E-ISSN: 1115 - 8425 P-ISSN: 3027-012X
MPRI-JAEE | INTERNATIONAL JOURNAL OF ASSESSMENT & EVALUATION IN EDU.
VOL. 06 NO. 8 – OCTOBER. 2024

ASSESSMENT OF ASEI-PDSI PEDAGOGICAL PARADIGM ON STUDENTS' MATHEMATICS ATTITUDE AND ACHIEVEMENT IN JUNIOR SECONDARY SCHOOLS (JSS) IN FCT-ABUJA

OSEMWINYEN, AMENAGHAWON CLEMENT

Department of Mathematics, School of Sciences, FCT- College of Education, Zuba, Abuja

Corresponding Author: amenosem@gmail.com

DOI Unique ID: 10.70382/mejaee.v6i8.010

Abstract

The ASEI-PDSI pedagogical paradigm championed by SMASE – Nigeria Project in collaboration with Japan International Cooperation Agency (JICA) is designed towards improving the quality of Mathematics which has consistently declined over the years in public secondary schools across the nation. The study assessed the ASEI-PDSI pedagogical paradigm on students' mathematics attitudes and achievement in Junior Secondary Schools (JSS) in Federal Capital Territory (FCT) – Abuja. Descriptive survey research design was adopted for the study. The study population comprised of all Mathematics teachers in the 161 Public JSS in FCT. 100 Mathematics teachers whom have implemented ASEI-PDSI pedagogical paradigm were selected from the six (6) Area councils of FCT using the proportionate stratified random sampling

Keywords: ASEI-PDSI pedagogical paradigm, Mathematics Attitude, Mathematics Achievement, SMASE.

EDITOR-IN-CHIEF
Prof. A.I. Mteiye [MALAWI]

technique. A researcher made 4-points Likert type of questionnaire was used for data collection and had reliability coefficient of 0.83 determined using the Pearson's product moment correlation coefficient formula. Collected data was analysed using mean and standard deviation for research questions, while hypotheses were analysed using Chi-square (X^2) and tested at 0.05 level of significance. The findings showed that, ASEI-PDSI pedagogical paradigm had a high positive influence on Junior Secondary Students' Mathematics Attitude and Achievement but the influence was only statically significant on Attitude. The study established that ASEI-PDSI pedagogical paradigm is an appropriate teaching and learning strategy for delivery effective mathematics instruction in JSS in FCT. The study recommended among others; the need for JSS mathematics teachers in FCT implementing the ASEI - PDSI pedagogical paradigm to sustain it application and also for the stakeholders like FCT - Universal Basic Education Board to be encouraged to maintain regular in-service programme for JSS mathematics teachers as well as train those yet to be trained on the paradigm.

Introduction

The concept of Mathematics by way of what it is and its diversity with respect to its functionality or role in every sphere of human endeavour cannot easily be expressed in few lines of thoughts. Fatima (2012) once stated: "The answer to the question, what is Mathematics is of complex: there are elaborate elucidations, some excellent on the subject but inevitably, even the best accounts give incomplete answer". Mathematics does not just appear as a discipline or a course of study but a phenomenon which is part of man's existence and his functionality. According to Anaduaka (2010), Mathematics is an integral part of man's existence that touches every aspect of human life. This integral nature of Mathematics has made it indispensable in improving the quality of life of all citizens.

As a discipline, Mathematics is a branch of science, which deals with numbers and their operations. It involves calculation, computation, solving of problems, etcetera. Mathematics is an exact, precise, systematic and logical subject.

Naturally, Mathematics has become an important subject in any school curriculum and there seems to be greater pressure for children to succeed in Mathematics than in many other subjects in the school curriculum (Mwelese & Atwoto, 2014). The importance of Mathematics to the child and society cannot be over emphasized, it could be seen as an arithmetic skill which are needed for use in everyday life situations e.g. at home, office and the workshop. While to others, Mathematics is the foundation for further studies that is, a service subject for disciplines like medicine, computer science, sociology, psychology, engineering specialization including the field of science and modern technology (Aguele & Usman, 2007). Mathematics is actually a basic entry requirement for several disciplines in the higher institutions and its role is strategic in the nation's aspiration for scientific and technological development (Anaduaka & Okwuoza, 2021). Due to the overall importance in various aspects of life, Mathematics has been made compulsory at both primary and secondary school levels in Nigeria education system (Federal Republic of Nigeria (FRN), 2014).

However, available evidences; Osemwinyen (2010); Omole, (2011); Anaduaka & Okafor (2013); Danjuma, (2015) and Anaduaka & Okwuozor, (2021) have shown that despite its importance, students' academic achievements in Secondary School Mathematics at internal and external examination have remained considerably poor at least for the past two decades and this is quite worrisome to stakeholders: Mathematics Educators, policy makers, curriculum planners, school administrators, parents, students and the entire society. Students' mathematics achievement actually reflects the level of understanding, problem-solving skills, and knowledge of mathematical concepts attained by a student. According to SCISPACE (2024), students' mathematics achievement is the competency shown by the student in the subject and it is measured by the score in mathematics test or examination. This poor mathematics achievement as seen in secondary schools in Nigeria including the Federal Capital Territory (FCT) has led to the general perception in some quarters that perhaps the

teaching of mathematics at secondary school level viz-a-viz its methods may not have had the desired impact on students (Anaduaka and Okwuozor, 2021). According to Adunola (2011) and the National Mathematical Centre (NMC) (2012), students' poor academic achievements in both internal and external examination in mathematics is due to teachers' ineffective teaching methods rather than the contents of the curricular for school mathematics. Ayiego, Mang'are, Ngome, & Madilah (2015), in their studies collaborated the aforementioned and submitted that, the way out of this unimproved mathematics achievements in the secondary school was in addressing pedagogical issues, like teacher-centeredness factor by moving away from traditional models of instruction and embracing modern theories of teaching as advocated by the Activity, Student-centred, Experiment, Improvisation - Plan, Do, See, Improve (ASEI-PDSI) pedagogy.

The ASEI-PDSI pedagogy or pedagogical paradigm is an innovative student-centered method of conducting mathematics lessons characterized by activity-based, student-centered and experiment-oriented learning and improvisation on the part of the teacher (Onchonga, 2013). ASEI-PDSI pedagogy encourages active learning rather than passive as it where in the traditional approach and active learning is a paradigm shift which has the potential to stimulate learners' attitude and improve academic achievement in mathematics (Mahapatra, 2020). Here, teachers acquire and improve on their improvisation skills and are able to demystify conventional activities by scaling down experiments, thereby relating mathematics to real life situations, ultimately creating the right students' attitude and improved achievement. Developing the right students' mathematics attitude is vital as it is synonymous to achievement.

According to Mumcu & Aktas (2015), Mathematics attitudes are those feelings or convictions that students have towards mathematics. Students' mathematics attitude sometimes could be predetermined and at other times may not and could be as a result of students' learning experiences during mathematics lessons. Students' mathematics attitude could be positive or

negative and there seems to be a correlation between attitude and achievement. A positive student's mathematics attitude is likely to translate to good academic achievement, while a negative attitudes toward mathematics may prevent the student's understanding and success in a mathematics lesson. (Kingir, Tas, Gok, & Vural, 2013, Mumcu & Aktas, 2015). Many researchers have come to the conclusion that these students' negative attitudes could be a product of the instructional strategies and methodology employed and several efforts are being made to stern the ugly tide (Kingir, Tas, Gok, & Vural, 2013). One of such efforts is the adoption of the ASEI-PDSI pedagogical paradigm which has the capacity to influence students' mathematics attitudes and achievement (Ayiego, et al, 2015).

The ASEI-PDSI pedagogical paradigm being facilitated in Nigeria by the Strengthening Mathematics And Science Education (SMASE) Nigeria project in collaboration with Japan International Cooperation Agency (JICA), is an intervention designed for in-service training (phase – by - phase) for teachers as part of professional development which aimed to improve the quality of instruction delivering most especially in Mathematics and the sciences in both primary and secondary education in Nigeria (Shuaibu. 2023).

ASEI-PDSI pedagogy has been largely implemented in most of the primary and junior secondary schools in FCT (FCT- UBEB, 2023). There is therefore need to assess the influence of ASEI-PDSI pedagogical paradigm on Students' mathematics attitude and achievement in Junior Secondary Schools (JSS) in FCT-Abuja

Statement of the Problem

Mathematics performance nationally, has been quite dismal over the years, largely swinging between poor and average achievement at internal and external examinations (Osemwinyen, 2010, Omole, 2011, Anaduaka & Okafor, 2013, Danjuma, 2015 and Anaduaka & Okwuozor, 2021). Yet the subject is essentially critical in course placement in most fields such as medicine,

engineering, architecture, technology, business, humanity, etcetera. The dismal performance not only locked out students from coveted courses since it is compulsory to all students at both Primary and Secondary level, but also undermines the overall vision for national growth and technological development (Ayiego, et al, 2015, Anaduaka & Okwuozor, 2021). Among the factors responsible for the dismal performance was lack of practice, and mastery of basic Mathematics concepts, attitudinal factors and over all teachers' inappropriate teaching methods which reflect inactive learning and display of teachers' poor attitude (Adunola 2011, NMC, 2012, Ayiego, et al, 2015). Many efforts to reverse the trend have been undertaken with minimal impact (Osemwinyen, 2010). Hence, the adoption and implementation of ASEI-PDSI pedagogical paradigm in FCT Junior Secondary schools, which aimed to revolutionize teachers' teaching approaches and the overall Mathematics teaching experience. Therefore, the study's aim to assess the influence of ASEI-PDSI pedagogical paradigm on students' mathematics attitude and achievement in Junior Secondary Schools in FCT becomes imperative.

Purpose of the study

The purpose of this study is aimed at assessing ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitude and Achievement in Junior Secondary Schools (JSS) in FCT-Abuja. Specifically, the study assessed the influence of:

- ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitude in Junior Secondary Schools (JSS)
- ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement in Junior Secondary Schools (JSS)

Research questions

The following research questions were formulated to guide the study

3. What is the influence of ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitude in Junior Secondary School (JSS)
4. What is the influence of ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement in Junior Secondary School (JSS)

Research Hypotheses

The following hypotheses were formulated to guide the study

5. **Ho_1:** There is no significant relationship between ASEI-PDSI pedagogical paradigm and students' mathematics attitude in Junior Secondary Schools (JSS)
6. **Ho_2:** There is no significant relationship between ASEI-PDSI pedagogical paradigm and students' mathematics achievement in Junior Secondary Schools (JSS)

Significance of the study

The information generated from this study would be beneficial to the mathematics teachers, students, curriculum planners, school administrators, ministries of education and the society. The findings of this study would create awareness and encourage Junior Secondary School Mathematics teachers on the need for paradigm shift in teaching in order to create a mathematically stimulating classroom environment that would promote learner-centered pedagogy and ultimately affect students' attitude and academic performance in Mathematics

The study would help policy makers/curriculum planners appreciate and appraise the impact of ASEI/PDSI pedagogy in delivering mathematics instruction and thus help them in modifying or redesigning the mathematics curriculum. It would also encourage inspectorate units of Ministry of Education and educators on the need to ensure school management are well prepared in terms of human and material resources for effective application of ASEI/PDSI pedagogy.

The study would encourage stakeholders like Federal Ministry of Education, FCT Universal Basic Education Board (FCT - UBEB), partners and relevant organizations on the need for regular/up-to-date SMASE IN-SET programs for Mathematics teachers. The study would benefit the learners as they are encouraged to take responsibility for their own learning, as such would no longer see mathematics as a difficult subject

Finally, the society at large would benefit from the contributions of these well-groomed mathematics students with the right-thinking and problem-solving skills, towards the development of the society in every field of endeavour.

Delimitation of the Study

The study was restricted to assessing the impact of ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitudes and Achievement in Junior Secondary Schools (JSS). The study was limited to Junior Secondary Mathematics teachers whom have been exposed to the SMASE-INSET programme and have implemented ASEI-PDSI pedagogical paradigm in the teaching and learning of Mathematics in Junior Secondary Schools (JSS) in FCT.

Assumptions of the Study

The study made the following assumptions:

- All the Stakeholders; school management and mathematics teachers in these Area councils had been fully prepared of their roles for effective practice and implementation of the ASEI-PDSI pedagogical paradigm.
- All Junior Secondary Mathematics teachers in the study Area had embraced the practice of the ASEI movement in teaching and learning of Mathematics.
- The PDSI teaching and learning approach was being implemented by all Junior Secondary Mathematics teachers in teaching and learning of Mathematics

Literature Review

Theoretical and Conceptual Framework

Two theories would be simultaneously adopted for the study; Albert Bandura's Social Learning Theory (SLT) and Constructivism. The Social Learning Theory (SLT) is often described as the 'bridge' between traditional learning theory (behaviourism) and the cognitive approach. This is because it focuses on how mental (cognitive) factors are involved in learning. According to Mcleod (2024), SLT believes humans are active information processors and think about the relationship between their behaviour and its consequences. SLT also believe that people learn new behaviours by observing and imitating others/models. The theory emphasizes the importance of observational learning, where individuals acquire knowledge, skills, attitudes, and beliefs by watching the actions of others/models and the consequences that follow, leading to the modelling and adoption of observed behaviours.

This is very significant to the ASEI-PDSI pedagogical paradigm as advocated by SMASE for mathematics instruction. Firstly, teachers are seen as models by their learners and through extensive and conscious planning on the part of the teacher followed by elaborate implementation of the plan in a well-prepared environment; problem solving abilities are transferred to the learners (Mcleod, 2024). Secondly, teachers' level of preparation, delivery and motivating in Mathematics delivery would cause a change in learners' behavior which then reflect in learners interests and attitude and overall learners' academic achievement (Ayiego, et al, 2015).

Constructivism theory: This theory falls under cognitive approach and is relevant to learning mathematics. Constructivism according to Cottrill, 2003 in Osemwinyen (2010) is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental model" which we use to make sense of our experiences. To the constructivist, learning

is therefore, the process of adjusting our mental models to accommodate new experiences.

According to Osemwinyen (2010). Constructivism approach impacts the learning of Mathematics through the following beliefs:

- It emphasizes hands-on problem solving which gives room for better understanding of mathematical concepts by students.
- de-emphasizes rote learning or memorizing and regurgitating answers when needed.
- It encourages knowing, discovering by oneself and ability to work out mathematical solutions to problems. Learning should be interactive. Instructors should tailor their teaching strategies to student responses and encourage students to analyze, interpret and predict information. It also gives room for collaboration among students.
- In teaching mathematics, learners should be given time and opportunity to reflect. Reflection in both the content learnt and the learning process. This will not only make learners active but also give them the ability to understand and think coherently.

These principles are core to the ASEI-PDSI pedagogical paradigm as advocated by SMASE- INSETs Nigeria project. Below illustrates the schematic flow chart for the influence of ASEI-PDSI pedagogical paradigm on student' Attitude and Achievement in JSS Mathematics.

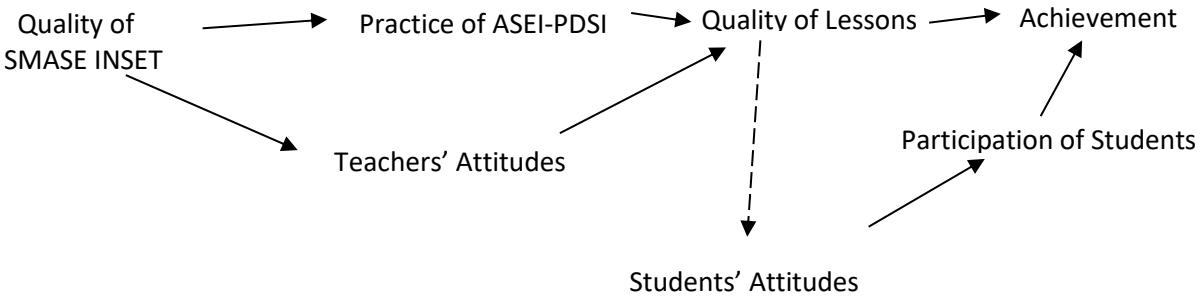

Figure 1: Hypothesized path for ASEI-PDSI pedagogical paradigm (through SMASE INSET) on students' attitude and achievement in Mathematics

Concept of ASEI-PDSI pedagogical paradigm

The ASEI-PDSI pedagogical paradigm is adopted by the Strengthening Mathematics And Science Education (SMASE) project - a project by the Federal Ministry of Education, Nigeria with Japan International Cooperation Agency (JICA) as technical partner. The aim is to put in place a system of In-service Training (INSET) for teachers of Mathematics in Nigeria in order to improve the teaching and learning process of Mathematics at both Primary and Junior Secondary Education levels.

ASEI & PDSI pedagogical paradigm is the effective method for ensuring the quality of Mathematics lessons and its improvement. ASEI, which is an acronym for **A**ctivities, **S**tudents-centered, **E**xperiments and **I**mprovisation, is a key word in the SMASE project for lesson innovation. It embodies efforts to encourage paradigm shift from teachers-centered to learner-centered pedagogy. ASEI lesson is made possible through PDSI practice (**P**lan, **D**o, **S**ee, **I**mprove). This encourages the culture of continue improvement. ASEI principle involves providing meaningful teaching **Activities** focused on **Student** learning mainly **Experimental**/practical work and **Improvising** resources where necessary. PDSI approach embraces orderly steps of executing learning activity by first **Planning** for the activity, then **Doing** it while **Seeing**, observing with intent to evaluate and then finally **Improving** on the process.

The activities of the Project are aimed at changing traditional teacher-centered teaching methods and equipping teachers with necessary skills for classroom practices that put emphasis on activity-oriented ways of teaching and learning that include:

- Creating opportunity for learners to take responsibility for their own learning;
- Employing inquiry-based approach as opposed to recipe-type experiments;
- Encouraging improvisation not only to augment conventional equipment, apparatus/materials but also to arouse interest & curiosity among learners;

- Encouraging teachers to draw content and examples from the learners' real-life experiences in order to capture their interest and imagination;
- Foster teachers' ability and appreciation for work planning;
- Systematic execution of the learner-centered teaching/learning process;
- Evaluation of the teaching-learning process against lesson objectives & outcomes;

ASEI-PDSI pedagogical paradigm therefore encourages learner-centered pedagogy whose essence is to emphasis on the learner learning rather than the teacher teaching. As Biggs (1999) aptly put it: "Without taking away from the important role played by the teacher, it is helpful to remember that what the student does is actually more important in determining what is learnt than what the teacher does. Just like the ancient Chinese philosopher, Confucius (551-479 BC) who expressed his belief in the importance of learning from experience when he wrote: "I hear and *I forget*, I see and *I remember*, I do and *I understand*" (BrainyQuote, 2015). Confucius related the acquisition of understanding and knowledge directly to living and experiencing which typically reflect a learner centered pedagogy.

The goal of teaching is to make students learn. The methods and materials used in delivering instructions should ensure the easy practice of learning. According to constructivism, learners construct their own knowledge. The teacher's role therefore is to create a conducive and stimulating atmosphere of learning and facilitate this process to assist learners make the required progress.

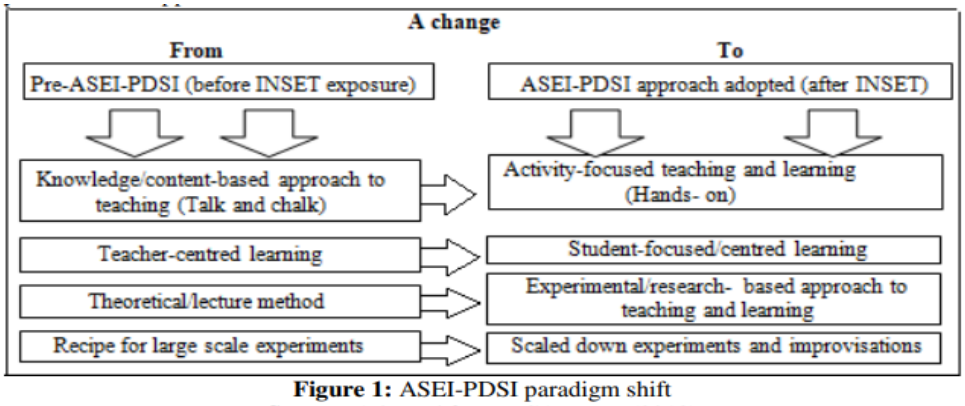

Figure 1: ASEI-PDSI paradigm shift
Source: Adopted from JICA report (2013)

RESEARCH DESIGN AND METHODOLOGY

Research Design

The descriptive survey research was adopted in order to produce statistical information by collecting data through questionnaire from a sample of individuals to determine the influence of independent variable on dependent variables and the nature, strength and direction of relationship that exit between the independent variable and dependent variables (Uzoagulu, 2011).

The Study Area

The study area comprises of the six (6) Area councils in FCT - Abuja namely; Abaji, Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kuje and Kwali. Most of the Junior School Mathematics teachers in these Area Councils have been well trained through the SMASE - INSET programme and have employed the ASEI – PDSI pedagogy in mathematics delivering.

The Study Population, Sample and Sampling Techniques

The study population comprises of all Mathematics teachers in the 161 Public Junior Secondary Schools (JSS) in Federal Capital Territory (FCT)-Abuja whom have implemented the ASEI-PDSI pedagogy. One hundred (100) Mathematics teachers whom have implemented ASEI-PDSI pedagogical paradigm were selected from the six (6) Area councils of FCT using the proportionate stratified random sampling technique. The technique recognizes all the strata and their proportion in the population (Uzoagulu, 2015).

Research Instrument

The instrument - SMASE Project Assessment on Attitude & Achievement Survey (SPAAAS) questionnaire was developed by the researcher as an impact assessment tool to assess ASEI-PDSI pedagogical paradigm on students' attitude and achievement of Junior Secondary School (JSS) Mathematics in FCT- Abuja. The instrument comprises of three (3) sections: A, B and C. Section A contains bio-data of respondents, while Sections B & C contain sixteen (16) multiple choice Likert scale items. Sections B has nine (9) items designed to address student's mathematics attitude with respect to ASEI-PDSI pedagogical

paradigm and Sections C has seven (7) items designed to address student's mathematics achievement.

Validation of the Instrument

The survey instrument: SMASE Project Assessment on Attitude & Achievement Survey (SPAAAS) questionnaire was developed by the researcher and validated by four (4) experts. The instrument was both face and content validated by two experts each from School of Sciences and School of Education, FCT - College of Education, Zuba - Abuja

Reliability of the Instrument

This study employed the test-retest method to establish the consistency with which the research instruments yielded same information on repeated attempts. The researcher administered thirty (30) copies of the research instruments in the pilot schools; scored manually; then administering the same instruments to the same group of subjects after two weeks and scoring the instruments manually again; then comparing the responses obtained in the two occasions. Pearson's product moment correlation coefficient was computed in order to determine the extent to which the research instruments were consistent in eliciting the same responses every time the instruments were administered. A correlation coefficient of 0.83 was obtained which indicated the instrument was good, stable and as such reliable.

Procedure for Data Collection

All selected Junior Secondary Schools were visited in their area councils by the researcher. Four research assistants were employed and trained to assist in administering and retrieving of the copies of the questionnaires. The four (4) research assistants were deployed to these schools accordingly. A total of one hundred (100) copies of questionnaires were administered for the study and same were retrieved showing a 100 percent response/retrieval rate.

Method of Data Analysis

Data collected were analyzed based on the research questions and hypotheses formulated for the study. Frequency count was used to reflect the responses

of participants on each item while descriptive statistics - mean and standard deviation was used to answer the research questions. A mean score of 2.50 and above indicated acceptance or positive influence while below 2.5 indicated rejection or negative influence. Also, all mean scores ranged from 1 to 4, with a higher score indicating a more positive or very positive influence and vice versa. Meanwhile for the hypotheses, inferential statistics was used to determine the significance of the study. Specifically, Pearson's Chi-Square analysis was used. Both analyses employed the use of Statistical Package for Social Sciences (SPSS) software and R- programming tool. The decision rule for Chi-Square was: If the p-value that corresponds to the test statistic X^2 with (number of rows - 1) *(number of columns - 1) degrees of freedom is less than the chosen significance level ($\alpha = 0.05$) then we reject the null hypothesis (H_o) otherwise DO NOT reject H_o.

DATA ANALYSIS, PRESENTATION AND DISCUSSION OF RESULTS

Result and Findings

Research Question 1

What is the influence of ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitudes in Junior Secondary Schools (JSS)

This research question was answered using data as shown in table 1.

Table 1: Teachers' responses on ASEI-PDSI pedagogical paradigm on Students' Mathematics Attitude

S/N	ASEI-PDSI pedagogical paradigm and Students' Attitude	N	Mean ($\bar{x}$	SD	Remark
1.	ASEI-PDSI method is stimulating enough to arouse interest and curiosity in students.	100	3.32	.601	Accepted
2.	ASEI-PDSI's healthy classroom interaction and students-centeredness in the teaching of Mathematics enhances students' learning.	100	3.41	.653	Accepted
3.	ASEI-PDSI's student-centred and healthy classroom interaction foster positive Mathematics attitude in students	100	3.38	.599	Accepted

4.	The idea of much group work as in collaborative learning engenders a positive attitude towards learning among students.	100	3.03	.703	Accepted
5.	Students now gradually view Mathematics as "a doing and collaborative subject" is impactful on their attitude.	100	3.23	.617	Accepted
6.	Discussing their individual thoughts and given solutions in class has a positive impact on students' attitude towards learning Mathematics	100	3.42	.639	Accepted
7.	This new ASEI-PDSI pedagogical paradigm is gradually changing the attitude of learners towards Mathematics from negative to positive	100	3.34	.639	Accepted
8.	Students' active roles and manipulation of learning materials have gradually improved their attitudes towards learning Mathematics	100	3.28	.604	Accepted
9.	Mathematics classes are now interesting and fulfilling thereby keeping students always around	100	3.38	.678	Accepted
	Valid N (listwise)	100			
	GRAND MEAN		**3.31**		

Table 1 shows that items 1 - 9 had response mean greater than the scale mean of 2.50; also, the grand mean of 3.31 out of 4 is well above the scale mean. Based on the result, ASEI-PDSI pedagogical paradigm had a high positive influence on Students' Mathematics Attitude.

Null Hypothesis 1 (HO_1)

There is no significant relationship between ASEI-PDSI pedagogical paradigm and students' Mathematics attitudes in Junior Secondary Schools (JSS)

The Chi-Square Test for Null hypothesis 1 is shown in table 2.

Table 2: Chi-Square (X^2) analysis for ASEI-PDSI pedagogical paradigm and students Mathematics attitudes

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.368[a]	24	.002
Likelihood Ratio	49.768	24	.002
N of Valid Cases	900		

a. 9 cells (25.0%) have expected count less than 5. The minimum expected count is .89.

From Table 2, the p-value (p = 0.002) is less than the alpha value (α = 0.05), so we reject H_0 which shows the result is statistically significant, that is, there is a significant relationship between ASEI-PDSI pedagogical paradigm and students' Mathematics attitudes.

Research Question 2

What is the influence of ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement in Junior Secondary Schools (JSS)?

This research question was answered using data as shown in table 3

Table 3: Teachers' responses on ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement

S/N	ASEI-PDSI pedagogical paradigm and Students' Achievement	N	Mean ($\bar{x}$)	SD	Remark
1.	Students' active roles in learning and abilities to manipulate learning materials improved students' understanding and Mathematics performance.	100	3.35	.557	Accepted

2.	Positive attitudes developed as a result of ASEI-PDSI pedagogical paradigm have improved students' Mathematics performance.	100	3.31	.598	Accepted
3.	The method ensured active learner participation in the learning process, eased every classroom tension that discourages active learning and hence improved their performance in Mathematics.	100	3.26	.645	Accepted
4.	The student-centred classroom environment boosts learning, ensures better retention of learnt concepts and skills, resulting in improved students' performance in Mathematics.	100	3.39	665	Accepted
5.	Effective use of instructional materials by teachers and the participatory activities of students now gradually facilitates improvements in students' Mathematical skills and abilities.	100	3.50	.611	Accepted
6.	ASEI-PDSI pedagogical paradigm brings in more work and more thinking that makes students more competent and independent in the learning process resulting in better performance in Mathematics.	100	3.30	.659	Accepted
7.	ASEI-PDSI pedagogical paradigm method has considerably improved the mathematics performance of	100	3.27	.584	Accepted

	students in their assessment and school internal examination				
	Valid N (listwise)	100			
	GRAND MEAN		**3.34**		

Table 3 shows that items 1 - 7 were all accepted indicating ASEI-PDSI pedagogical paradigm influenced Students' Mathematics Achievement, because they had response mean greater than the instrument scale mean of 2.50. Also, the grand mean of 3.34 out of 4 is well higher than the scale mean which implies high positive influence of the ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement.

Null Hypothesis 2 (HO_2)

There is no significant relationship between ASEI-PDSI pedagogical paradigm and students' Mathematics achievement in Junior Secondary Schools (JSS)

The Chi-Square Tests for Null hypothesis 2 is shown in table 4

Table 4: Summary of Chi-Square (X^2) analysis for ASEI-PDSI pedagogical paradigm and attitudes of students

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.399[a]	18	.260
Likelihood Ratio	22.473	18	.212
N of Valid Cases	700		

a. 7 cells (25.0%) have expected count less than 5. The minimum expected count is .86.

From Table 4, the p-value (p = .260) is greater than the alpha value (α = 0.05), so we accept H_0, which shows the result is not statistically significant, that is, there is no significant relationship between ASEI-PDSI pedagogical paradigm and students' Mathematics achievement

Summary of Findings

1) ASEI-PDSI pedagogical paradigm had a high positive influence on Students' Mathematics Attitude and was statistically significant.
2) Though, there was a high positive influence of the ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement, but was not statistically significant.

Discussion of Findings

The findings revealed that ASEI-PDSI pedagogical paradigm had a high positive influence on Students' Attitude towards Mathematics. Further testing of the associated hypothesis showed that the influence was statistically significant. This finding was supported by Mwelese and Atwoto, 2014 who in their studies found out that students taught through the ASEI-PDSI approach had a better view and attitude towards mathematics than those taught through the traditional approaches. This finding was also in – line with Ayiego, et al (2015), who observed that the practice of PDSI approach, positively affected the attitude of students due to teachers' improved usage of improvised teaching and learning aids and varied classroom activities making Mathematics simple to understand for the learners.

The findings also revealed that there was a high positive influence of the ASEI-PDSI pedagogical paradigm on Students' Mathematics Achievement, though impact was not statistically significant. This was also collaborated by Ayiego, et al (2015), who also observed that, as teachers employed the ASEI approach, there was positive impacts on mathematics performance of students as there were improved teaching methodologies, improvisation of resources, and use of lesson rationale in Mathematics. Teachers engaged students in varied activities in class and at home.

This finding was also in – line with Kibe, Otieno & Ateng, 2008 who in their studies, observed that the "capability" or rather academic ability of students in mathematics had significantly improved after being exposed to ASEI/PDSI

EDITOR-IN-CHIEF
Prof. A.I. Mteiye [MALAWI]

mode of instruction delivery. In a similar way, Mwelese & Atwoto, 2014 in their report, confirmed the finding that ASEI-PDSI approach had a positive impact on students' mathematics achievement but in their case, the impact was statistically significant. They observed in their work that students taught using the approach performed better than those taught through the traditional approaches.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study established that ASEI-PDSI pedagogical paradigm is an appropriate teaching and learning strategy for delivery effective mathematics instruction in this present times where advocacy for a shift from teacher – centred pedagogy to a learner-centred pedagogy is high, so as to stem the perennial under-performance of students in mathematics. In this study, the practice of ASEI-PDSI pedagogical paradigm in teaching and learning of Mathematics in Junior Secondary Schools in FCT was observed to have caused significant students' attitudinal change and improved academic achievement. The ASEI-PDSI pedagogical paradigm actually encompasses the formulation of activities which enhanced students‟ participation making the subject very interesting and enjoyable to the learners, hence causing a change in learners' mathematics attitude and performance.

However, it is pertinent to note that improved results could be sustained where teachers' improved teaching methodologies, improved usage of improvised teaching and learning aids and varied classroom activities are guaranteed.

Recommendations

Based on the research findings, the following are recommended:

i. Encourage stakeholders: Federal Ministry of Education, FCT Universal Basic Education Board (FCT-UBEB), international partners and other relevant organizations on the need for regular/up-to-date SMASE IN-SET programs for Mathematics teachers.

ii. Encourage FCT - Universal Basic Education Board (FCT- UBEB) in particular on the need to expand the SMASE IN-SET programs to accommodate other Mathematics teachers yet to be trained across the Junior Secondary Schools in FCT
iii. Encourage Junior Secondary School Mathematics teachers that are currently implementing ASEI - PDSI pedagogical paradigm on the need for sustainability so as to continuously create a mathematically stimulating classroom environment that would promote learner-centered pedagogy and ultimately affect students' attitude and academic performance in Mathematics
iv. Encourage policy makers, curriculum planners, inspectorate units of Ministry of Education and educators on the need to ensure school management are well prepared in terms of human and material resources for effective application of ASEI/PDSI pedagogy
v. Encourage the inspectorate units of FCT - Education secretariat on the need for constant monitoring exercise to ensure Junior School Mathematics teachers are fully compliant of the ASEI practice
vi. Learners would be encouraged to take responsibility for their own learning and as such would no longer see mathematics as a difficult subject.

Acknowledgement

The author is profoundly grateful to Tertiary Education Trust Fund (TETfund) for the sponsorship of this research work and also to the mathematics teachers of Junior Secondary Schools in the study area for their cooperation.

References

Adunola, O. (2011). *The Impact of Teachers' Teaching Methods on the Academic Performance of Primary School Pupils in Ijebu-Ode Local Government Area of Ogun State*. Ogun: Ego Booster Books.

Aguele, L.I. & Usman, K.O (2007). Mathematics education for dynamic economy in Nigeria in the 21st Century. *J. Soc. Sci., 15(3):* 293-296. Retrieved 17th September, 2017 from https://www.researchgate.net/publication/272747098_Mathematics_Education_for_Dynamic_Economy_in_Nigeria_in_the_21_st_Century

Anaduaka, U. S., & Okafor, C. F. (2013). Nigeria School Children and Mathematics Phobia: How Mathematics Teacher can help. *American Journal of Educational Research, 1(7)*, 247–251. Retrieved on 12th November, 2019 from https://pubs.sciepub.com/education/1/7/5/abstract.html

Anaduaka, U.S. & Okwuozor, S. O. (2021). Effect of ASEI-PDSI Teaching Approach on Junior Secondary School Students' Retention in Mathematics in Abuja, Nigeria. *Journal of Mathematical Sciences Education,* 6(1), 963-980

Anaduaka, U.S. (2010). Acquisition of Mathematical knowledge for Sustainable Development: Implication for Teaching and Learning. In N. S. Talla, M, H. Mohommed, S. A. E. Apara and E. O. Ogungbe (Eds), *Education for Sustainable Development in Nigeria*. Jos: SmartPrint Production. 237-247

Ayiego, E. M., Mang'are P. A., Ngome, C. K, & Mandilah, L (2015). Analytical Study of the Extent of Practice and Implementation of Asei-Pdsi Approach by Teachers of Mathematics in Vihiga County, Kenya. *American Research Journal of Mathematics,* 1(2), 7 – 19, Retrieved May 10, 2017, from https://www.arjonline.org

Biggs, J. (1999) What the Student Does: teaching for enhanced learning. Retrieved on 20th April, 2022 from https://ucalearningandteaching.files.wordpress.com/2015/11/biggs-1999-what-the-student-does-v3.pdf

BrainyQuote (2001). I hear and I forget, I see and I remember, I do and I understand. Retrieved 25th November, 2019 from https://www.brainyquote.com/quote/confucius_136802

Danjuma, I. M. (2015). An Investigation of Pre- Service Teacher Problem- Solving Behaviour in Solving Selected Numerical Problem in Chemistry. Unpublished PhD Thesis, Abubakar Tafawa Balewa University, Bauchi.

Fatima, R. (2012). Role of Mathematics in the Development of Society. Current Research in Elementary School Mathematics. Retrieved 23rd July 2019, from https://www.semanticcholar.org/.../Role-of-Mathematics...Fatima/bae6bf15245ble.56

Federal Republic of Nigeria (FRN) (2014). *National policy on education* (6th ed.). Lagos: Nigerian Educational Research and Development Council press.

https://www.simplypsychology.org/bandura.html#:~:text=Social%20learning%20theory%2C%20proposed%20by%20Albert%20Bandura%2C%20emphasizes,factors%20interact%20to%20influence%20human%20learning%20and%20behavior

Kibe, S. K., Odhiambo, J. O. & Ogwel, J. C. A. (2008). Impact of SMASSE INSET on Students' Capacity through Improved Teaching and Learning in the Classrooms. Retrieved May 12, 2017, from https://www.academia.edu/465278/Impact_of_SMASSE_INSET_on_Students_Capacity_through_Improved_Teaching_and_Learning_in_the_Classroom

Kingir, S., Tas, Y., Gok, G., & Vural, S. (2013). Relationships among constructivist learning environment perceptions, motivational beliefs, self-regulation and science achievement. *Research in Science & Technological Education*, *31*(3), 205-226.

Mahapatra, P. K. (2020). Math Phobia: Causes And Remedies. Retrieved 24th May 2024, from https://timesofindia.indiatimes.com/readersblog/a-common-man-viewpoint/math-phobia-causes-and-remedies-21792/

Mcleod, S. (2024). Albert Bandura's Social Learning Theory. Retrieved 23rd July 2024, from

Mumcu, H. Y., & Aktas, M. C. (2015). Multi-program high school students' attitudes and self- efficacy perceptions toward mathematics. *Eurasian Journal of Educational Research,* (59), 207. doi:10.14689/ejer.2015.59.12

Mwelese, K. & Atwoto, J. O. (2014). The influence of the ASEI-PDSI approach on Students' views and attitudes towards Mathematics Instruction. *Journal of Education and Practice 5(24)*. Retrieved 23rd May. 2017, from https://www.iiste.org

Omole, M. (2011). The Relevant of Science Technology Engineering and Mathematics (STEM) FAIR in learning. The Punch Newspaper, Friday 23rd September, 2011.

Onchonga, O. B. (2013). Implementation of ASEI-PDSI approach in Mathematics Lessons in Nyamiya Division, Nyamira County, Kenya. Retrieved 23rd May 2017, from https://www.pdfsemanticscholor.org/dfd7/48an6220b3a2e83199368bd01e3b0a99ffd5.pdf

Osemwinyen, A. C (2010). Effects of E-learning on Retention and Achievement in Secondary School Mathematics in FCT, Abuja. Unpublished M.Ed Project, University of Nigeria, Nsukka

SCISPACE, (2024). What is Mathematical achievement. Retrieved on 24th September, 2024 from https://typeset.io/questions/what-is-mathematical-achievement-588vj27kt4

Uzoagulu, A.E. (2011). *Practical Guide to Writing Research Project Reports in Tertiary Institutions*. Enugu: Cheston Ltd.