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Dr. Bamidele, Abiodun Daniel and Dr. Adegoke, Adebare Idowu

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Enriching Science Technology Engineering and Mathematics Teachers' Awareness and Utilization of Research Findings on Instructional Strategies through Collaborative Intervention in Ibarapa Region

Dr. Bamidele, Abiodun Daniel
Department of General Studies Education, Oyo State College of Education, Lanlate

Dr. Adegoke, Adebare Idowu
Department of Integrated Science, Oyo State College of Education, Lanlate

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Abstract

Purpose: The goal of this study is to examine the level of awareness of STEM teachers about the educational research findings on instructional strategies before and after collaborative intervention. Also, the study examines the level of utilization of educational research findings on instructional strategies by STEM teachers. The study intends to investigate the effects of utilization of educational research findings on instructional strategies by STEM teachers on student's academic performance in STEM subjects

Methodology: Collaboration action research method was adopted in the study. This involves the working together of the Experts (Researchers) and STEMS teachers in the secondary schools with the aim of sharing expertise knowledge, fostering dialogue and enhancing STEM teachers' awareness and utilization of educational research findings on instructional strategies. The purposive sampling technique was used for the selection of sixty (60) STEM teachers with minimum of first degree (BSc.Ed or BSc). The instruments used in the study were educational research findings package for collaborative intervention. This was developed from three Ph.D theses related to STEM education subjects. The data collected were analyzed using descriptive statistics of frequency count, simple percentage, mean and standard deviation. Tables were used to preset the data

Findings: The result shows that STEM teachers have moderate knowledge about educational research findings on instructional strategies and they have been adopting part in the teaching/learning process. However, the level of awareness and utilization increased after the intervention as shown by the weighted mean of .66 to .77 and 3.18 to 3.28 respectively.

Unique Contribution to Theory, Practice ad Policy: The study was built around three theories Lev Vygotsky's Social Constructivist Learning Theory, Communication Theory or Diffusion of Innovation Theory ad Model of knowledge Transfer Theory. Based on the findings it was suggested that workshops and in-service training programs should be organized for STEM teachers on regular basis to update their knowledge on the current findings and way of utilizing the findings in the teaching/learning of STEM subjects which will lead to good students' academic performance and increase in the admission rate to higher institutions.

Keywords: *STEM, Collaboration, Instructional Strategies, Awareness, Utilization*

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INTRODUCTION

The purpose of education is to equip the learners with self-transforming knowledge which can be used to change environment and execute whatever task that may be assigned. Science, Technology, Engineering and Mathematics (STEM) education is seen as a challenging opportunity to promote the development of 21st century skills and competences needed for update and upgrade the graduate to be employable. STEM education explains events in nature, helps people to think and reason in a logical manner, solves problems encountered on a day to day basis, develops social skills through proper handling of objects and equipment, develops social skills by establishing friendship while working cooperatively in groups and helps to satisfy curiosity through opportunities in carrying out investigation (Wasagu, 2019). Widya, Ronal and Yosi (2019) further explain that STEM education can improve students' abilities in problem solving, innovative, independent and to be able to connect what was learned with daily activities. They further stated that STEM education is implemented in many countries to enable students develop personal and social skills to cooperate with the others. Students do not only have knowledge, but also apply that knowledge to any problem in their daily life. In summary, STEM education is capable of equipping learners with the 21st century skills which are necessary for sustainable national development.

However, research findings shows that students performed poorly in science subjects at secondary school level due to some factors. One of the factor identified as responsible for the poor performance of students in science subjects is poor instructional strategy which is didactic and not activities based (Bamidele, 2014; Widya, Ronal & Yosi 2019). The poor performance of students at O level examination is affecting their admission rate into the higher institutions of learning like the Oyo State College of Education, Lanlate.

Table 1: Students Enrolment List according to Schools, for Eleven Years in Oyo State College of Education, Lanlate

S/N	YEAR	ARTS & SOS	ECCPED	LANGUAGES	SCIENCE	VTE	TOTAL
1	2015	68 (14)	86(18)	80(17)	87(18)	162(34)	483
2	2016	72(15)	66(14)	95(20)	82(17)	179(37)	494
3	2017	51(16)	36(12)	52(17)	69(22)	109(35)	317
4	2018	52(20)	21(08)	63(24)	51(20)	76(29)	263
5	2019	62(16)	43(11)	64(17)	83(21)	144(37)	396
6	2020	73(19)	27(07)	92(24)	96(25)	99(26)	387
7	2021	50(18)	30(11)	53(19)	57(21)	91(33)	281
8	2022	35(17)	13(07)	53(26)	57(28)	49(24)	207
9	2023	38(21)	21(12)	31(17)	43(24)	53(29)	186
10	2024	73(29)	19(08)	50(20)	42(17)	71(28)	255
11	2025	39(21)	12(07)	37(20)	36(20)	61(33)	185
	TOTAL	**613(17.75)**	**374(10.83)**	**670(19.40)**	**703(20.35)**	**1094(31.67)**	**3454**

Source: Admission office, Oyo State College of Education, Lanlate

Note: Numbers in Parenthesis are Percentage

From table 1 above, one could observed that out of the admission rate for 11 years under review admission into science courses has highest percentage only in 2022, 57 candidates amounted to 28% and as low as 17% in year 2024.

LITERATURE REWIEW

What student learns depends not only on what they are taught but also on how they are taught, their development level, and their interests and experiences. While developing the lesson plan, teacher makes decisions about what the learner needs to learn and not just what they will learn but how the learning will take place. The instructional strategies and approaches often have the greatest impact on learner success (Akinsola, 2023)

STEM education is seen as a challenging opportunity to promote the development of 21st century skills and competences to the public and in particular educational community. STEM education entails connecting Science, Technology, Engineering and Mathematics to develop students' creativity through problem solving (Sulai and Sulai 2021; Amado and Carreia, 2022; Tzafikon, Perifanou and Economides, 2022). STEM education explains events in nature, helps people to think and reason in a logical manner, solves problems encountered on a day to day basis, develops social skills through proper handling of objects and equipment, develops social skills by establishing friendship while working cooperatively in groups and helps to satisfy curiosity through opportunities in carrying out investigation (Wasagu, 2019). Widya, Ronal and Yosi (2019) further explains that STEM education can improve students' abilities in problem solving, to be innovative, to be independent and to be able to connect what was learned with daily activities. They further stated that STEM education is implemented in many countries to enable students develop personal and social skills to cooperate with the others. Students do not only have knowledge, but also be able to apply that knowledge to any problem in their daily life. In summary, STEM education is capable of equipping learners with the 21st century skills which are necessary for sustainable national development.

STEM education gives students the opportunity to improve their critical thinking skill, and be creative, logical, innovative, productive and directly compatible to real conditions which can make as well as skilled artisans required to turn the nation's economy around from a consumer nation to a producer nation. Despite the importance of STEM education to national development, studies show that students' achievement in STEM subjects has continued to be poor. The poor performance of students in STEM subjects is manifested in their poor performance in West African Senior Secondary School Certificate Examination (WASSCE May/June Chief Examiner's report 2019-2022). The poor performance of students in STEM has been a major concern to researchers and stakeholders in education. The situation has no doubt informed many research efforts which are directed towards the factors responsible for the poor performance of students in STEM subjects. Among the factors identified as responsible for poor performance are; Poor teaching method (Olaoluwa, 2009; Bamidele, 2014; Adegoke, 2015), Poor exposure to practical class (WAEC Examiner's report, 2018, 2019)

The poor academic performance can be improved by enriching the contents, method and strategies of teaching and learning of STEM subjects (Ogunleye, 2015). A good number of researchers had worked the instructional strategies which had been tested and found to be effective in teaching STEM subjects. These instructional strategies are students' centered where students actively

participated as proposed by the Constructivist theory of learning. In spite of these research findings, studies still ascribed students' poor performance to ineffective instructional strategies (Ekine, 2010; Armanta, Ligita, Jurate and Dangole, 2021). The problem may be due to the fact that these educational research findings did not get to the STEM teachers who are final end users. There is therefore the need to investigate the level of awareness of STEM teachers on the research findings on the instructional strategies. Also, there is need to find out the level of application of these instructional strategies on the teaching and learning of STEM subjects.

STEM education requires students to master multidisciplinary knowledge (e.g., science, technology, engineering, mathematics) and solve open-ended, ill-structured problems in the real world. Traditional instructor directed strategies might fail to help students achieve a high quality of learning effects in STEM education because it mainly highlights the efficiency of knowledge Conveying and memorizing rather than students' understandings (Sapounidis & Alimisis, 2020; Xu & Ouyang, 2022). For example, under traditional lecturing modes, students might have difficulty in understanding the complex STEM concepts and have few opportunities to develop higher-order thinking such as problem-solving ability and creativity. (Bers, 2021). Adequate knowledge in STEM education is very necessary by the citizenry for national development. To gain the required knowledge in STEM would require adequate teaching/learning process through effective teaching. The use of instructional strategies which makes students to be actively involved in problem-solving as advocated by Constructivist theory is needed.

Educational research is a way of logical search for information in order to accomplish an educational task and present it in a comprehensive form. It is not meant just for its own sake but rather directed at solving educational problem. Research is carried out in order to share ideas or increase understanding of challenging topics (EduBirdie, 2016; Afolabi, 2019). STEM teachers are regarded as practitioners of educational research findings. Their acquisition and utilization of research findings have been traced to themselves; research-based or combination or both. Teachers as individual personalities tend to use their time and efforts for whatever suit their interest. Inaccessibility to research reports has been identified as one of the problem militating against acquisition and utilization of research findings (Firdaus and Mohammed, 2023). However, Afolabi, (2019) reported that Mathematics teachers are moderately aware of research findings in Mathematics education. He further reported that there is significant difference between teachers' qualification in Mathematics and the use of research findings. One of the major ways of getting educational research findings to the final end users the STEM teachers is to develop a communication network links between the researchers and STEM teachers. This can be done through collaboration method. Collaboration is a method for improving research impact in education which includes the development of communication network, links between researchers and practitioners in the research process and approaches to the sharing of "Good Practices". Here the researcher who conducted the research collaborate with the teachers who are practitioners for the purpose of sharing ideas and identifying areas and ease of application of the findings in classroom teaching (Bansal, Mahendiratta, Kumar, Sarma, Prakash and Medhi, 2019) This paper therefore, investigates the level of awareness and utilization of STEM teachers on the research findings on instructional strategies by STEM teachers in Ibarapa Region of Oyo State in Nigeria.

Theoretical Framework

The study was built around three theories namely.

Lev Vygotsky's Social Constructivist Learning Theory

This learning theory states that learning and development is a social and collaborative activity that cannot be taught to anyone. Leonard, Noh and Orey (2010) stated that this theory of social and constructivist is based on specific assumptions which are; reality, knowledge and learning. The theory is very relevant to this study on the fact that the STEM teachers who are the end users of educational instructional strategies research findings have to interact with the researchers' through collaboration and share ideas with them. This will then determine whether the research finding will be utilized and the extent of such instructional strategies utilization.

Communication Theory or Diffusion of Innovation Theory

This theory was propounded by Everett, M. Rogers in 1962 and it is one of the oldest social science theories (Wayne, 2022). It originated in communication to explain how, over time, an idea or product gains momentum and diffuses or spreads through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behaviour, or product. In this context, Adoption means that a person does something differently than what they previously did. They key to adoption is that the person must perceive the idea, behaviour, or product as new or innovative. It is only this way that diffusion is possible. Researchers in diffusion theory have developed analytical models for explaining and forecasting the dynamics of diffusion of an innovation (an idea, practice, or object perceived as new by an individual) in a socio-technical system. This makes this theory relevant to this study.

Model of Knowledge Transfer Theory

There are various models of knowledge transfer (Dixon, 2000). However, this study adopts the Expert Knowledge Model. In this model, individual that may have been known to have experienced and overcome similar problems are viewed as "Experts". The experts are the researchers who engaged in the identification of educational problems and attempt to solve the problems through carefully planned and executed investigation. The STEM teachers in secondary schools who encounter "Problems in the classroom teaching and learning require research findings from the "Expert" and transfer of knowledge from experts to STEM teachers would enhance research awareness and utilization of research findings on instructional strategies to the end users

Statement of the Problem

Many researches had been carried out on method of teaching and their effects on students' academic performance in STEM education. The direction of these studies is towards the search for better strategies towards effective teaching/learning of STEM education. It is expected that new and effective instructional strategies are communicated to the practitioners through in-service-training programme. However, such in-service-trainings are organized seldom for teachers. There is therefore the need to sensitize the STEM teachers about the research findings. This study therefore examined the impact of communicating research findings between researchers and STEM teachers through collaboration method.

Aims and Objectives of the Study

- To examine the level of awareness of STEM teachers about the educational research findings on instructional strategies before and after collaborative intervention
- To examine the level of utilization of educational research findings on instructional strategies by STEM teachers
- To investigate the effect of utilization of educational research findings on instructional strategies by STEM teachers on student's academic performance in STEM subjects

Research Questions

Two research questions were raised and answered in this study. These are:

1. What is the level of awareness of STEM teachers about the educational research findings on instructional strategies before and after collaborative intervention?
2. What is the level is the level of utilization of research findings on instructional strategies by STEM teachers before and after collaborative intervention activities?

METHODOLOGY

Collaboration action research method was adopted in the study. This involves the working together of the Experts (Researchers) and STEMS teachers in the secondary schools with the aim of sharing expertise knowledge, fostering dialogue and enhancing STEM teachers' awareness and utilization of educational research findings on instructional strategies. The study is an action research in which a problem is identified with a social group and solution is proffered in the group. Hence the study made use of one group pretest, posttest pre-experimental design in which there is no control group. The variables in the study include:

Independent variable: The collaborative intervention programme within an action research setting;

Dependent variable at two levels

i. STEM teachers' awareness of educational research findings (instructional strategies);
ii. STEM teachers' utilization of educational research findings (instructional strategies)

Selection of Participants

The purposive sampling technique was used for the selection of the participants after the consent of the Local Inspectors of Education (LIE) and the school Principals of the selected schools in Ibarapa Region had been sought. Sixty (60) STEM teachers with minimum of first degree (BSc.Ed and BSc) in all senior secondary schools of the selected schools and who show positive interest in the collaborative intervention were randomly selected to be participants in the study.

Instruments

The instruments used in the study are:

Educational research findings package for collaborative intervention. This was developed from three Ph.D theses related to STEM education subjects. These focused on teaching strategies classroom interaction, and feasibility of implementation in the classroom and school setting. It

contains the abstract, statement of the problem, summary of the findings and recommendations of each of the five Ph.D theses selected.

The titles of the selected theses are:

1. Olaoluwa, S. A. (2009). Impact of Brain-Based instructional strategy on students' learning outcomes in senior secondary Mathematics in Oyo State, Nigeria. An unpublished PhD thesis, Faculty of Education, University of Ibadan, Ibadan.
2. Bamidele, A. D. (2014). Effects of Peer-led guided inquiry and Classwide peer tutoring instructional strategies on senior secondary school student's performance in practical skills in Chemistry. An unpublished PhD thesis, Faculty of Education, University of Ibadan, Ibadan
3. Adegoke, A, I. (2015). Effects of Active review and Practice-invention strategies on students' attitude to, and process skills in Basic Science in Oyo State. An unpublished PhD thesis, Faculty of Education, University of Ibadan, Ibadan

Other instruments used in the study were two questionnaires one to elicit response on STEM teachers level of awareness of educational research findings on instructional strategies and the other on STEM teachers' utilization of educational research findings on instructional strategies. Also, observation scale on STEM teachers' classroom practice and teacher interview guide on utilization of research findings. The procedure for the study followed pretest, pre-intervention classroom observation and interview, intervention proper, joint seminar and posttest.

Data Analysis

The data collected were analyzed using descriptive statistics of frequency count, simple percentage, mean and standard deviation. These were used to answer the two research questions.

RESULTS

Research Question1: What is the level of awareness of STEM teachers about the educational research findings on instructional strategies before and after collaborative intervention?

Table 2: Awareness about the Educational Research Findings on Instructional Strategies before Intervention (N=60)

Research Areas	Heard(1)	Not Heard(0)	Mean	Decision
STEM instructional strategies apart from conventional	39(65)	21(35)	0.65	Accept
Students' learning behaviour	34(56.7)	26(43.3)	0.57	Accept
Students' attitude to learning	50(83.3)	10(16.7)	0.83	Accept
Effects of Gender	42(70.0)	18(30.0)	0.70	Accept
Cognitive Ability	45(75.0)	15(25.0)	0.75	Accept
STEM instructional materials	38(63.3)	22(36.7)	0.63	Accept
Environmental factors	31(51.7)	29(48.3)	0.52	Accept
Teachers factors (Qualification & Experience)	46(76.7)	16(23.3)	0.77	Accept
WAEC examiners report	50(83.30)	10(16.7)	0.83	Accept
STEM testing and Assessment	34(56.7)	26(43.3)	0.57	Accept
Students' prerequisite knowledge	32(53.3)	28(46.7)	0.53	Accept
IT and STEM teaching and learning	25(41.7)	35(58.3)	0.42	Not Accept
School leadership and STEM learning	51(85.0)	09(15.0)	0.85	Accept
Weighted mean average			**0.66**	**Accept**

Source: Field Work

Values in Parentheses are Percentages

This study considered thirteen possible areas of research in STEM education from which STEM teachers can derive knowledge for effective teaching. These areas are; STEM instructional strategies apart from conventional Students' learning behaviour, Students' attitude to learning, effects of gender, cognitive ability, STEM instructional materials, environmental factors, teachers' factors (Qualification & Experience), WAEC examiners report, STEM testing and assessment, students' prerequisite knowledge, IT and STEM teaching and learning, school leadership and STEM learning. Table 1above shows the level of awareness of STEM education teachers before the intervention. The mean score value of .5 was taken as benchmark for decision on the level of awareness for acceptance, any value lower than the benchmark is taken as low level of awareness. From the table, twelve out of the thirteen areas of research findings were well above the benchmark of .5, and only one item of research area (Information and Technology and STEM teaching) fall below the benchmark with mean score value of 0.42. However, the weighted average mean score of 0.66 indicated that STEM teachers are averagely aware of research findings on qualitative educational research findings on instructional strategies of teaching STEM subjects. This finding is in agreement with the findings of Afolabi (2019) who also found out that Mathematics teachers are moderately aware of research findings in Mathematics which is one of the STEM subject. However, the finding is not in agreement with the findings of Firdaus and Mohammed (2023) that STEM teachers have low level of awareness

Table 3: Awareness about the Educational Research Findings on Instructional Strategies after Intervention (N=60)

Research Areas	Heard(1)	Not Heard(0)	Mean	Decision
STEM instructional strategies apart from conventional	57(95.0)	03(5.0)	0.95	Accept
Students' learning behaviour	53(88.3)	07(11.7)	0.88	Accept
Students' attitude to learning	54(90.0)	06(10.0)	0.90	Accept
Effects of gender	53(88.3)	07(11.7)	0.88	Accept
Cognitive ability	50(83.3)	10(16.7)	0.83	Accept
STEM instructional materials	51(85.0)	09(15.0)	0.85	Accept
Environmental factors	55(91.7)	05(8.3)	0.92	Accept
Teachers factors (qualification & experience)	52(86.7)	08(13.3)	0.87	Accept
WAEC examiners report	57(95.0)	03(5.0)	0.95	Accept
STEM testing and assessment	49(81.7)	11(18.3)	0.82	Accept
Students' prerequisite knowledge	45(75.0)	15(25.0)	0.75	Accept IT
STEM teaching and learning	43(71.7)	17(28.3)	0.72	Accept
School leadership and STEM learning	58(96.7)	02(3.3)	0.97	Accept
Weighted mean average			**0.77**	**Accept**

Source: Field Work. Values in Parentheses are Percentages

Table 2 shows an improvement in the level of awareness of STEM teachers on educational research findings on instructional strategies in STEM education. The improvement is seen in increase in the weighted mean value of 0.66 before the collaboration intervention to 0.77 after the intervention. It can be concluded that by the application of educational research findings to practice, one can update and expand professional knowledge and skills in various domains such as pedagogy, curriculum, assessment, leadership, management, communication, collaboration and ethics.

Research Question 2: What is the level of utilization of research findings on instructional strategies by STEM teachers before and after collaborative intervention activities?

Table 3: Implementation of Educational Research Findings on Instructional Strategies before Intervention (N=60)

Research Areas	Always(4)	Sometimes(3)	Rarely(2)	Never(1)	Mean	Std. Dev.
STEM instructional strategies apart from conventional	25(41.7)	20(33.3)	8(13.3)	7(11.7)	3.05	1.0
Students' learning behaviour	36(60.0)	18(30.0)	01(1.7)	5(8.3)	3.41	.88
Students' Attitude to learning	34(56.7)	15(25.0)	01(1.7)	10(16.7)	3.21	1.1
Effects of gender	32(53.3)	14(23.3)	09(15.0)	5(8.3)	3.21	.99
Cognitive ability	34(56.7)	16(26.7)	03(5.0)	7(11.7)	3.28	1.0
STEM instructional materials	35(58.3)	18(30.0)	03(5.0)	4(6.7)	3.40	.86
Environmental factors	28(46.7)	21(35.0)	6(10.0)	5(8.3)	3.20	.93
Teachers factors (Qualification & Experience)	30(50.0)	14(23.3)	09(15.0)	7(11.7)	3.11	1.0
WAEC examiners report	30(50.0)	15(25.0)	10(16.7)	5(8.3)	3.16	.99
STEM testing and Assessment	24(40.0)	18(30.0)	11(18.3)	7(11.7)	2.98	1.0
Students' prerequisite knowledge	41(68.3)	12(20.0)	05(8.3)	2(3.3)	3.53	.79
IT and STEM teaching and learning	15(38.3)	12(35.0)	16(1.7)	17(5.0)	2.42	1.23
School leadership and STEM learning	36(60.0)	17(28.3)	04(6.7)	3(5.0)	3.43	.86
Weighted mean average					**3.18**	

Source: Field work. Values in Parentheses are Percentages

Awareness and implementation are two different concepts. The fact that STEM teachers are aware of qualitative educational research findings on instructional strategies on the teaching of STEM subjects does not amount to effective implementation of the findings on their teaching/ learning activities. This form the basis for justification for raising research question 2 in this study.

Table 3 shows the expression of STEM teachers before intervention on the extent to which they apply the research findings on the thirteen research areas in the STEM education. The responses were based on the 4-poin Likert scale rated as 4, 3, 2, and 1 for Always, Sometimes, Rarely and Never respectively. A bench-mark of 2.5 was set as acceptable so mean above value above 2.5 is accepted to have heard and utilized the research findings, while mean value score below 2.5 is taken as heard but not used. Twelve out of the thirteen research areas have expression above the bench-mark, while only one - IT and STEM teaching and learning have mean score value of 2.42 indicating that STEM teachers have not been applying it in the teaching and learning of STEM subjects. This may be as result of lack of efficient digital infrastructure in school because positive attitude to using IT in teaching of STEM is linked to efficient digital infrastructure in the school. And technological characteristics have been recognized to influence the adoption ad integration of particular innovation (Lawrence and Tar, 2018; Ttzafilkon, Perifanou and

Economides, 2022). The highest mean value is 3.53 Students' prerequisite knowledge in teaching and learning of STEM subject. This could mean that research reports on the students' prerequisite knowledge is popular or that it is taken as of paramount importance. There are expressions on research findings that reported the importance of Students' prerequisite knowledge. This includes

the study of Bamidele and Ogunleye who reports the importance of students' prerequisite knowledge in the acquisition of practical skills in practical Chemistry.

Table 4: Implementation of Educational Research Findings on Instructional Strategies after Intervention (N=60)

Research Areas	Always(4)	Sometimes(3)	Rarely(2)	Never(1)	Mean	Std. Dev.
STEM instructional strategies apart from conventional	33(55)	21(36.7)	4(6.7)	01(1.7)	3.45	.69
Students' learning behaviour	43(71.7)	14(23.3)	01(1.7)	02(3.3)	3.63	.68
Students' attitude to learning	38(63.3)	19(31.7)	01(1.7)	02(3.3	3.55	.69
Effects of gender	40(66.7)	16(26.7)	01(1.7)	03(5.0)	3.55	.76
Cognitive ability	39(65.0)	18(30.0)	01(1.7)	02(3.3)	3.56	.69
STEM instructional materials	39(65.0)	17(28.3)	02(3.3)	02(3.3)	3.55	.72
Environmental factors	38(63.3)	18(30.0)	03(5.0)	01(1.7)	3.55	.67
Teachers factors (Qualification & Experience)	35(58.3)	19(31.7)	04(6.7)	02(3.3)	3.45	.76
WAEC examiners report	38(63.3)	16(26.7)	04(6.7)	02(3.3)	3.50	.77
STEM testing and Assessment	43(71.7)	14(23.3)	01(1.7)	02(3.3)	3.63	.68
IT and STEM teaching and learning	35(58.3)	25(38.3)	00(0.0)	02(3.3)	3.51	.67
School leadership and STEM learning	42(70.0)	16(26.7)	01(1.7)	01(1.7)	3.65	.60
Weighted mean average					**3.28**	

Source: Field work. Values in Parentheses are Percentages

Table 4 shows that after intervention, the mean scores for STEM teachers' utilization of educational research findings on instructional strategies range from 3.45 to 3.65, these values are generally high and the weighted average of 3.28 at post-intervention stage compare to 3.18 obtained in the pre-intervention stage indicates that the level of utilization has improved at the end of the intervention activities as it was higher than value obtained before intervention.

The result obtained in this study shows an increase in the level of awareness of STEM teachers on educational research findings on instructional strategies. This is as a result of the collaboration with researchers on strategies for enriching teaching and learning of STEM subjects. The result is in line with the findings of Hairon (2014) that reports that teachers need to be conversant with current research findings on teaching/learning strategies through collaboration with other experts.

The study also revealed that the level of utilization of STEM teachers on the areas of research findings increased especially in the area of integrating IT into the teaching/learning of STEM education. This was a result of the experts' interaction with the STEM teachers during the collaboration period.

CONCLUSION AND RECOMMENDATIONS

The study shows that the interaction between the researchers and end users of research findings, the STEM teachers through collaboration has impacted positively on STEM teachers. There was also improvement in the level of adaptation of the research findings on the instructional strategies.

The study therefore, recommended that there is need regular collaboration between STEM teachers and researchers on current instructional strategies on the teaching and learning process. Also, workshops, conferences, and in-service training programmes should be organized for STEM teachers on regular basis to update the teachers on the current finding and way of utilizing the findings in the teaching/learning of STEM subjects which will lead to good students' performance and national development.

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