



Teachers' Perception of Strengthening Mathematics and Science Education (SMASE) Pedagogy in Kwara State

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Abstract

The Nigerian government through the Federal Ministry of Education (FME) adopted the Strengthening Mathematics and Science Education (SMASE) in-service training and encouraged teachers to teach science and mathematics with Activity, Student-centered, Experiment, Improvisation-Plan, Do, See, and Improve (ASEI-PDSI) approach. Hence, this study investigated teachers' perception of ASEI-PDSI in Kwara State, Nigeria. A descriptive research type was adopted; the population was all Basic School teachers in Kwara State; and 183 core teachers were purposively selected. The Questionnaire on Perception (QoP) of ASEI-PDSI with reliability coefficient of 0.78 was the data gathering tool; and analyses were done using descriptive statistics. The study established that teachers perceived ASEI-PDSI positively, and that gender, qualifications and experience didn't influence their perceptions. The study concluded that teachers in Kwara State adjudged ASEI-PDSI to be worthwhile and thus, recommended that teachers should be motivated and monitored for proper classroom actualization of ASEI-PDSI and sustainability of positive perception.

Keywords: ASEI-PDSI, Basic Schools, Teachers' Perception, SMASE INSET,

Introduction

Many African countries focused their attentions to scientific and technological advancement. This is because, the contemporary world is evolving greatly around technology and any nation that does not dance to its tune, becomes obsolete. Specifically, in Nigeria, improving the quality of science and mathematics education is essential for technological development and joining one of the top industrial countries of the world in accordance with the vision 2030. Hence, the need to strengthen teaching and learning of science and mathematics at all levels of education in Nigeria becomes imperative.

Despite the growing efforts to strengthen science and mathematics education in Nigeria, literature is replete with evidence of students' under-achievement in these subjects and a lot of factors are attributed to this dwindling performance. These factors are teachers' factors, students' factors, socio-economic factors, school type (Amukowa, 2013; Mwaba, 2011). Odhiambo (2016) submitted that shortage of qualified teachers, inappropriate teaching methodologies, poor mastery of contents by teachers, limited teaching and learning resources are factors adduced to poor achievement in science and mathematics. In addition, Ngeme (2016) investigated factors that cause poor performance in science subjects and concluded that change in curriculum, teachers' teaching load, resources and lack of specialized content knowledge and medium of instruction were the major contributing

factors to students' under-achievement in science and mathematics.

From the perusal of the factors responsible for students' poor achievement in science and mathematics, teachers' factors are recurrent. Hence, the role of teachers in improving the quality of education of any nation cannot be over-emphasized. Teachers are the major determinant of successful learning and, are in the best position to meet the education needs of their students. Thus, the need for teachers to have access to sustainable and qualitative professional development such as In-Service Education and Training (INSET) becomes imperative. In-Service Education and Training (INSET) are relevant courses and activities that serving teachers partake to upgrade their professional knowledge, skills, and competence in the teaching profession (Osamwonyi, 2016). Thus, INSET is a continuous and deliberate manpower development in the education sector. For efficiency and improved students' achievement, it is crucial to develop manpower (teachers), as no education system can rise above the quality of its teachers. No wonder, the education system in Japan has succeeded because it embraces continuous INSET for its teachers through mentorship research groups and workshops (Odhiambo, 2016).

Several INSET programmes such as Science Orientation Course (SOC), Teacher Vacation Course (TVC), Millennium Development Goals (MDGs) and so on, have been organized and conducted for primary

and secondary teachers. However, these INSET programmes lack sustainability and ability to yield effective change in teaching and learning (Shuaibu, 2016). Nevertheless, the FRN (2013) posited that in-service training should be an integral part of teacher education and that, teacher education shall continue to take cognizance of changes in methodology and in the curriculum through regular exposure to innovations in teaching.

In an attempt to revive INSET in Nigeria, the Nigerian government through the Federal Ministry of Education (FME) collaborated with the Japan International Cooperation Agency (JICA) to re-establish a system of retraining for serving teachers in the areas of mathematics and science education entitled Strengthening Mathematics and Science Education (SMASE) Nigeria project. The choice of JICA was born out of the several successes of its collaboration in instituting, organizing, and executing sustainable and qualitative INSET programmes for mathematics and science teachers in many African countries such as Kenya, Ghana, Uganda, Malawi, Egypt and so on (SMASE, 2010). The SMASE Nigeria project is an on-going project that kicked off in 2006 and has realized active participation of pupils in mathematics and science classroom through INSET (SMASE-Africa, 2017). The SMASE national INSET centre at the National Teachers' Institute (NTI), Kaduna organized national INSETs and coordinated the state and local INSETs. So far, four hundred and twenty- nine (429) state trainers, ten thousand, eight hundred and sixty (10,860) core teachers and nine thousand, five hundred and ten (9,510) classroom teachers have been trained (SMASE-Africa, 2017).

The SMASE INSETs training were organized into three cycles of different theme. Cycle one addresses attitudinal change towards teaching/learning of mathematics and science; cycle two enhances classroom activities for effective teaching and learning; and cycle three emphasizes classroom actualization of ASEI-PDSI principle. The overall goal of SMASE Nigeria project is to upgrade the capability of Nigerian basic school students in mathematics and science, and teaching skills of basic school teachers in mathematics and science by promoting student-centered teaching through ASEI-PDSI instructional strategy (JICA, 2006).

The ASEI is an acronym for Activity, Student-Centered, Experiment and Improvisation, an inherent strategy that promote student-centered pedagogy among teachers while PDSI stands for Plan,

Do, See, and improve that encourages culture of continuous improvement (Mwelese & Atwoto, 2014). The principle of ASEI-PDSI serves as foundation upon which teachers can build a substantive and sustainable change in concept of learning in the classroom with the ultimate aim of enhancing the quality of teaching/learning of mathematics and science (SMASSE, 2007). Hence, the ASEI-PDSI emphasizes students' learning rather than teachers' teaching.

The PDSI is the means through which the teacher achieves ASEI. That is, the ASEI belongs to the students while the PDSI belongs to the teacher. For a lesson to attain as ASEI status, the teacher plans, implements, observes and improves on the subsequent lessons. Thus, the premise of SMASE Nigeria centers on extensive and conscious planning of the lesson for better classroom implementation. The ASEI-PDSI has been used and proved to be effective by science and mathematics educators (Adamu, 2017; Mwelese & Atwoto, 2014). Also, efforts have been put in place by relevant stakeholders such as the national trainers, FME and Universal Basic Education Commission, UBEC to ensure classroom actualization of ASEI-PDSI through the school-based training; and monitoring and evaluation. However, successful classroom actualization would depend on teachers' support which may be influenced by their perceptions of the instruction (ASEI-PDSI).

Teachers' perception is crucial, and a driving force behind successful classroom practices. Teachers' perceptions could therefore enhance or inhibit classroom implementation of ASEI-PDSI. Studies have been carried out on teachers' perceptions of the SMASE's program and findings from these studies indicated that teachers had positive perception of SMASE program and ASEI-PDSI. Hence, the teachers plan better and more consistently for lessons, and had confidence to perform practical activities previously thought to be difficult (Cheruiyot, 2018; Kariisa, 2015; Wambui, 2014). These studies were carried out outside Nigeria. However, in Nigeria, ASEI-PDSI was introduced to science and mathematics teachers in basic schools, it has not been known whether teachers in Nigeria perceive it positively or negatively. Thus, this study sought to investigate basic school science and mathematics teachers' perception of ASEI-PDSI approach in Kwara State, Nigeria.

Research Questions

Based on the problem of the study, answers were provided to the following questions in this study:

1. How do teachers perceive ASEI-PDSI approach?
2. What is the difference in male and female teachers' perception of ASEI-PDSI?
3. What is the difference in qualified and less qualified teachers' perception of ASEI-PDSI?
4. What is the difference in less experienced, moderately experienced and experienced teachers' perception of ASEI-PDSI?

Methods

The study was descriptive research of the survey type. Descriptive research involves collecting information by interviewing or administering questionnaires to sample of individuals and enables the researcher to determine the present status of the population with regards to the number of variables. Hence, it enables the researcher the researcher to collect information about perception of teachers on ASEI-PDSI as a mode of instruction.

Population and Sample

The population for the study was all Kwara State Basic School teachers while the target population was 6224 science and mathematics teachers in the Basic Schools. This is because improving the quality of teaching science and mathematics was the overall aim of the SMASE Nigeria project and these categories of teachers must have received training on ASEI-PDSI either at national level as state trainers, state level as core teachers, local level as classroom teachers or through the school-based training. Purposive sampling technique was used to select 183 (121 females, 62 males) core teachers that attended SMASE cycle III INSET across the 16 local government areas of Kwara State.

Research Instrument

The data gathering tool was a researcher designed Questionnaire on Perception (QoP) of ASEI-PDSI. The QoP of ASEI-PDSI is comprised of two sections A and B. Section A contained the demographic data about the respondents, B was designed to elicit information on how the respondents perceive the ASEI-PDSI. The researcher initially produced a draft of 25 items on perceptions on a 4-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The draft was given to two experts in the field of science education to comment on the items in terms of relevance, sentence structure and adequacy of the

instrument. Based on their recommendations, four of the items were discarded. The responses were scored 4, 3, 2, 1 for positive items and the reverse coding of 1, 2, 3, 4 were used for the negative items. In order to determine the internal consistencies of the items of QoP of ASEI-PDSI, a test-retest reliability method was employed involving 20 non-participating science and mathematics teachers in Kwara State. The resulting data were analyzed using Cronbach's alpha and a reliability coefficient of 0.78 was obtained. Hence, QoP of ASEI-PDSI was adjudged to be reliable.

Data Collection

The researcher formally sought for permission of SMASE desk Officer before the INSET through the informed consent form. Having granted permission, the researcher interacted with the teachers, enlightened and acquainted them with the nature of the study. Consequently, the researcher apprised them of the significance and benefits of the study, affirmed and disclosed that the data obtained from the study is strictly for research purpose; their identity would be treated with utmost confidentiality; the study would not be forced on them; and they may withdraw their participation at any stage of the study and thus, formally sought their consents through the informed consent forms. The QoP of ASEI-PDSI was administered during the State INSET. A total of 200 QoP of ASEI-PDSI were given to the representatives of each local government area for monitoring and coordination. However, 183 copies were returned, hence, constituted the valid sample. The resulting data were analysed using frequency, percentage, mean and chi-square. The chi-square was measured at 0.05 level of significance. The choice of chi-square was considered appropriate because the data were categorical; there was no relationship between the subjects and the variables were not paired.

Results

These sections present the analyses and interpretations of data gathered from QoP of ASEI-PDSI.

The analysis on Table 1 shows the perceptions of teachers on ASEI-PDSI instruction. It shows distribution of teachers' level of agreement or disagreement for a particular item and its corresponding mean. As shown in Table 1, the mean score of their perception for all items was 3.04, greater than 3.00 of Agree (A). This implies that all the teachers agreed with all the features of ASEI-PDSI and thus, had positive perception on the instruction.

Table 1
Analysis of Responses of Teachers' Perception of ASEI-PDSI

Items	SA	A	D	SD	Mean
ASEI-PDSI lesson planning is not difficult to carryout	9	103	67	4	2.63
ASEI-PDSI planning is tasking and time consuming	58	107	9	9	3.17
Learning point inclusion in ASEI-PDSI lesson planning makes lesson objectives easier to achieve	129	49	4	0	3.68
ASEI-PDSI lesson delivery is interesting	134	45	4	0	3.71
Lesser job is required during ASEI-PDSI classroom instruction	62	85	27	9	3.10
ASEI-PDSI instruction makes learning more permanent than other approaches	129	54	0	0	3.71
ASEI-PDSI instruction is not better than other learning approaches we have used	4	22	85	71	3.22
Preparing class activities for every ASEI-PDSI lesson is bothersome	22	71	67	22	2.49
ASEI-PDSI activity-based instructions delay syllabus coverage	13	40	71	58	2.95
ASEI-PDSI paradigm shift is an illusion	9	40	71	62	3.02
ASEI-PDSI approach is easy to practice	36	85	54	9	2.80
Task and students' coordination simultaneously is not possible during ASEI-PDSI lesson delivery	9	31	71	71	3.12
Formulating rationale for every ASEI-PDSI lesson is not necessary	4	13	62	103	3.44
Conventional and textbooks experiments are easier to set-up than improvising	9	31	94	49	3.00
ASEI-PDSI lessons can be done without school management's intervention	27	62	64	40	2.41
Students' prior experiences make ASEI-PDSI classroom instruction easier	62	107	13	0	3.27
Curricular and topic analysis is not my duty to perform	13	0	107	62	3.19
Feedback from students and colleagues is not necessary for improvement in subsequent lessons	98	67	9	9	1.61
Developing interaction plan for every lesson is not necessary for bridging in ASEI lesson	9	13	98	62	3.17
The ASEI principle of chalkboard usage is tasking and time consuming	13	58	71	40	2.76
Allowing individual thinking time during lessons enhances participation	98	62	13	9	3.39
Total					3.04

To answer research question 2, the percentage and chi-square analysis were employed. In Table 2, 68.7% (% of SA and A) of the female teachers had positive perception of ASEI-PDSI while 70.0% of male teachers had positive perception of the instruction. To test whether a difference existed in male and female teachers' perception of ASEI-PDSI instruction, chi-square analysis was carried out in Table 3. The result of the chi square analysis revealed chi-square

calculated value of 7.47 which is less than the table value of 7.82 for degree of freedom 3 and at 0.05 level of significance ($\chi^2_{(3,183)cal.} = 7.47 < \chi^2_{(3,183)tab.} = 7.82$, $p > .05$). Thus, no significant difference existed in male and female teachers' perception of ASEI-PDSI instruction. This implies that male and female teachers did not perceive ASEI-PDSI differently

Table 2

Analysis of Difference in Male and Female Teachers' Perception of ASEI-PDSI

		SA	A	D	SD	TOTAL
Female	Observed <i>f</i>	3427	3539	1876	1288	10130
	%	33.8	34.9	18.5	12.7	100.0
	Expected <i>f</i>	3254.094	3788.536	1977.63	1109.74	10130
	%	32.1	37.4	19.5	11.0	100.0
Male	Observed <i>f</i>	1511	2210	1125	396	5242
	%	28.8	42.2	21.5	7.6	100.0
	Expected <i>f</i>	1683.906	1960.464	1023.37	574.2602	5242
	%	32.1	37.4	19.5	11.0	100.0

Table 3

Chi-Square Analysis for Difference in Male and Female Teachers' Perception

Gender	Agree	Disagree	df	Calc. Value	Tab. Value	Decision
Female	6996	3164	3	7.47	7.82	NS
Male	3721	1521				

$p > .05$

In the same vein, research question 3 was answered using percentage and chi-square. In Table 4, 69.3% (% of SA and A) of the qualified teachers had positive perception of ASEI-PDSI while 72.3% of the less qualified teachers had positive perception of the instruction. To test for a difference in teachers' perception of ASEI-PDSI instruction based on qualification, chi-square analysis was carried out in Table 5. The result of the chi square analysis showed chi-square calculated value of 0.82 which is less than the table value of 7.82 for degree of freedom 3 and at

0.05 level of significance ($\chi^2_{(3,183)cal.} = 0.82 < \chi^2_{(3,183)tab.} = 7.82, p > .05$). Thus, no significant difference existed in the qualified and less qualified teachers' perception of ASEI-PDSI instruction. This implies that teachers, regardless of their qualifications did not perceive ASEI-PDSI differently.

Table 4

Analysis of Difference in Qualified and Less Qualified Teachers' Perception of ASEI-PDSI

		SA	A	D	SD	TOTAL
Qualified	Observed <i>f</i>	4603	5273	2829	1541	14246
	%	32.31	37.01	19.86	10.82	100.00
	Expected <i>f</i>	4576.29	5327.89	2782.10	1559.72	14246
	%	32.12	37.40	19.53	10.95	100.00
Less-qualified	Observed <i>f</i>	335	476	173	142	1126
	%	29.75	42.27	15.36	12.61	100.00
	Expected <i>f</i>	361.71	421.11	219.90	123.28	1126
	%	32.12	37.40	19.53	10.95	100.00

Table 5

Chi-Square Analysis for Difference in Qualified and Less Qualified Teachers' Perception

Qualification	Agree	Disagree	df	Calc. Value	Tab. Value	Decision
Qualified	9876	4370				

			3	0.82	7.82	NS
Less Qualified	811	315				

$p > .05$

Also, research question 4 was answered using percentage and chi-square. In Table 6, 70.8% (% of SA and A) of the experienced teachers perceived ASEI-PDSI instruction positively, 68.4% of the moderately experienced teachers perceived ASEI-PDSI instruction positively, while 70.3% of less experienced teachers perceived the instruction positively. To test whether a difference existed in teachers' perception of ASEI-PDSI instruction based on their teaching experience, chi-square analysis was carried out in Table 8. The result of the chi square analysis showed chi-square calculated value of 12.04 which is less than

the table value of 12.59 for degree of freedom 6 and at 0.05 level of significance ($\chi^2_{(3,183)cal.} = 12.04 < \chi^2_{(3,183)tab.} = 12.59, p > .05$). Thus, there was no significant difference in the perception of experienced, moderately experienced and less experienced teachers. This implies that teachers, irrespective of their professional experience, did not perceive ASEI-PDSI differently.

Table 6
Analysis of Difference in Teachers' Perception of ASEI-PDSI Instruction Based on Teaching Experience

		SA	A	D	SD	TOTAL
Experienced	Observed <i>f</i>	1856	2383	1136	618	5993
	%	31.0	39.8	19.0	10.3	100.0
	Expected <i>f</i>	1925.542	2241.332	1170.374	655.752407	5993
	%	32.1	37.4	19.5	10.9	100.0
Moderately Experienced	Observed <i>f</i>	2728	2667	1602	882	7879
	%	34.6	33.8	20.3	11.2	100.0
	Expected <i>f</i>	2531.511	2946.68	1538.691	862.118007	7879
	%	32.1	37.4	19.5	10.9	100.0
Less Experienced	Observed <i>f</i>	355	699	264	182	1500
	%	23.7	46.6	17.6	12.1	100.0
	Expected <i>f</i>	481.9477	560.9875	292.9352	164.129586	1500
	%	32.1	37.4	19.5	10.9	100.0

Table 7
Chi-Square Analysis for Difference in Teachers' Perception based on Experience

Experience	Agree	Disagree	df	Calc. Value	Tab. Value	Decision
Experienced	4239	1754	5	12.04	12.59	NS
Moderately experienced	4995	2824				
Less Experienced	1054	446				

$p > .05$

Discussions

Findings from this study revealed that the teachers agreed to all the features of ASEI-PDSI approach. This implies that teachers perceive the ASEI-PDSI positively. This is not surprising because the teachers, having gone through training on ASEI-PDSI, realized that, the approach allows students to construct their

own meaning of science; gives room for active participation; advocates for the use of local materials; and encourages cooperative learning among students. This finding is consistent with the earlier findings of Kariisa, 2015 Ndiku, Role, and Biego (2011); Mwelese and Atwoto, 2014; Ndirangu (2017) which

reported that teachers had positive view of ASEI-PDSI.

Finding on influence of gender, qualification and experience on teachers' perception of ASEI-PDSI revealed no significant difference in gender, qualification and experience of teachers' perception of ASEI-PDSI. This suggested that gender did not have influence on their perception of ASEI-PDSI. This is expected, as all the teachers, regardless of their gender, qualification and experience embraced the instructional approach during training because, they all submitted that lesser job would be required during lesson delivery if lesson is adequately planned. These findings agree with the findings of Ndirangu (2017) that teachers' variables didn't have influence on their perception of ASEI-PDSI. However, disagree with the finding of Chaniywo, Ngeno and Barchoic (2013).

Conclusions and Recommendations

Conclusively, teachers in Kwara State adjudged ASEI-PDSI to be worthwhile, beneficial and effective for teaching science and mathematics in the basic schools. Hence, it is recommended that teachers should be motivated and monitored for proper classroom actualization of ASEI-PDSI instruction and sustainability of positive perception.

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