

Using an Improvised Game Board to Solve Algebraic Expressions: A Case of a Ghanaian Basic School

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Abstract: - The research which is conducted for pupils of Kyiremfaso Anglican Primary six (6) is an action research and aimed at helping the pupils in adding algebraic expressions using an improvised game board. The population consisted of 34 pupils from basic six, of which thirteen (13) were girls and the remaining 21 were boys but only 20 pupils were selected and used as the target group through simple random sampling technique. Efforts were made by the researcher to find the interventions to the problem identified. Based on the objectives stated, the researcher observed and tested the pupils in order to be certain about the true picture of the problem of the pupils' inability to add algebraic expressions. In analyzing the data, percentage tables were used. After careful analysis of the data obtained, the results revealed some of the causes of the pupils' inability to add algebraic expressions. Despite the fact that the intervention assisted to solve all the problems, it is suggested that teachers should try as much as possible to use adequate teaching and learning materials in teaching. Also, the use of local language to explain certain aspects should be encouraged. Finally, the researchers recommend that, there should be the need for teachers to attend in-service training and workshops to update themselves in the new system of teaching.

Keywords: Improvised, Game board, Algebraic Expressions, Logical, Mathematic Curriculum.

I. INTRODUCTION

1.1: Background to the Study

There is an increasing and continuous demand for good scientist and technicians all over the world. This has created the need for greater and quicker development of science and technical education. People who wish to keep in touch with development need a wider knowledge of mathematics, which has become the bedrock of scientific advancement.

In response to the fast changes in the society, Ghana has developed and maintained a compulsory mathematics curriculum for all levels of education, starting from basic school to tertiary institution to pave way for pupils to acquire relevant mathematical idea needed for technological development of the country. It is not easy to give one simple straight forward answer to what mathematics is.

The history of mathematic offers interesting information about the development of mathematical knowledge within a culture and across different cultures (Radford, 1997). Mathematics is a branch of science, which deals with numbers and their operations. It involves calculation, computation, solving of

problems etc. Mathematics is the science of numbers and space or Mathematics is the science of measurement, quantity and magnitude. It is exact, precise, systematic and logical subject.

Mathematics teaching is very important for intellectual developments, there is no other subject in the curriculum like mathematics which makes students brain active. Problem solving helps in the development of mental faculties. Mental work is needed to solve mathematics problems. If a child, has a mathematical problem his/her brain becomes active in solving that problem. Each problem of the mathematics possesses such sequence which is necessary for constructive and creative process. In this way, all-mental abilities of child are developed through mathematics.

Moreover, mathematics makes the man very calculative so that he/she can economies time, money, speech, thought etc. It develops a strong will power, patience and self-reliance. It, also develop the faculty of discovery and invention.

Mathematics as stated by Asarfo Adjei (2005), is a subject that deal with the ways of finding answers to problem using our knowledge of shape and measure in everyday life using numbers in country and thinking for ourselves in seeing and using relationship. From this thought, it means that mathematics is a subject that enables us to calculate, reason logically, apply our knowledge of shape and space to find answers to problems that confront us daily. It implies that, it is a very important subject in all levels and pupils' in basic school must be taught not only how to solve particular problem, but also understand why the method is used in teaching. In this case it is the role of the teacher to encourage pupils in practical activities by manipulating TLM's and to find out mathematical rule or concept themselves. This is advocated by Richard Skemp (1994), and Chinese proverb quoted by Nuffield mathematics Textbook (1994), as "I hear I forget, I see I remember, I do I understand". From this point of view, the researchers attempted to make teaching and learning of mathematics practically oriented so that pupils' will participate effectively in the lesson. Mathematics is of central importance to modern society. It provides the vital under pinning of the knowledge of economy. It is essential in the physical sciences, technology, business, financial services and many areas of ICT. It is also of growing importance in biology, medicine and many of the social sciences.

Mathematics forms the basis of most scientific and industrial research and development. Increasingly, many complex systems and structures in the modern world can only be understood using mathematics and much of the design and control of high-technology system depends on mathematical inputs and outputs.

One of the practical topics in mathematics is algebraic expression. Algebraic expression is the result of adding things together also when variables are used with other numbers or operations they create an algebraic expression. In all aspect of human life, mathematics is needed. Farmers, shopkeepers in their store, and market places apply the concept of algebraic expression during their daily activities. But on the contrary most pupils' of today attach little importance to the learning of mathematics and for that matter do not learn it. This case is not different from pupils' of Kyiremfaso Anglican Basic six.

During the study at Kyiremfaso Anglican basic six, it was seen that most of the pupils' performed poorly after an evaluation exercise was administered. The problem was due to the fact that the teacher did not use concrete material and correct approach in teaching the topic. As a result, pupils' have developed a negative attitude towards the subject. This prompted the researchers to research strongly into the problem.

The school that the researchers did this research is Kyiremfaso Anglican Primary. It is situated in Kyiremfaso, a sub town of Mampong which is part of Ashanti region in Ghana. Kyiremfaso Township is 3km drive from Mampong, the population of the town is about two thousand. Occupation of most of the people is farming and others are traders. The occupation of this community affects the punctuality of the pupils, thus making them to have fewer attendance to mathematics period and also be sleeping in class. At times these pupils follow their parents to farm and some to market before and even during classes' hours.

TLM's are materials and equipment that can be used to arouse and maintain pupils' attention and sustain their interest in what is being taught (Dosso, 2001). It is therefore necessary that teachers provide these teaching and learning materials during teaching periods. Due to the diverse ways in which teaching learning materials help both the teacher and the pupils, the researcher believes that the problem at hand can be rectified when an improvised game board is designed and use appropriately in the lesson presentation and facilitate pupils' understanding and let them have interest in mathematics as subject.

1.2: Statement of the Problem

It is an indisputable fact that through addition, multiplication and subtraction, one can easily solve basic problems relating to Mathematics. It is with this idea that the mathematics syllabus is well structured in such a manner that every Ghanaian child of school going age is expected to be introduced to addition right from the basic one (1).It is

however a big problem to find pupils in Basic Six at Kyiremfaso Anglican who upon their early stages of introduction to addition of algebraic expression as contained and expected to be achieved in the curriculum still find problem in solving addition of simple algebraic expressions.

These came to light after the researchers conducted a pre-test for 20 pupils among a class of 34 pupils on addition of algebraic expressions. After marking, it was realized that the pupils did not perform well. As a result of the answers some of them gave, the researchers then identified the pupils' problem to be inability to understand the topic "addition of algebraic expressions".

1.3: Purpose of the Study

The main purpose of the study is to improve the performance of the pupils of Basic six of Kyiremfaso Anglican Basic School on the topic "Addition of Algebraic Expressions". Therefore, by the end of the research process, the researcher intends:

1. to identify the causes of the pupils' inability to solve addition of algebraic expressions.
2. to identify solutions to the causes of pupils' inability to do simple calculation on addition of algebraic expressions.
3. to design a game to teach the concept of addition of algebraic expressions.

1.4: Research Questions

In order to carry out the study effectively, the researchers were guided by the following research questions.

1. What are the causes of Kyiremfaso Anglican Basic Six (6) pupil's inability to understand the topic "Addition of Algebraic Expressions"?
2. What steps should be taken to improve the knowledge of Basic Six pupils on the "addition of algebraic expressions" in Kyiremfaso Anglican Basic School?
3. How effectively will the game of "addition of algebraic expressions" help to improve the understanding of Basic Six pupils of Kyiremfaso Anglican Basic School on the concept, "addition of algebraic expressions"?

1.5: Significance of the Study

The outcome of the study will be very helpful to pupils, teachers and educational planners as well. Thus, it will help improve pupils' interest in mathematics as they interact with the concrete material.

Again, it will help teachers to use varieties of teaching methods and techniques in teaching for pupils to easily catch up concept.

In addition, the findings of the study will be very beneficial to other teachers in guiding them to develop and use teaching and learning aids during teaching.

To crown it all, this action research will serve as a reference book for all and sundry especially educationists and curriculum planners, so that they can contribute their quota effectively to the growth and development of our country Ghana.

II. REVIEW OF RELATED LITERATURE

The concept of Algebra

The word algebra comes from the Arabic “al-jabr”. It was used together with “al-muqabala” in a famous text concerning equation solving, written by al-Khwarizmi, who lived in Bagdad in the beginning of the 9th century AD (Kiselman & Mouwitz, 2008). The word “al-jabr” can be translated as “restoring” (Katz, 1993). It refers to the operation of moving one term with a minus sign from one side of an equation to the other side and changing the sign to a plus sign (Kiselman & Mouwitz, 2008). The word “al-muqabala” can be translated as “comparing” and denotes the operation involved when taking away equal amounts from both sides of an equation (Katz, 1993). Transforming the equation $3x + 2 = 4 - 2x$ into $5x + 2 = 4$, is an example of “al-jabr”, while converting the same equation to $5x = 2$ it is an example of “al-muqabala”. It is notable, as Katz explains, that our word algebra, is a corrupted form of “al-jabr” and came into use when the work of al-Khwarizmi and other related treatises were translated into Latin. The word “al-jabr” was never translated and became the established general term for the entire science of algebra.

According to Gerald, et al (1981), algebra is a generalization of arithmetic in which variables play an important part. Algebra is a branch of mathematics designed to help solve certain types of problem quicker and easier. Algebra is based on the concept of unknown values called variables, unlike arithmetic which is based entirely on known number values. Algebra is one of the broad parts of mathematics, together with number theory, geometry and analysis. It is a branch of mathematics dealing with symbols and the rules for manipulating

In its general form, Algebra is the study of mathematical symbols and the rules for manipulating these symbols, it is a unifying thread of almost all of mathematics. It’s includes everything from elementary equation solving to the study of abstractions such as groups and fields.

We use Algebra every day of our lives. Examples of ways that we use algebra are finding the distance, perimeter of an area, volume, determining the coast of something, renting something, time relationships, pricing options for something you want to buy, and more.

According to AsafoAdjei (2002); Algebra is a very formal and abstract topic in Mathematics. He further explained that algebra may be termed as any reasoning or thinking which might give rise to symbols likes x 's and y 's. It involves mathematical exercises which required the manipulation of symbols like simplification of expressions, substitutions,

setting up equations and solving the equations. In order to teach the concept to the understanding of the pupils, Asafo-Adjei suggested Teaching Learning Materials (TLMs) such as flag diagram, counters and rectangular cut out. The above mentioned points have been confirmed in the recent work of Apronti and Afful (2001); that in algebra, symbols are used to denote mathematical concepts such as numbers, sets, relations and operations.

They further explained that a box \square can be represented by a letter such as a, b, c, and so on. We normally use x, y, and z but any letter can be used. We can therefore write $3 + \square = 7$ as $3 + x = 7$.

The concept of Algebraic expression

Algebraic expression is a mathematical expression that consists of variables, numbers and operation, and a topic under the concept Algebra. It is formed from variables and constants using different operations. Algebraic expressions are made up of terms. A term is the product of factors; Factors may be numerical as well as algebra. Coefficient is the numerical factor in a term. Sometimes, any factor in a term is called the coefficient of the remaining part of the term. The terms having the same algebraic factors are called like terms and the terms that have different algebraic factors are called unlike terms. Expressions with one term is called a monomial whereas expressions with two unlike terms is called a binomial. In mathematics, an algebraic expression is built up from integer constant, variables and the algebraic operations (addition, subtraction, multiplication, division and exponentiation by an exponent that is a rational number). For examples, $3x^2 - 2xy + c$ is an algebraic expression.

For the pupils to follow the concept, Apronti and Afful (2001) suggested the use of, Teaching Learning Materials (TLMs) such as flag diagram, balance, model and number line to teach the topic, “addition of algebraic expressions”. In algebraic expressions, letters stand for numbers. The numbers can be whole numbers or fractions, positive or negative. For example, $3a + 4$, $b + 27$, $3d + 2e + 21$. Algebraic expressions can be written without brackets. They further suggested rectangular shapes to teach the topic, addition of algebraic expressions for the pupils to understand.

Kaufmann (2015), in his development described algebra as generalized arithmetic. He stated that, in arithmetic, symbols such as 6, $\frac{2}{3}$, 0.27 and π are used to represent numbers. The operations of addition, subtraction, multiplication, and division are commonly indicated by the symbol +, -, \times and \div respectively. Using these symbols, specific numerical expressions can be formed. For example, indicated sum of six and eight can be written as $6 + 8$. Kaufmann suggested the real number line to teach the topic addition of algebraic expressions to the understanding of the pupils.

Algebraic expression is a “language of Mathematics”. It uses small letters to stand for unknown

numbers. These letters are called variables, since they can be replaced by different numbers. In the examples below, the letter x can take on many values, such as $x=1$, $x=2$, $x=3$ and so on. The number that is placed in front of a variable in an expression is called coefficient of the variable. So the coefficient of x in $3x$ is the number 3, and the coefficient of y in $5y$ is the number 5. They further suggested Box method to teach the topic addition of algebraic expressions in order for the pupils to understand.

Tirosh, et al (1998) found that the teachers who had conceptual knowledge and the knowledge of students could show effective practice with explaining like term and unlike term, and use strategies for simplification algebraic expressions appropriately. In algebra learning, both conceptual and procedural development of the algebraic expression is essential for forming an equation and solving it (Capraro & Joffrinon, 2006). However, manipulating algebraic expressions is one of the difficult algebra topics for students (Banerjee & Subramaniam, 2012; Livneh & Linchevski, 2007; MacGroger & Stacey, 1997; Seng, 2010). At this point, the studies about algebra teaching are scarce and there is also a need to understand the causes of students' difficulties in algebra learning. Thus, this study focuses on teaching practices of addition of algebraic expressions.

All the above literatures agreed on the use of variables to denote the unknown in the addition of algebraic expression and also stated the use of flag diagram, rectangular cut out and number lines to treat the concept. Therefore, the researchers think if the above recommendations are followed appropriately, the problem facing the pupils of Kyiremfaso Anglican primary will be rectified.

Causes of pupils' inability to add Algebraic expression

The abstract structure of algebraic expressions posed many problems to pupils such as understanding or manipulating them according to accepted rules, procedures or algorithms. One of the cause of pupils' inability to add algebraic expression is the poor arithmetic background of them.

Another cause of pupils' inability in adding algebraic expressions is their difficulties in translating mathematical phrases into symbols, thus; pupils' inability to interpret the sentences.

Again, inappropriate use of teaching and learning materials by teachers during instructional period. The use of only one method and strategy by teachers in teaching the concept of algebraic expressions.

Also, one biggest struggle of pupils in adding algebraic expressions is understanding of the letter symbolic form of the algebraic equations presented to them. Moreover, the use of inappropriate method and procedure in teaching is another cause of pupils' inability to add algebraic expression.

In addition, learners' failure to grasp concepts or rules in the concept can be attributed to lack of motivation by teachers and parents.

The Remedy Tool

The researchers intended to use an improvised game board to help pupils of Kyiremfaso Anglican Basic six to add algebraic expressions. The game board is made up of a plywood and on which there is a game pieces cut out in a fine shape. On this game board there are different colours such as blue, green, white and an additional sign painted with black and white colour which makes the game pieces.

In using the game board to add algebraic expressions, you represent a given variable by a colour on the board, group like terms and then you add the colours to get an answer. On the game board different colours cannot be added, this tells that different variables cannot be added.

Uses of teaching and learning material in teaching

Teaching and learning materials are any collection of materials including animate and inanimate objects and human and non-human resources that a teacher may use in teaching and learning situations to help achieve desired learning objectives. Teaching and learning materials are used to enhance the learning of students in the classrooms. A teacher uses it to make teaching and learning effective. TLMs also helps learners to achieve the learning outcomes after classroom teaching and learning.

The importance of using Teaching and Learning Materials are:

1. It makes lesson practical and real.
2. It saves time and energy of the teacher.
3. It reduces the workload of the teacher.
4. It helps pupils have the opportunity to interact with objects thereby actively involving the pupils.
5. It also promotes the development of generic skills of learning, observing, measuring and recording,

Ghana Education Service (GES), (2001), sees the importance of the use of Teaching Learning Materials because of the following good effects it has on teaching and learning:

1. Teaching and Learning Materials demystifies science and creates interest in learning.
2. It enables many of the learners to engage in practical activity at the same time.
3. It enables many learners to develop an appreciation of the use of everyday things in their environment.
4. It saves the teacher from talking more.

Teaching and Learning Materials have good impact on teaching and learning. Some of these impact or importance are as follows;

1. It makes pupils active and participations are encouraged
2. Pupils' interest is sustained

3. It shows the pupils that learning can be fun, real and exciting activity.
4. It brings variety into teaching.

Piaget's educational implication of his theory explains that, the use of teaching and learning materials to teach children helps them to interact well with their environment which helps them to build up mental picture and structure effective learning.

In education, Fianu (2005) stated that the use of teaching and learning materials will enable the teacher to decide exactly when and how materials should be used during lesson delivery. It also enables the teacher to plan what question to ask pupils and what follow-up activities might be appropriate. In addition, Fianu (2005) stated that inappropriate use of Teaching Learning Material by some of the teachers in lesson delivery makes it difficult for the pupils to understand whatever topics they teach.

III. METHODOLOGY

This chapter focuses on the researcher's techniques and method employed in the study. It also elaborates on the research design, population, sample and sampling procedure, research instruments, data collection procedure/intervention processes as well as data analysis. It again describes the research design that were used to make the research work valid and reliable.

3.1: Research Design

Educational research is the study and investigation in the field of education or bearing upon educational problems. The research design used was an action research. It focuses on specific problems in a particular setting for example in a single classroom situation.

Action research is simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out (Carr and Kemmis 1986).

Meyer (2000) maintains that action research's strength lies in its focus on generating solutions to practical problems and its ability to empower practitioners, by getting them to engage with research and the subsequent development or implementation activities. Meyer states that practitioners can choose to research their own practice or an outside researcher can be engaged to help to identify any problems, seek and implement practical solutions, and systematically monitor and reflect on the process and out-comes of change.

The researchers used action research in the course of carrying out the study because, the study focuses on specific problem in Kyiremfaso Basic Six, a particular setting, therefore there is the need to use it.

The action research design has some strengths which are;

1. The researcher gets enough time to research into that specific setting.
2. The action research helps the classroom teacher to establish conditions in the classroom which enables him or her to achieve a particular result
3. It helps to adopt the use of effective method of teaching.
4. It provides a powerful means of improving and enhancing practice as well as bridging the theory-practice gap.
5. It aids in improving the effectiveness of teaching as a measure of making teachers efficiency in imparting knowledge and development on the students.
6. Action research aids in building of a professional culture in the profession of the practitioners.

Despite those strengths of action research, there are some weaknesses such as;

1. The disappointment and discouragement as the researcher finds it difficult to get resource materials for the study.
2. It does not allow the researcher to relate his or her study to other settings having similar problem.
3. Researchers are not allowed to form team.
4. It is time consuming.
5. It is localism, often takes place on a local scale.
6. It is difficult in planning.

3.2: Population

The target population for the study is thirty-four (34) pupils in a class. The girls are thirteen (13) and the boys are twenty-one (21) in number.

3.3: Sample and Sampling Procedure

The researchers sampled only twenty (20) pupils for the study. They used simple random sampling technique to select the twenty pupils. In selecting the number of pupils for the study, the researchers wrote numbers on piece of papers that corresponded to the number of pupils in the class. The papers were placed in a box mixed up. Pupils were then invited to pick a paper each. All those invited who picked 'from 1 to 20 were chosen for the research. The researchers used this particular technique to select pupils in order to avoid bias in the selection of the sample for the study.

3.4: Research Instruments

Observation and test were the main instrument used for the study. These instruments were used because it would make it easier to obtain the necessary information for the study. It will also help the researchers to obtain valid and reliable results and know how to correct the problem of inability to add algebraic expressions among the pupils.

3.5: Intervention Processes

It is a set of strategies planned and implemented to solve a specific problem. Is a step by step procedure, and the process

includes the pre-intervention stage, the intervention stage and the post-intervention stage.

3.5.1: *Pre-Intervention stage:* The researcher constructed and administered a pre-test to help diagnose the problem.

Administration of the Pre-test

The researcher gave out pieces of papers to the 20 selected pupils for the study and asked them to write their names, date and the class in which they are on the paper. The researcher then wrote five algebraic questions on the chalkboard for them to solve. This was done in the classroom at a reasonable time given by the researcher. The summary of the marks obtained by the pupils after the marking are shown in table 1 below.

Table 1: A table showing the performance of pupils in the pre-test

Marks	Number of pupils	Percentage (%)
0 – 5	13	65
6 – 10	7	35
Total	20	100

From the above table, thirteen pupils representing 65% scored from 0-5. Seven pupils representing 35% scored from 6-10. Therefore, from the table, 65% of the pupils selected performed poorly. The poor performance of pupils made the researchers to undertake series of interventional activities to remedy the situation.

3.5.2: *Intervention Stage*

The intervention put in place is a game of addition of algebraic expressions board. On the game board, there is a ‘game piece’ made in pentagonal shapes and painted with colours; green, blue and yellow with the addition sign painted black and white. The following is the description of how the intervention was designed and the necessary materials used.

Development of the intervention tool

(A) Tools

Plane

Saw

Hammer

Try square

Measuring rule

Pencil

Materials

Plywood

Nails

Vanish paint

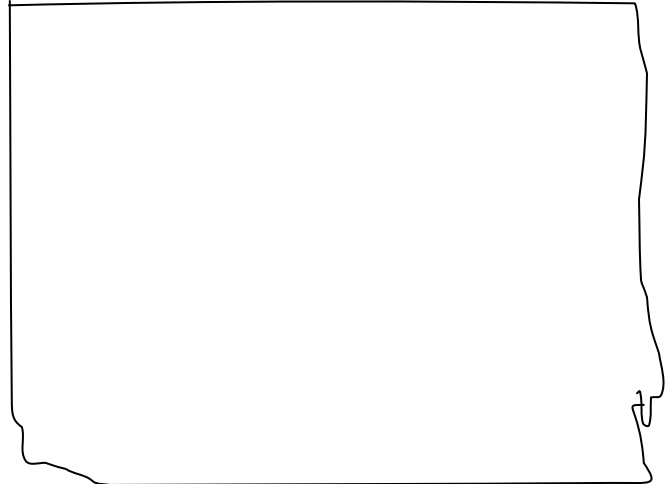
Oil paints – green, blue, yellow and black and white.

Button

(B) STAGE ONE

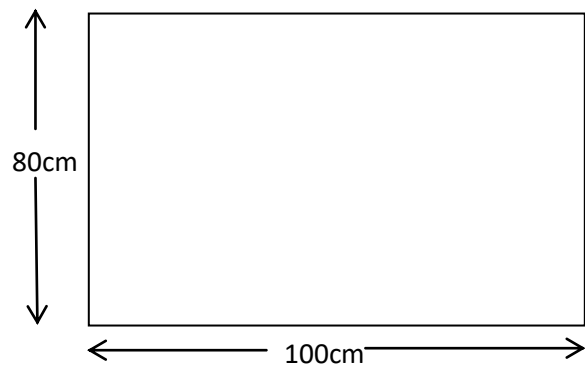
Dimensioning

The researchers used a rule and pencil to mark out the dimension of the board on the plywood.



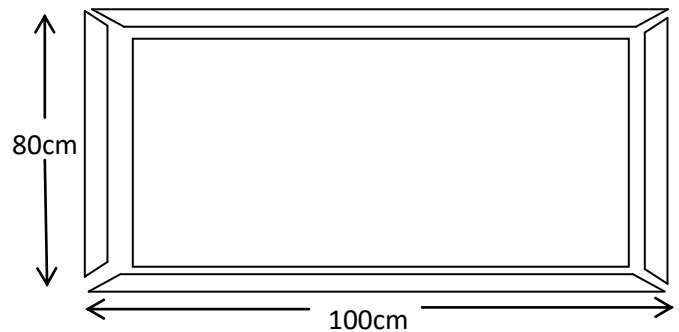
(C) STAGE TWO

A saw was used to cut the marked out board from the plywood.



(D) STAGE THREE

Buttons were cut to re-enforce the edges



(E) STAGE FOUR

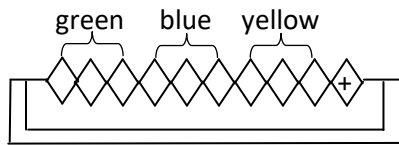
- i. A thin plywood was cut to divide the board into two halves to hold the “game pieces”
- ii. Thin cut outs were also made to re-enforce this edges.



(F) STAGE FIVE

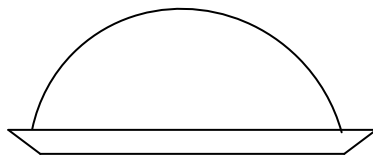
(i) “Game pieces” were made in a fine shape and painted with colours of green, blue and yellow and black and white for the ‘game piece’ with the addition sign.

(ii) A re-enforced button was made in between the button edge and the middle division to hold the ‘game pieces’



(G) STAGE SIX

Hooks were made at the back of the upper edge to hang the teaching learning material on board during teaching.



(H) STAGE SEVEN

Assembling the project:

Nails were used to hold all the parts together. Emery cloth was used to polish the surface of the plywood and buttons. Vanish paint was applied to give it a good finish.

How the intervention tool was used?

After the TLM was designed by the researchers, they used it to teach the pupils of Kyiremfaso Anglican Basic Six (6) class to improve their understanding on the concept “Addition of Algebraic Expressions”. The steps are as follows;

The researchers ask pupils to identify the like terms in the expression below by crossing them out $2a + 6c + 3a - 4c + 2c + 13m - a + 6m$. The researchers let pupils re-group the like terms in the expression thus $2a + 3a - a - 6c + 2c - 4c + 13m + 6m$. The researchers then display the game board on board for pupils to see and voice out what they observe.

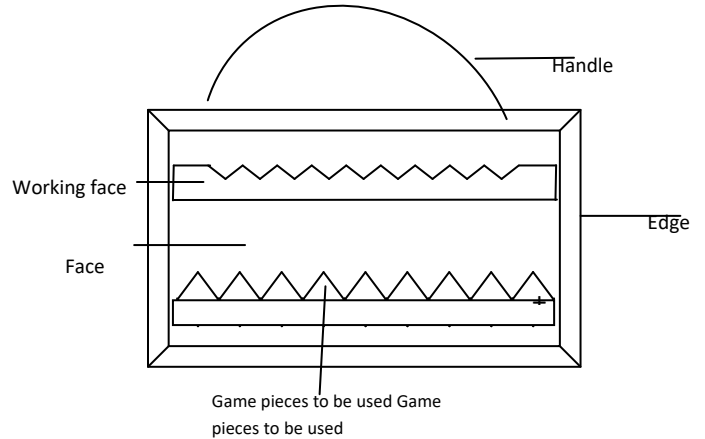
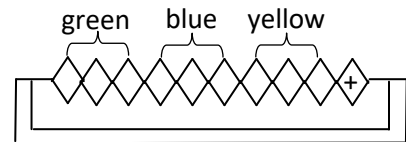


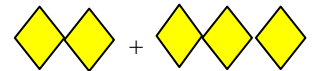
Fig. 1: Improvised Game Board

The researchers let pupils identify the various colours making up the game pieces. Thus green, blue and yellow on the game pieces to be used.



The researchers then demonstrate for pupils the addition of like termed algebraic expressions using the coloured game pieces by picking 2 yellow and 3yellow with the addition sign to show the expressions below:

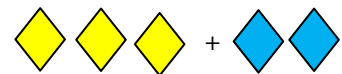
2 yellow + 3 yellow



The researchers let x denote colour yellow and guide pupils to realize addition in terms of the variable x in the expression above and guide them to add up to get 5yellow which is 5x.

The researchers demonstrated for pupils the addition of unlike terms with two different coloured game pieces in the expression below;

3 yellow + 2blue



The researchers let pupils realize from the expression above that different colours cannot group to form a group of one colour. The researchers again let y denote the blue colour and let pupils realize that unlike terms do not add.

The researchers allowed the pupils to solve the following questions using the game board designed.

1. $4x + c$
2. $2y + 3y$
3. $3a + 2x$
4. $x + y$
5. $c + 2c$

3.5.3: Post Intervention Stage

The post intervention stage is the last stage of the intervention process. The researchers went over the core points briefly with pupils and gave a parallel exercise to the pupils to solve in their exercise books. The exercise books were collected afterwards, marked and errors observed were corrected accordingly. Through the use of the intervention material, "game board", the pupils now understood the concept of "Addition of Algebraic Expression". This was confirmed by the results of the post-test.

IV. RESULTS AND DISCUSSION

This section of the study presents the analysis and interpretation of the results attained before and after the intervention. The tables below represent the results of both the pre-test and post-test.

4.1: Data Presentation and Analysis

The following are the data and analysis of the pre and post-tests represented in the tables below. The test items were marked over ten.

Table 2: Pre-test results

Marks	Number of pupils	Percentage (%)
0 – 5	13	65
6 – 10	7	35
Total	20	100

Table 3: Post-test results

Marks	Number of pupils	Percentage (%)
0 – 5	4	20
6 – 10	16	80
Total	20	100

From the tables above, in the pre-test, thirteen pupils representing 65% scored between 0 – 5, 35% of seven pupils scored marks between 6 and 10. Also, from table 3, that is the post-test, four pupils representing 20% of the pupils scored marks between 0 – 5 and 80% of the pupils representing sixteen pupils scored marks between 6 – 10.

After analyzing the pre and post-tests, 65% representing thirteen pupils performed poorly in the pre-test while 80% representing sixteen pupils performed marvelously well in the post-test. Looking at the result of the Basic six pupils of Kyiremfaso Anglican Basic School, their performance in the post-test was good. The researchers then

realized that the teaching learning material designed and implemented actually helped the Kyiremfaso Anglican Basic Six (6) pupils to understand the concept of "Addition of Algebraic Expressions" and also helped the researchers to achieve their stated objectives.

In summary, the study findings are as follows;

On the data presented, the researchers realized that the performance of the pupils of Kyiremfaso Anglican Basic Six (6), in the pre-test was below average while the performance of pupils in the post-test was above average. This clearly indicates that the pupils understood the topic, "Addition of Algebraic Expressions" properly because of the intervention put in place.

The intervention helped the researchers to present their lesson sequentially and logically, this helped the pupils to understand the concept "Addition of Algebraic Expressions". The instrument used helped the researchers to obtain the various marks obtained by the pupils to guide them analyze the findings to see whether they have achieved the stated objectives or not.

The researcher's teaching and learning material designed helped to teach and improve the ability of pupils of Basic six at Kyiremfaso Anglican primary school in the addition of algebraic expressions. The teaching and learning material also encouraged other teachers in the school to use teaching and learning material during lesson delivery. This brought a positive change in the school as far as teaching and learning is concerned.

V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

This section of the research deals with the summary of the key findings, drawing of conclusion and recommendation.

5.1: Summary

The main findings from the study were on issues of the need for teachers to use appropriate teaching and learning materials in teaching mathematics. It was realized that teachers who use appropriate teaching learning materials in teaching mathematics help in enhancing pupils' ability in mathematics.

Again, it was obvious that allowing unprofessional teachers to teach mathematics in basic school results in ineffective teaching of the aspect as these types of teachers lack the skills in applying the right teaching technique.

Moreover, the study disclosed the fact that most parents of Kyiremfaso were not encouraging and motivating their wards to solve questions involving calculations at home. All these contributed to the pupils' inability to add algebraic expressions.

In view of this, the researcher reviewed the concept "addition of algebraic expressions".

Thus, what authors say concerning the named concept, "Algebraic expressions" to help get solution to the problem identified.

A methodology was adopted for the study. It centered on the population of the study, mode of sample selection, instrument and intervention used for the study. The population for the study was 20 pupils from primary six of Kyiremfaso Anglican.

Observation and test were the main instrument used for the data collection. The observation was done secretly while the test was open. The pre-test was used to diagnose the problem of the pupils and their performances were poor. The researchers then design a game board to teach the named concept, "Algebraic expressions", where pupils were given the chance to manipulate the game board to their understanding. Afterwards a post-test was conducted to evaluate the impact of the teaching learning material used and their performances were good.

The researchers analyzed the performance of the pupils in both tests which were presented on percentage tables. The analysis showed that the post intervention put in place solved the problem of the pupils' hence positive results in pupils' performance.

5.2: Conclusion

The analysis of the data collected by the researchers reveal that, if concrete materials are effectively used to involve pupils in series of activities, much can be achieved in pupils' ability to add algebraic expressions. This confirms the findings in the literature review; according to Asarfo Adjei who said that, in algebra, letters stand for numbers and the use of teaching and learning materials appropriately decide exactly the actual concept that the teacher wants the pupils to know.

Again, teachers in general should adopt different strategies and techniques during instructional period. Therefore, stakeholders, teachers and philanthropist in education sector should find appropriate means to help pupils improve in mathematics since it is requisite in the curriculum

5.3: Recommendations

In every human society, changes are inevitable as development increases. It is on this note that the researchers will like to make some recommendation which cropped up in the course of the study. The researchers requested that findings about addition of algebraic expressions should be taught in schools using the updated Teaching and learning material so as to make pupils achieve better results. This will help them to apply the knowledge gained in their lives for better living.

In addition, in-service training should be conducted for all teachers especially for teachers who teaches mathematics for effective handling of the subject.

Parents and other stakeholders should motivate their wards by providing them with mathematics work books and other mathematics materials to enable them learn always and boost up their calculations skills.

Ministry of Education in collaboration with Curriculum Research and Development Division of Ghana Education Service should design textbooks which depict pictures to enhance pupils interest in mathematics.

Circuit supervisor on the other hand should make several visit to schools to ensure that teaching and learning materials are used by teachers in teaching mathematics.

The researchers also recommend that teaching should be activity based, method of teaching should be equipped with TLMs rather than teaching in abstract terms. According to the Behaviourist psychology, children see learning in terms of connections between stimulus and response or between response and reinforcement. Therefore, large environment of pupils should be structured in a way that, learners can discover and gain new experience on their own. Also, the appropriate reinforcement should be given when necessary.

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