for the use of the calculator, Mathematics Apps, computer games and other relevant software in the

teaching and learning of mathematics in the early years of schooling. The Ghana Education Service and the Ministry of Education in collaboration with the Curriculum Research and Development Division have made the use of calculators and computers mandatory in the teaching and learning of mathematics. The National Council of Teachers of Mathematics (NCTM) and various other organizations and individuals recommend that the appropriate calculator be made available for use by learners at every grade level from kindergarten through to college (NCTM, 2000). As stated in the syllabus for core mathematics, the use of calculators in teaching and learning mathematics is to enhance understanding numerical computation and to solve the real-life problems (Ministry of Education, 2012). Calculators have become a great working tool for learners in the senior high school. The device has replaced the traditional method of working mathematics problem such as the use of multiplication tables, four-figure tables, abacus and others.

Herbel-Eisenmann, Johnson, Otten, Cirillo and Steele (2015), in their work argue that all learners can learn and they must be given challenging tasks throughout units of learning. More so, extra task must be given to learners after lessons to engage them after school, Teachers are hereby advised not to underestimate the capabilities of any child as research has shown that any form of good teaching should be able to challenge students and push them as far as they can go. According to Arthur, Asiedu-Addo and Assuah (2017), if learners have a good perception in mathematics, it can influence their interest and motivate them to learn. Adu, Mereku, Assuah, and Okpoti (2017) recommends that mathematics teachers at the secondary school should take time to engage students in teamwork and take them through activities that would give them the opportunity to express themselves during mathematics lessons. Designing learning experiences to develop a learner's mathematical knowledge, understanding, skills and abilities from situations that relate to their interests, is an important characteristic of meaningful mathematics that are of transferrable real-world connections (Sparrow, as cited in Giardini, 2016). Effective mathematics lessons must be full of realistic and interesting stories form learners background. This has the tendency to bring the real world into the classroom. There is the need for this research, since it seems to test the practicability of the PSA in teaching mathematics with the aim of bridging the gap between classroom and real life.

METHODOLOGY

3.1 Research Design

Research design is a formal plan of action for a research project (Creswell as cited in Eduafo, 2014) the researcher made use of the descriptive research design for the study.

3.2 Target Population

Target population is the aggregate cases about which the researcher would like to make generalisations and it is the unit from which sample is required and actually studied (Amedehe, 2002). According to Amedehe (2002) researchers normally sample from the accessible population and hope to make generalisation to the target population. The target population was all the teachers at Bekwai SDA Senior High School and the mathematics teachers form the accessible population.

3.3 Sampling Technique and Sample size

Sampling as a procedure is a way to use small number of units of a whole population to make generalisation about the population. It has the advantage of reducing cost, saving

time and to get a better result for a better conclusion (Crossman, 2018). Purposive sampling according to Etikan, Musa and Alkassim (2016) is a form of non-random sample method whereby the researchers use their own judgement in choosing participants for the study. The researcher has clearly defined what they are researching or studying. Researchers use purposive sampling when they want to access a particular subset of people with specific characteristics, experience or specialised knowledge Bakkalbasioglu (2020). Accordingly, the researcher purposefully selected Twenty (20) teachers from mathematics Department using the Total Population Sampling (TPS) method. According to Etikan et al. (2016), it is best to use the TPS when the entire population meet the criteria for selection and are commonly useful when the cases being investigated are relatively small. The number of full-time teachers handling mathematics at SDA SHS Bekwai are 25 in number and they are all Graduates of mathematics, hence, the decision to include everyone, however, participation was voluntarily. All the members contacted initially agreed to participate, but, 5 pulled out along the line without any reasons.

3.6 Research Instruments

The main instruments which the researcher used for the collection of data in this study was the questionnaire.

3.7 Data Collection Procedure

In order to answer the research questions, questionnaire was designed for teachers to respond to them. A likert scale was used in order to help the researcher generate quantitative data for a better and formidable analysis, conclusions and recommendations. Quantitative research emphasizes objective measurement and the statistical, mathematical, or numerical analysis of data. The conclusions from quantitative research are generalizable due its larger sample size compared to qualitative research design (Babbie, 2010; Mahajan, 2018). Its analysis according to Benny (2016) are considered reliable due the statistical methods employed and it is appropriate for situations where systematic and standardized comparisons are needed.

All the twenty teachers who responded to the questionnaire all males and each of them has at least first degree in mathematics. The first part of the questionnaire was to find out how often the teachers use problem-solving approach in linking classroom mathematics to real life activities. Thirteen questions were put up for teachers to respond to them. These questions focused on how often teachers use group work, computers, field trips, whole class discussions, individual activities, among others in their teaching. The second part of the questionnaire also had sixteen questions which seek to find out from respondents the difficulties they face in the use of the problem - solving approach in linking mathematics to real-life activities.

3.8 Validity

Validity according to Zohrabi (2013), is often defined as the extent to which an instrument measures what it asserts to measure. Validity according to Csikszentmihalyi and Larson (2014) requires that the instrument measures accurately the concepts under study. Oliver (2010) hinted that the extent at which requirements of scientific research method have been followed during the process of generating research findings is termed as validity of research. Zohrabi (2013) said in no uncertain terms that validity of a research is based on the fact the findings are trustworthy and dependable. To ensure validity of both the tests and the questionnaire, I adapted a lot of the questions from

internationally recognized institutions like the IEA responsible for TIMSS, WAEC Examiners Reports among others. I also tried the items at different settings to reshape and resize where necessary. Finally, I presented them to my supervisor for one on one review of the items one after the other to ensure that they are plausible and can stand the test of time.

3.8.1 Reliability

Reliability refers to a measurement that supplies consistent results with equal values. Zohrabi (2013) reveals that reliability measures consistency, precision, repeatability, and trustworthiness of a research. Mohajan (2017) asserts that, it is the degree to which an assessment tool produces constant (flawless) and consistent outcomes. Expert views were sought on the preparation of the questionnaire just to make sure that the items are very reliable.

3.8 Ethical consideration

In connection with the rules and regulations of the university with regard to conducting research using human subjects, the following ethical consideration were made during the course of the research.

3.9.1 Permission

With an introduction letter from the Mathematics Education Department of UEW, I applied to the Headmaster of SDA SHS Bekwai to obtained written permission to conduct this research, in order to ensure that it is a legal exercise and also to satisfy the requirements that govern research at the school of graduate studies, University of Education Winneba.

3.9.2 Confidentiality and Privacy

Confidentiality refers to handling the information concerning the respondents in a confidential manner. Respondents were assured that the information was strictly for academic work and they would be dealt with in the strictest confidence. The participants were assured that their trust would not be exploited for personal gain, rather the outcome is solely for the improvement in the teaching and learning of mathematics at the SHS.

3.9.3 Voluntary Participation

The principle of voluntary participation was explained to the respondents and they were also informed that they had the right to withdraw from the study at any time. No one was forced to answer the questionnaire since, participation was voluntarily.

RESULTS

Research question one:

How often do mathematics teachers use problem solving approach effectively in linking classroom mathematics to real life activities?

The main aim of research question one was to find out how frequent teachers use the PSA in teaching mathematics at Bekwai SHS. The responses of the 20 teachers have been summarized in Table 4.1 be low to give a visual impression to foster easy understanding and evaluation.

Table 4.1 The Frequent Use of Problem-Solving Approach to Link Classroom Mathematics to Real Life Activities

How often do you ask learners to do the following in your class?	**V. R**	**R**	**N**	**F**	**V. F**	**Total**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N(%)**
explain the reason behind an idea	2 (10)	3 (15)	7 (35)	6 (30)	2 (10)	20(100)
represent and analyse relationship using tables, charts or graphs	1 (5)	3 (15)	6 (30)	8 (40)	2 (10)	20(100)
work on pr oblems for which there is no immediately obvious method of solution	5 (25)	3 (15)	7 (35)	4 (20)	1 (5)	20(100)
use computers to solve exercises or problems	12 (60)	6 (30)	1 (5)	1 (5)	0 (0)	20(100)
write equations to represent relationships	1 (5)	1 (5)	6 (30)	6 (30)	6 (30)	20(100)
practice computational skills	3 (15)	0 (0)	3 (15)	7 (35)	7 (35)	20(100)
use graphing calculator to solve exercise or problems	8 (40)	5 (25)	3 (15)	2 (10)	2 (10)	20(100)
work individually with the assistance of the teacher	0 (0)	0 (0)	4 (20)	9 (45)	7 (25)	20(100)
work individually without the assistance of the teacher	1 (5)	0 (0)	6 (30)	10 (50)	2 (10)	19(95)

work in pairs or small groups without the assistance of the teacher	1 (5)	1 (5)	9 (45)	7 (35)	2 (10)	20(100)
work in pairs or small groups with the assistance of the teacher	2 (10)	3 (15)	5 (25)	9 (45)	1 (5)	20(100)
work together as a class with students responding to one another	1 (5)	2 (10)	5 (25)	6 (30)	5 (25)	19(95)
go on field trips	13 (65)	4 (20)	2 (10)	1 (5)	0 (0)	20(100)

Key

VR: very rarely, R: rarely, N: neutral, F: frequently, VF: very frequently, N: number of responses, (%): percentage of responses

From the Table 4.1, only 40% that is 8 respondents, frequently ask learners to further explain the reason behind an idea. A total of 10 out of the 20 respondents said they frequently represent and analyse relationships using tables, charts or graphs. Again only 5 respondents representing 25% frequently engage learners in contextual (non-routine) problems. However, 14 respondents representing 70% of them practice computational algorithms frequently. It was also revealed that 65% of the respondents provide formulas to learners frequently but those who frequently guide learner to either use computer or graphing calculators to solve problems are 5% and 20% respectively.

The high rate of teacher-centred approach is evident here as 16 of the 20 respondents, a whopping 80% said they frequently assist learners individually and only 60% allow learners to work individually without the assistance of the teacher. Frequent group work without the assistance of the teacher is 45% and 50% rate for group work with assistance of the teacher. Whole class discussion saw 55% frequent use and only 5% percent field trips in mathematics lessons.

It is evident from Table 4.1 above that teachers of mathematics at SDA SHS Bekwai do not use the problem-solving approach frequently to link their lessons to real life activities. The responses show that; group work, field trip and other child centred approaches and enquiry-based methods are not frequently used in their lessons.

4.1.2 Research Question Two

Difficulties Teachers Face in using Problem-Solving Approach to Link Classroom Mathematics to Real Life Activities.

Table 4.2 gives a summarized response from the teachers on the challenges they face in the mathematics classroom if they use the problem-solving approach in linking classroom mathematics to real life. The responses to each question have been recorded against its percentage value. This makes it very easy to read and understand for critical analysis and comparison

Table 4.2 The Difficulties Teachers Face in Using the Problem-Solving Approach to Link Classroom Mathematics to Real Life Activities.

How do you agree with the following as difficulties in linking classroom mathematics to real life activities.	**S. D**	**D**	**N**	**A**	**S. A**	**Total**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N(%)**
Class size	0 (0)	0 (0)	1 (5)	7 (35)	12 (60)	20(100)
Time constrains	0 (0)	1 (5)	1 (5)	12 (60)	6 (30)	20(100)
Students' unwillingness to talk in class	0 (0)	4 (20)	0 (0)	11 (55)	4 (20)	19(95)
Student's lack of interest in word	1(5)	0(0)	0(0)	11(55)	8(40)	20(100)
Difficulty in getting real life examples for every topic	1(5)	3(15)	3(15)	8(40)	5(25)	20(100)
Lack of space in the classroom for group work	0(0)	4(20)	2(10)	8(40)	5(25)	19(95)
Seating arrangements	1(5)	2(10)	5(25)	10(50)	1(5)	19(95)
Places high demand on the teacher	0(0)	4(20)	2(10)	8(40)	5(25)	19(95)
Requires a lot of teaching and learning resources	0 (0)	2 (10)	0 (0)	11(55)	7(35)	20(100)
Does not provide for individual learner assessment	1 (5)	6 (30)	3(15)	7(35)	1(5)	18(90)
Pressure to complete the syllabus	0 (0)	1 (5)	1(5)	11(55)	7(35)	20(100)
Students may think that mathematics is only limited to real life	3 (15)	5 (25)	3(15)	6(30)	2(10)	19(95)

Does not encourage transfer of learning	5 (25)	5 (25)	3(15)	7(35)	0(0)	20(100)
Makes abstract thing very difficult, some topics must remain abstract	5 (25)	4 (20)	1(5)	6(30)	3(15)	19(95)

KEY
SD: Strongly disagree, D: disagree, N: neutral, A: agree, SA: strongly agree, N: number of respondents, (%): percentage

Almost all the 20 respondents that is, 19 out 20 respondents representing 95% agreed that class size is an impediment to smooth integration of PSA in mathematics lessons. A total of 18 out the 20 respondents representing 90% agreed that the PSA is time consuming and there is always pressure to complete the syllabus, thereby making it very difficult to stick to the PSA. Moreover 15 respondents representing 75% allude to the fact that learners are not willing to talk in class. It therefore makes it difficult to engage learners in discussions, presentations, brainstorming and other process that are in conformity with the PSA and 13 respondents representing 65% totally agreed that it is very difficult to get real life examples for every lesson. Lack of space in the classroom and seating arrangements are also cited as some of the difficulties that impede smooth integration of the PSA in mathematics lessons.

A whooping 18 respondents thus 90% openly declared that the PSA requires a lot of teaching and learning resources and 65% respondents that is 13 agreed that the method places high demand on the teacher. In a sharp contrast, most of the responders are of the view that the PSA encourages transfer of learning and it provides for individual learner assessment however, they were divided as to whether or not the PSA makes abstract thinking difficult.

In all, it can be seen from Table 4.2 above that the teachers at Bekwai SDA SHS do not use the PSA mainly because of time constraints, seating arrangements, difficulty in getting real life examples for every lesson, learners' unwillingness to talk in class, among others.

4.2 Discussion

The responses obtained from the questionnaire in respect of research question one is a clear indication that teachers at Bekwai SDA SHS use the PSA infrequently. As a result of the traditional method of instruction they are unable to link the classroom mathematics to real life activities. This revelation is in tandem with Anamuah-Mensah et al. as cited in Nyala, Assuah, Ayebo and Tse (2016), which revealed that, the use of the PSA is limited in Ghanaian Schools because teachers spent most the instructional time on solving textbook questions. Developing fast calculations and computational algorithms is inconsistent with Morden researches. (Baah-Duodu, Osei-Buabeng, Cornelius, Hegan & Nabie, 2020; Adu, Mereku, Assuah, & Okpoti, 2017), Ina et al.2016; Arthur, Asiedu-Addo & Assuah, 2017; Nabie, Akayuure & Sofo, 2013; Sullivan, 2011; Rittle-Johnson & Schneider, 2015; Boaler, 2015; Zaharin, Sharif & Marianppa, 2018).

The second part of the questionnaire also showed various difficulties teachers at Bekwai SDA SHS face in linking the classroom mathematics to real life activities. The prominent among them are; large class size, pressure to complete the syllabus, learners' unwillingness to participate in discussions, time constrains, difficulty in getting real life examples for every lesson, increasing the teacher's workload, demands a lot of teaching and learning resources and learners lack of interest in word problems. This observation is not new as Eduafo (2014) admitted without any shred of doubt that the implementation of a problem-solving approach has been greeted with plethora of difficulties as teachers see it as time wasting, only applicable to small class size, puts high demand on the teacher, requires lots of resources, difficulty of implementing without non-routine activity-oriented text book, difficulty of implementing it with an examination driven curriculum, and lacking in individual evaluation. He however, concluded that the difficulties notwithstanding, teachers must endeavour to use the problem-solving approach since it is the only way to link the classroom mathematics to the real-life activities.

5.1 Summary

The purpose of the study was to find teachers frequent use of the PSA in linking classroom mathematics to real life. It also sought to find out the difficulties or impediments to the use of the PSA. Twenty (20) Mathematics teachers were used for the study, the instruments used for the study was questionnaire and was analysed using SPSS.

5.2 Findings

Research question one: How often do mathematics teachers at SDA Senior High School use problem-solving approach in linking classroom mathematics to real life activities?

The analysis of the responded questionnaire from the SPSS is very clear and precise in bringing out the teachers' attitude towards the use of the problem-solving approach in teaching mathematics at the SHS with the aim of making the classroom mathematics relevant to life. It was evident that notwithstanding, the numerous benefits in using this approach in teaching, teachers still use the Traditional cookbook approach in teaching. Teacher centred methods of instruction which focus on computational algorithms rather than the child centred methods such as; group works, discussion, presentations, brainstorming among others. It is these child centred methods that develop learners' oral communication skills, as well as enhancing relational understanding of concepts and ideas which aim at improving learners' performance. However, only few teachers rather occasionally use the problem-solving approach in their mathematics teaching.

Research question two: What are the difficulties teachers encounter in using the problem-solving approach in linking classroom mathematics to out of school mathematical activities?

The second part of the questionnaire revealed the perceived challenges and difficulties that are associated with the use of the PSA in teaching mathematics at the SHS. Among the difficulties that impedes the smooth integration of the PSA according to the respondents are; Large class size, pressure to complete the syllabus, learners' unwillingness to participate in discussions, time constrains, difficulty in getting real life examples for every lesson, increasing the teacher's workload, teaching and learning resources and learners lack of interest in word problems.

5.3 Conclusion

As per the findings of the study, the researcher wishes to conclude that; teachers at SDA SHS Bekwai must endeavour to use the problem-solving approach to link their lessons to real life activities because the difficulties associated with it.

5.4 Recommendations

Based on the findings, the study recommends the following;

1. Teachers must have conceptual understanding of every topic they teach.
2. Teachers should endeavor to read around each topic to get enough practical examples for every topic they teach.
3. Teachers must ensure that their lessons are linked to real life activities
4. Teachers must provide opportunities for all learners to learn
5. Heads of Department at the mathematics should ensure that teachers have access to resources and materials for smooth instructions.

APPENDIX F

THIS IS SOLELY FOR ACADEMIC WORK. YOUR RESPONSE WOULD BE HANDLED CONFIDENTIALLY AND ANONYMOUSLY. PLEASE WE NEED YOUR RESPONSE TO HELP IMPROVE ON THE TEACHING AND LEARNING OF MATHEMATICS AT THE SHS

Thank you for your time, effort and thought in completing this questionnaire

PART ONE

How often do you ask students to do the following in your mathematics class?

Check one box in each row

	Very Rarely	Rarely	Occa.	Freq.	VF
a. explains the reason behind an idea……	☐	☐	☐	☐	☐
b. represents and analyze relationship using tables,charts or graphs..	☐	☐	☐	☐	☐
c. work on problems for which there is no immediately obvious method of solution……	☐	☐	☐	☐	☐
d. use computers to solve exercises or problems……	☐	☐	☐	☐	☐
e. write equations to represent relationships……	☐	☐	☐	☐	☐
f. practise computational skills……	☐	☐	☐	☐	☐
g. use graphing calculator to solve exercise or problems…….....	☐	☐	☐	☐	☐

h. work individually without the assistance of the teacher……..…

☐ ☐ ☐ ☐ ☐

i. work individually with the assistance of the teacher……..….

☐ ☐ ☐ ☐ ☐

j. work in pairs or small groups without the assistance of the teacher

☐ ☐ ☐ ☐ ☐

k. work in pairs or small groups with the assistance of the teacher....

☐ ☐ ☐ ☐ ☐

l. work together as a class with students responding to one another…

☐ ☐ ☐ ☐ ☐

m. go on field trips……..

☐ ☐ ☐ ☐ ☐

PART TWO

Hindrance to smooth integration of Problem-Solving Approach in the teaching and learning of mathematics at the SHS

Check one box in each row

	Strongly Agree	***Disagree***	***Neutral***	Disagree	Agree
a. class size ……	☐	☐	☐	☐	☐
b. time constrains ……	☐	☐	☐	☐	☐
c. students' unwillingness to talk in class……	☐	☐	☐	☐	☐
d. difficulties in getting real life examples for every lesson……...	☐	☐	☐	☐	☐
e. most student·s	☐	☐	☐	☐	☐

f. were taught using the computational algorithms at the basic school……

g. students ' lack of interest in the word problem…

h. lack of space in the classroom for group work …

i. seating arrangements ……

j. places high demand on the teacher ……

k. requires a lot teaching and learning resources …

l. does not provide for individual learner assessment ……

m. pressure to complete the syllabus ……

n. Students may think that mathematics is only limited to real life....

o. does not encourage transfer of learning……

p. makes abstract thinking difficult some topics should remain abstract