Development and Validation of a Practical Manual for The Improvement of Learners' Interest and Achievement in Mathematics in Abia State College of Education (Tech) Arochukwu.

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Abstract- Most Nigerian students at all levels of education see the subject "mathematics" as a nightmare. This has resulted into poor performance in the subject as well as high profiled examination malpractice as the students do not have confidence that they can pass the subject without external assistance. This is more pronounced in the tertiary institutions, Abia State College of Education (Technical) Arochukwu being a typical example. Due to its cumbersomeness and complicated proceedings, students have totally lost interest in its study. This is evident in the enrollment of students in the Department of Mathematics in several higher institutions. While other departments are rejecting students on the basis that they have admitted the maximum number they require, department of mathematics is clamouring for student enrollment. If this situation continues, time will come when not even a single student will enroll to study mathematics. Majority of students feel mathematics only stresses their life and has no real life application. Some other students lost interest because the subject is taught theoretically and the whole calculations bothers on an individual intelligent quotient and as such, only gifted people can study it. There is therefore need to come up with a mathematics manual on practical approaches to mathematics which will arouse the interests of learners and at the same time achieve academic success. This research aims at developing a mathematics practical manual that will adopt captivating (real life situations and games) and technological (softwares, programming, social media and internet) approach of teaching mathematics in order to improve leaners' interest and at the same time achieve learning of the subject. To be able to do this, the researcher conducted literature review that culminated into writing the introduction which gives an overview of the subject, its nature, importance, methods and real life application. The next section captures the reasons that necessitated the development of the practical manual followed by the objectives of the study which centers on the development and testing of the manual. The literature review section contains other manuals previously developed by other researchers on the subject. The research lead to the production of a practical manual on mathematics that will improve learners' interest and drive home the learning of the subject thereby achieving academic success in Abia State College of Education (Technical) particularly and Nigeria in general. The manual was produced and the validity was tested. The population of study was small and can be managed so there was no need for sampling. The result of the test shows the mean interest of the students when the manual was used to be 61% wheras it was 45% when traditional method was used. The paired sample t test shows a significant difference in interest of students using the manual as the p-Value was 0.000001 which less than the specified 0.05. Similarly, the ANOVA result shows that there is a significant difference in performance of students when the manual is used as the F calculated was found to be 400.76 and the p-Value was found to be 0.013. It was concluded that the developed manual boasted the interest and performance of students in mathematics. It also helped

I. INTRODUCTION

Mathematics as a subject is a systematized, organized and exact branch of science that deals with quantitative facts, relationships as well as problems

involving space and form. It is a logical study of shape, arrangement and quantity (MIS Alagappa University 2017). Mathematics is the science and study of quality, structure, space and change. It seeks out patterns, formulates new conjectures and establish truth by rigorous deduction from appropriately chosen axioms and definitions (Tennessee Tech University 2024). As a science of abstract objects, mathematics relies on logic rather than observation as its standard of truth, yet employs observation, simulation, and even experimentation as means of discovering truth. (National Academy of sciences 1989).

One of the importance of mathematics is problem solving. It teaches us how to break down complex problems into smaller, more manageable parts and find solution through logical reasoning. Also, it fosters critical thinking skills that can be applied to various real-world situations. Again, is essential for innovation as it is the foundation for many scientific and technological advancements. Furthermore, the study of mathematics aids financial literacy as its concepts such as interest rates, inflation and budgeting can help us make informed decisions about our finances. It also helps us to understand the world around us as some patterns found in nature such as hexagonal bee combs, spider webs and symmetric snowflake are mathematical patterns. In addition, the study of mathematics helps us to make sound decisions in real life such as calculating the calories in each meal before indulging, keep track of how long it takes to burn off excess calories etc. That apart, mathematics offers excellent career opportunities as employers of labour prefer to hire people who can solve complex problems. Allen (2023).

Many people think that mathematics bothers only on theories and calculations and does not have real life application. This idea is totally wrong as there are many activities in our everyday life in which we apply the knowledge of mathematics. In home decorating and remodeling, calculation of the area of the rooms is very important to know the quantity of paint to buy, the quantity of tiles needed, the position of fancy bulbs, wall frames etc. In recreational sports, geometry and trigonometry can help to know the angle within which the player will play to get points in games like lawn tennis, table tennis and squash and for football, the angle within which a player will shoot to score a

penalty. In cooking, proportions and ratios are used to make correct calculations for each ingredient hence it is very common to say "use half or double of a recipe". Simple interest and compound interest are skills that will help one in managing money knowing best ways to save and invest money. Rit (2021)

Apart from these everyday life applications, mathematical models are used to solve more complex real life problems such as lunching a satellite, predicting the arrival of the monsoon, controlling pollution due to vehicles, reducing traffic jams in big cities, location of oil well through convergence of series etc. This shows that goal of mathematics as a subject is not all about stating theories and calculations rather application of these theories and calculations to solve real life problems facing mankind. Barnerjee (2021).

The major cause of lack of interest in mathematics and poor performance in the subject is the method of teaching the subject. There are several methhods of teaching mathematics such as: lecture method, demonstration method, Lecture Cum-Demonstration method, Inductive-Deductive method, Analytic-Synthetic method, Laboratory method, Heuristic method, project method, and Problem-solving method. (Wikipedia.org 2022). The method to use depends on several factors such as: educational level (Nursery, Primary, Secondary and Tertiary), nature of learners (intelligent quotient), and academic environment (infrastructure, technology and equipment). These factors should be considered before chosing a method or combination of methods to use. It is the duty of the teacher to carefully study these factors and select the appropriate method. The subject itself is a subject of methods. The methods of mathematics include: functions, graph, calculus, algebra, number theory, geometry, arithmetic, probability and statistics. (Virtual School Victoria). This implies that the method of mathematics to be taught also determines the teaching method to use.

However, it is important to understand that the interest of students is captured by what they see (pictures and videos), what they encounter or experience (real life situations) and what they are able to practicalize (games, programs and applications). It is also important to note that learning occurs when there is

interest. That is to say that interest is a prerequisite for learning. It is therefore pertinent to develop a practical manual in the subject that adopts these interest-capturing methods in order to improve both interest and performance in the subject.

II. PROBLEM STATEMENT/ JUSTIFICATION

Student enrollment into the department of Mathematics in Abia State College of Education (Technical) Arochukwu for some time has not been something to write home about. Some of the few ones that enroll seek change of course after a semester or two. When asked the reason for seeking for change of course, some say they do not like the subject because it is cumbersome and cannot be applied in real life while others say they do not understand the subject and cannot perform well in the subject even though they have access to many books from the college library. This is because most of the books in the college library are foreign books written with standard above their comprehension and whose real life application does reflect what is obtainable in our country. Furthermore, there is nothing that capture their interest to make them continue studying the book. A student once said that mathematics textbooks have become sleeping tablets for him such that any time he wants to sleep, all he needs to do is to open mathematics textbook to study and he will dose off. The few indigenous textbooks found in the college library are not learner centered. They are not practical based and do not trigger their interest.

Producing an interest-capturing practical-based indigenous textbook in mathematics will go a long in enhancing teaching and learning of Mathematics in Abia State College of Education (Technical) Arochukwu which will in turn improve students enrollment into the department of mathematics of the institution as well as sustaining the number admitted till graduation thereby reducing the number of drop outs

III. OBJECTIVES OF THE STUDY

The main objective of this study is to develop a practical manual that will improve learners' interest and achieve teaching and learning of mathematics. Specifically, the study will:

1. determine the objectives the practical manual to be developed.

2. determine the content of the practical manual to be developed.

3. determine the instructional materials for the topics in the practical manual to be   developed

4. determine the techniques and strategies to be used in the practical manual to be   developed.

5. determine the criteria for evaluation of students' performance and assessment of their interest in the subject.

6. develope the practical manual.

7. determine the efficacy of the developed manual.

Statement of Hypothesis:

$H_0 1$: There is no significant difference in interest boosting using the developed manual.

$H_1 1$: There is a significant difference in interest boosting using the developed manual.

$H_0 2$: There is no significant difference in performance of the students using the developed manual.

$H_1 2$: There is a significant difference in performance of the students using the developed manual.

IV. LITERATURE REVIEW

In this section, some practical manuals and textbooks written in mathematics are reviewed. The review portrays information, knowledge, skills and techniques previous authors used in mathematics textbooks and manuals.

Greenan (1984) developed a practical manual in mathematics which he divided into five categories namely: general mathematics, mathematics for vocation and technical instruction, mathematics for individual programs, advanced mathematics and measurement and matrics . He said that the resource directory is designed to serve as a resource guide for vocational educators who need additional instructional material in teaching of mathematics or vocational-oriented mathematics in their classes. Apple II Plus, 1

diskette was used to code drills on addition, subtraction, multiplication and division.

Schewartz (1999) developed a mathematics manual captioned "REAL-LIFE MATH" in which he focused on business transactions and personal money management through role playing activities.

Quek (2012) in his work titled 'Diffusion of the mathematics practical paradigm in the teaching of problem solving' identified five aspects of practical manual that makes it result achieving as: relative advantage, compatibility, ability to build capacity to understand its design as well as its implementation, trialability and observability. According to him, teachers must perceive the relative advantages of the practical manual and that would make them not to be hesitant to adopt the manual for use. Also the manual must be compatible with the existing mathematics curriculum in the country where it will be applied. The manual should have the ability to build capacity to understand its design as well as its implementation so as to remove complexity. There should be opportunity for students to trail the design on a limited scale. Lastly observability in the sense that the result of the innovation should be visible. The results are often interpreted in terms of students' performance in examination.

Laozano (2023) in .his work titled ' A Game-Based learning Application to help learners practice mathematical patterns and structures' developed a game-based mobile application to help learners practice mathematical patterns and structures. He applied a mixed-method research design and prototyping methodology to guide the study in developing the mobile application. The study developed a mobile application based on the octalysis framework. The application fully achieved all its intended features based on the rating provided by the students and IT experts.

Pho and Dinscore (2015) defined game –based learning (GBL) as a teaching approach incorporating educational games into the learning process. It is an active learning technique to enhance students learning into which existing and innovative games are often incorporated. It is an effective way to engage and motivate students particularly when it comes to learning mathematics.

Besalti and Kul (2021) says that game-based learning (GBL) allows students to learn without realizing it. This is because GBL is an approach that is often and most of the time crafted based on specific learning objectives. Gil-Domenech and Berbegal-Mirabent (2019) in their work concluded that GBL helps simulate students' interest and engagement in mathematics.

Lambic (2008) identified the biggest problem in teaching of mathematics as the motivation of students. According to him, the core of this problem is the insufficient comprehension of the reasons by students for which they should learn mathematics and in which way they could apply acquired knowledge of mathematics. He says his work is compiled to make mathematics closer to students by the use of software c++. R. Orim and Ekwueme (2011) examined the role of games in teaching and learning of mathematics and concluded that use of games in teaching of mathematics help to arouse students' interest in the subject and also help them to understand the subject.

Penny de Byl (2022) in his research work titled 'Mathematics for game programming and computer graphics' explores the essential mathematics for creating, rendering, and manipulating 3D virtual environments. He employed trigonometry, vectors and triangles as well as coordinate spaces to develop computer graphics rendering visual realism like a Pro.

Moursund (2016) in his research work titled 'Learning Problem-solving Strategies by the use of games' used games like chess, Sudoku puzzle, cribbage board.2X2 dots and boxes game etc. to teach problem solving. He categorizes them into one-player game, two-player game and multiple player game and uses these games to teach problem-solving in real life.

Hmelo-Silver (2004) examined problem-based learning. He employed education philosophy to examine how students learn. He concluded that students can only learn when they show interest. He emphasized the need to capture the interest of the students in order to facilitate learning. He advised that teachers should device a means of arousing the interest of students by trying to identify what triggers the interest of the students and try to incorporate those things either as instructional technique or as instructional material to capture their interest.

Lave and Wenger (1991) in their work titled 'Situated learning: Legitimate peripheral participation' emphasized that learning is achieved when it is rightly situated. Some topics require practical to be understood and such topic should be learnt in a laboratory where the much needed apparatus is. Also, they emphasized that learning can only be achieved in a subject like Mathematics when there is at minimum, a legitimate peripheral participation of the learners.

National Council of Teachers of Mathematics (NCTM) (2014) in their publication titled 'Principles to Actions: Ensuring mathematics Success for All' elucidated principles and actions that ensures learning of mathematics. One of the major principles discussed is finding a way to capture the interest of learners. They noted that it is very difficult and almost impossible to learn when there is no interest. Another principle discussed is practicalizing the topics. This involves using real life experiences to bring home to learners' understanding the concept. Also, they support the incorporation of technological advancement into the teaching and learning of mathematics. This include the use of softwares, programs, games, you tube and other social media platforms. Not only will these technological advancements capture their interest but they will also reduce the ambiguity and complexity of the solutions.

Schoenfeld (1992) in his publication titled 'Handbook of research on mathematics teaching and learning' says that learning to think mathematically is the first step to achieving learning of mathematics. According to him, mathematics requires rational thinking therefore teachers of the subject should first guide the learners towards thinking mathematically. This can be achieved by creating things (improvisation) with materials at disposal that will make the concept to be taught appear real to make them visualize the concept. The next step to learning mathematics according to him is to inculcate problem solving mind set in the learners. Teachers should first convince learners on the real life application of the subject. Making them understand that every topic in mathematics has a real life application hence intends to solve real life problems. Therefore someone learning mathematics is simply learning problem solving. Another step to learning mathematics is metacognition. This simply refers to the processes used to plan, monitor and assess one's understanding and performance. Metacognition includes a critical awareness of ones thinking and learning as well as oneself as a thinker and learner. The final step in learning mathematics according to him is sense making. This involves developing an understanding of a situation, context or concept by connecting it with other knowledge. Sense making according to him should occur in every mathematics classroom every learning day.

V. METHODOLOGY

This section discusses the procedures that will be used in the course of developing the practical manual as well as validating it. The procedures include; the design of the study, area of the study, population for the study, sample and sampling technique, instrument for data collection, validation and reliability of the instrument, procedure for developing the training manual and method of data analysis.

VI. DESIGN OF THE STUDY

The study will adopt a mixed-method research design. The mixed-method research design according to George (2021) combines elements of quantitative research and qualitative research in order to gain a more complete picture than a standalone quantitative or qualitative study as it integrates benefit of both methods. The mixed model is often used in behavioral, health and social sciences, especially in multidisciplinary settings and complex situational or societal research. Also, the research and development design will be adopted. According to Gall and Borge (2007), this design stipulates that the findings of a research are used to design new product and procedures which are systematically field tested, evaluated and refined until they meet specific criteria of effectiveness, quality or similar standard. The study will adopt four phases. The phases are as follows:

Phase I Needs Assessment

- Determination of the objectives.
- Determination of the contents.
- Determination of the evaluation criteria.

Phase II Development of the Practical Manual

- Selection of teaching methods, instructional materials, learning theories and practical exposures.
- Expert consultations.
- Drafting

Phase III Validation of the practical manual

- Pilot testing
- Data Collection (questionnaires to measure learners' interest and achievement tests to assess learners understanding and application of the mathematical concepts.)
- Data Analysis

Phase IV Refining

- Learner and Teacher feedback
- Expert Review (Manual submitted to Mathematics education experts to review and incorporate feedback.)
- Revision and finalization.

VII. AREA FOR THE STUDY

The research will be conducted in the Department of Mathematics education, Abia State College of Education (Technical) Arochukwu.

VIII. POPULATION FOR THE STUDY

The total population of the study comprised of 15 persons. This consist of 9 students, 4 lecturers and two consultants. These will be assigned to the phases appropriately according to need.

IX. SAMPLE AND SAMPLING TECHNIQUE

There will be no sample and sampling technique since the population can be effectively managed.

X. INSTRUMENTS FOR DATA COLLECTION

There will be use of two instruments for data collection for the study. One of the instruments is Mathematics Practical Manual Instruction Questionnaire (MPMIQ) and the other is Mathematics Practical Manual Assessment Test (MPMAT). MPMIQ will contain six sections labelled A, B, C, D, E, and F. Section A contains information on personal data of the respondents. Section B contains items

seeking information on the objectives of the practical manual. Section C contains items seeking information about the contents of the practical manual. Section D contains items seeking information on the instructional materials. Section E contains items seeking information on the teaching methods and section F contains items seeking information on criteria used in assessing students. MPMAT will be an instrument containing practical tests intended to measure students' understanding of various mathematics topics taught with the manual.

XI. VALIDATION AND RELIABILITY OF THE INSTRUMENT

The instruments (MPMIQ and MPMAT) will be sent to two consultants for validation of the contents and the structure. The validated instrument will then be subjected to reliability test.

XII. PROCEDURE FOR DEVELOPING THE MATHEMATICS PRACTICAL MANUAL.

Phase I Needs Assessment

A careful study of the topics in the curriculum (Minimum Standard) provided by the National College of Education Commission is made to ensure that the instructional objectives, instructional materials and instructional techniques stipulated are incorporated in the manual to be developed, hence:

- Writing the Content
- Writing the performance Objectives.
- Writing Assessment Instrument.

Phase II Development of the Practical Manual

- Writing of the Teaching methods.
- Writing of the Instructional Materials
- Learning Theories and Practical Exposures.
- Consultation of Experts
- Drafting of the Practical Manual

Phase III: Validation of the Developed Training Manual

XIII. EXPERIMENTAL PROCEDURE

The two main objectives of the developed practical manual is improvement of learners' interest and

achievement of learning of the subject. (Mathematics). Therefore, two test will be carried one for each. The paired sample t-test will be used to test whether the developed practical manual has improved learners' interest. The variable X will denote learners' interest and will be measured using five attributes namely: prompt arrival for class, enthusiasm, zeal to practice, anxiousness to inquire and desire to solve problems. These will be obtained from MPMIQ on a five point scale. There two treatments t_t and t_m on the same set of students. t_t is traditional teaching (without the developed manual) whose outcomes are denoted with X_t for n=5 where n is the attributes of learners' interest. t_m on the other hand is teaching with the developed manual whose outcomes are denoted as X_m for n=5 as well. The difference 'd' between the outcomes for each n_i is obtained as d= X_m-X_t and the mean of the differences '**d**' is calculated. Sd, the standard deviation of d is also calculated. The test statistics t_{cal}= **d**/ (sd/$\sqrt{n}$) is calculated and the p value obtained. These will be done with a statistical software SPSS.

Analysis of Variance (ANOVA) will be used to test whether learning is achieved using the developed manual. This will make use of two factor treatments which includes: t_m (teaching with the developed manual) serving as the experiment and t_t (traditional teaching) serving as the control. The ANOVA will consist of blocks L_1, L_2, L_3,and L_4 serving as replicates from four lecturers.

XIV.   METHOD OF DATA ANALYSIS

For items on 5 point scale in MPMIQ, the mean value of the responds on each attribute is obtained and used as the ith values of X_t and X_m respectively.

The paired sample t-test is done at 95% level of confidence which means testing the null hypothesis of t 0-05 level of significance. When p-value is less than or equal to 0.05 showing that t-calculated (test statistic) is greater than t-tabulated (critical value), the null hypothesis will be rejected and the alternative hypothesis supported meaning that the developed

manual has convincingly improved learners' interest. The reverse is the case when p-value is greater than 0.05.

Similarly, the mean scores of the students in MPMAT provide the response for the two treatment factors and the four lecturers that taught using the treatments provide the replicates serving as the blocks.

The Analysis of Variance f-test will be done at 95% level of confidence which means testing the null hypothesis of f 0-05 level of significance. When p-value is less than or equal to 0.05 showing that f-calculated (test statistic) is greater than f-tabulated (critical value), the null hypothesis will be rejected and the alternative hypothesis supported meaning that the developed manual has convincingly achieved learning of the subject. The reverse is the case when p-value is greater than 0.05.

XV.   RESULT

T-TEST PAIRS=tradmethod WITH manualmethod (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.
T-Test

Table1

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	tradmethod	45.3333	12	6.16933	1.78093
	manualmethod	61.0000	12	9.86269	2.84711

Table 2

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	tradmethod & manualmethod	12	.205	.523

Table 3

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	tradmethod - manualmethod	15.66667	10.50829	3.03348	2.34332	18.99002	-5.165	11	.000001

Table 4
ANOVA TABLE 95% Confidence level

Source of Variation	df	SS	MS	F-ratio	Sig
Teaching Method	1	1653.123	1653.123	400.76	0.013
Different Lectures	3	534.375	178.125	43.18	0.011
Error	3	12.375	4.125		
Total	7	2199.875			

XVI. RESULT DISCUSSION

Result in Table 1 shows the mean interest of the students when the traditional method is used as 45.33 whereas the mean interest of students when the manual is used is 61 showing a very significant increase in the mean interest.

Table 2 shows the correlation coefficient of the two methods to be 0.205 which signifies that there is no correlation between the two methods in terms of boosting students' interest as the correlation coefficient is far less than 0.5. This means that the methods are not related.

Table 3 shows the result of the paired sample T test and the "sig" is the p value. According to the table, the p value is 0.00001 which far less than 0.05 suggesting the rejection of the null hypothesis (H_01) and the acceptance of the alternative hypothesis (H_11).

Table 4 shows the p value of the teaching method (Treatments) to be 0.013 and that of different lecturers (Block) to be 0.011both being very much less than 0.05 suggesting the rejection of null hypothesis (H_02) and the acceptance of the alternative hypothesis (H_12).

CONCLUSION

In both hypothesis, the alternative hypothesis is accepted and the following conclusions are drawn:
- There is a significant difference in terms boosting students 'interest when the developed practical manual was used compared to the traditional method.
- There is a significant difference in the performance of the students when the developed manual is used compared to when the traditional method is used.

There are other conclusions that can be drawn from the research work. The developed mathematics practical manual will improve learners' interest in the subject thereby increasing their chances of learning it. It will also lead to mastery of the subject thereby improving performances in examination. It will reduce the rate of students dropping out or switching to other departments from the department of mathematics in Abia State College of Education (Technical) Arochukwu and will motivate secondary school students in the host community to seek admission into the department.

The lecturers are not left out. It will enable them teach the subject effectively. Also, it will increase their passion for the job as the manual is result-oriented. The result they achieve will motivate them the more.

REFERENCES

[1] Allen (2023) Mathematics in daily life: Uses, Importance and Facts. Published on allenoverseas.com on 24th November 2023.

[2] Banerjee (2021) Mathematical modelling in real life. Published on Urbanpro.com on 3rd March 2021.

[3] Basalti and Kul (2021) Mathematics through Game-Base. Marnalyn Publishers Newzeland.

[4] David Moursand (2016) Learning problem solving strategies by the use of games. Information Age Education Press Oregon USA.

[5] Greenan J. P (1984) A guide to mathematics for vocational education. Hodder and Stoughton publishers. London.

[6] Hmelo-Silver (2004) Problem-Based Learning. Educational Psychology Review, Volume 16,issue3, pages 235-266.

[7] Lambic (2008) Problems of teaching and learning of mathematics. Hufflaton and Nebagarry printing press. Freetown.

[8] Lavi. J and Wenger.E (1991) Situated Leraning Legitimate Perpheral Participation. Cambridge University Press. New York.

[9] Lazano A.S (2023) A game base learning application to help learners practice mathematical patterns and structure. College of computing Don Ventura State University. Mexico.

[10] NCTM (2014) Principles to actions ensuring mathematics success for all. National Council of teachers of Mathematics. Reston. Virginia.

[11] Penny de Byl (2022) Mathematics for Game Programming and Computer Graphics. Packt Publishing Ltd. Birmingham. UK.

[12] Pho and Dinscore (2015) Engaging students in the learning process with game-based learning. The fundamental concepts of international Journal of Technology in Education (IJTE), 4(3), 542-552.

[13] Quek K.S (2012). Diffusion of mathematics practical paradigm in the teaching of problem solving. Mathematics Education Research Group of Australasia. Adelaide. Australlia.

[14] Rit. H (2021) 15 uses of mathematics in our everyday life .Published on Medium.com 18th August 2021.

[15] Schewartz.S.C (1991) Real-Life Mathematics. Wolters Kluwer and Aspen Publishing. Alphen aan den Rijn. Netherlands.

[16] Schoenfeld. A.H (1992) Handbook of Research on Mathematics Teaching and Lesrning. AMS and MAA. USA.