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SURVEY ON INTEGRATED SCIENCE TEACHERS' ATTITUDES AND AWARENESS TOWARDS INNOVATIVE TEACHING STRATEGIES FOR PROMOTING CAPACITY BUILDING IN SCIENCE AND TECHNOLOGY.

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ABSTRACT

This survey delved into the attitudes and awareness of Integrated Science teachers regarding innovative teaching strategies in senior secondary across Plateau State. Employing a purposive sampling technique, 141 Integrated Science teachers from eighteen selected schools participated in the study. The research utilized an adapted questionnaire, "Teachers' Awareness and Attitude towards Innovative Teaching Strategies," which underwent validation and reliability assessments. Employing both descriptive and inferential statistical analyses, including ANOVA and t-test, the study addressed two research questions and formulated four hypotheses. The findings indicated a commendable awareness among Integrated Science teachers regarding the existence of innovative teaching strategies, accompanied by a positive attitude toward their implementation. Gender was found to hold no significant sway on the awareness of these strategies, although female educators exhibited a more favourable attitude toward innovative teaching methodologies compared to their male counterparts. Notably, teachers' experience exhibited an inverse relationship with their attitude toward innovative teaching strategies. Based on these findings, the study recommends the organization of in-service training seminars, workshops, and symposiums tailored towards fostering innovative teaching strategies among Integrated Science educators. Such initiatives are crucial for sustaining their awareness, nurturing positive attitudes, and encouraging practical utilization, thereby enhancing performance and capacity building in the realms of science and technology within the educational landscape.

INTRODUCTION

The contemporary challenges of unemployment underscore the pivotal role of science educators in fostering innovation and creativity among students. The necessity to nurture talents and augment learning processes is crucial for future career development and global competitiveness Mbajiorgu (2014). Science education stands not as an end in itself but as a pivotal contributor to societal advancements. Nations worldwide invest in science education to breed a cadre of scientists, engineers, technologists, and a scientifically literate populace, pivotal for sustainable growth and technological progress (Chokri, 2015). Integrated science, a cornerstone of scientific education, delves into the exploration of the physical world, encompassing all sciences, energy transformation and material properties, thereby propelling advancements in modern technology (Obafemi & Ogunkunle, 2013). This discipline serves as the bedrock for admission into various career paths, including Engineering, Medicine, and other science-oriented disciplines because it teaches the basics of sciences. Moreover, effective Integrated science instruction cultivates critical thinking, problem-solving abilities, data interpretation skills, and proficient communication—all indispensable for professional competence and self-employability (Velmovska & Bartosovic, 2017; Chasteen, 2010).

Despite its pivotal role, students performance in Integrated science often falls short (Brame, 2014; Olanikooba, 2013). Pedagogical practices often lack innovation, leading to ineffective teaching methods, disconnected curriculum implementation, and a failure to adapt to evolving educational methodologies (Barros and Elia, 2012). The disparity between global best practices in teaching innovations, particularly in developed countries, and the stagnant methods prevalent in

Nigeria exacerbates the perennially low achievements in Integrated science examinations (Sambo, Joshua, & Ogbola, 2019).

Conventional teacher-centered methodologies contribute to limited students' learning, highlighting the urgency for a paradigm shift towards innovative teaching strategies (Ding, 2016; Ogbola, 2019). Current approaches often replicate ineffective traditional methods, resulting in poor achievement and declining interest in science among secondary school students (Rawatee, 2014; Thom, 2013). Hence, there exists an imperative to revamp teaching methodologies and align them with global best practices through teachers' creativity and innovation.

Innovation in teaching encompasses the strategic design of methods, practices, techniques, and technology to enhance students motivation and learning experiences. Various innovative instructional methods, such as Interactive Lecture Demonstrations, Just-in-Time Teaching, and Active Learning Problem Sheets, have demonstrated efficacy in promoting active learning and knowledge construction (Thornton, 2017; Brame, 2013; Velmovska & Bartosoviel, 2017). Implementing these strategies becomes crucial to meet the educational needs of students for capacity building in science and technology.

The process of capacity building hinges on teachers' adept navigation among these innovative strategies, influencing the degree of positive learning outcomes and contributing significantly to the broader capacity building agenda. Moreover, teachers' attitudes significantly impact students' personalities and behavioural patterns, emphasizing the influential role of teacher attitudes toward innovative teaching strategies in Integrated science (Ulug, Ozden, & Erylimar, 2011). Awareness of these strategies profoundly shapes attitudes and contributes to individual responses and behaviours in educational settings.

Statement of the Problem

The primary obstacle thwarting students' achievement in Integrated Science lies in the ineffective teaching strategies employed within the discipline. Rawatee's observation in 2014 highlighted a stark disparity between the learning methodologies and the teaching approaches in Integrated Science education. This discrepancy perpetuates a cycle of ineffective traditional teaching methods being passed down to students, resulting in a superficial grasp of Integrated Science concepts. Consequently, this academic shortfall translates into perpetually low performance levels among students in Integrated Science.

Moreover, this deficiency directly impacts capacity building, particularly concerning careers in Engineering, Medicine, and Integrated Science Education. The requisite knowledge in Integrated Science and other scientific domains for university admissions remains inadequately cultivated due to this prevailing teaching inadequacy. The International Labour Organization's report on global unemployment, indicating that over 197 million individuals were jobless in 2012, underscores the urgency of addressing these deficiencies in educational preparation (Global Employment Trend, 2013). Students grappling with insufficient knowledge due to poor teaching practices face a disadvantage in competing for jobs and contributing to the workforce.

Recognizing the pressing need to revamp these traditional pedagogical approaches, teachers must embrace innovative teaching strategies to elevate students' performance and facilitate robust capacity building for enhanced labour competitiveness and employability. Therefore, this study aims to investigate the awareness and attitudes of teachers towards innovative teaching strategies in Integrated Science. By probing into teachers' perspectives and inclinations regarding these strategies, the research endeavours to lay the groundwork for the eventual adoption and effective implementation of innovative teaching methodologies.

PURPOSE OF THE STUDY

The aim of the study was to carry out a survey on Integrated Science teachers' attitude and awareness towards innovative teaching strategies for promoting capacity building in Science and Technology. The study was designed to determine:

1. Integrated Science teachers attitude and awareness towards innovative teaching strategies for promoting capacity building in science and technology.
2. The level of Integrated Science teachers' attitude to the use of innovative strategies towards innovative teaching strategies for promoting capacity building in science and technology.
3. The influence of gender and experience on the awareness level of integrated Science teachers in promoting capacity building in science and technology.
4. The influence of gender and experience on teachers attitude towards innovative strategies in promoting capacity building in science and technology.

Research Questions

The following research questions guided the study.

1. What are the Integrated Science teachers' level of awareness of innovative teaching strategies for promoting capacity building in science and technology?
2. What are Integrated Science teachers' attitude towards innovative teaching strategies for promoting capacity building in science and technology?

Hypotheses

The following hypothesis were tested at 0.05 level of significance

1. There is no significant difference between male and female Integrated Science teachers in their awareness of innovative strategies for promoting capacity building in science and technology.
2. There is no significant difference between the attitudes of male and female Integrated Science teachers towards the use of innovative teaching strategies.
3. There is no significant difference between Integrated Science teachers attitude and their awareness of innovative strategies in promoting capacity building in science and technology.
4. There is no significant difference between attitude of experienced Integrated Science teachers and less experienced teachers towards their awareness of innovative strategies for promoting capacity building in science and technology.

Method

The study utilized a survey approach, employing a descriptive method to search Integrated science teachers' awareness of and attitudes toward innovative teaching strategies within the Plateau State educational context. The population encompassed all Integrated science teachers across the state. Eighteen schools meeting specific criteria were purposively selected for the study, totaling 141 Integrated Science teachers. This criterion ensured inclusion of schools with established Integrated Science teaching. The primary instrument used for data collection was the Teachers Awareness and Attitude Towards Innovative Strategies Questionnaire(TAATISQ). This adapted questionnaire comprised four sections (A, B, C, and D). Section A captured teachers' biographical information. Section B assessed awareness, featuring 19 items categorized into Aware and Not Aware. Section C delved into teachers' attitudes toward innovative strategies using a scale with options: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), rated 4, 3, 2, and 1, respectively. It included 15 items structured to search attitudes. The questionnaire was administered to the Integrated Science teachers, and data were collected for subsequent analysis. Mean and standard deviation computations were employed to analyze the data. Mean scores of 2.50 and above indicated agree, while scores of 2.49 and below indicated disagree concerning the attitude section. To ensure the instrument's reliability, it underwent a validity process by experts in Integrated Science education and Test and Measurement due to its integrated nature. The reliability coefficients obtained were 0.78 and 0.86 using Cronbach coefficient alpha for awareness and attitude scales, respectively. Frequencies, percentages, and mean scores were utilized to address the two research questions posited in the study. Additionally, the study employed t-tests and ANOVA tests to evaluate the four hypotheses formulated. These statistical tests were instrumental in examining potential differences and relationships between variables such as awareness, attitude, and demographic factors among the Integrated science teachers surveyed.

RESULTS

The results are presented from the data collected and analysed research questions and hypotheses.

Research Question 1: What are the Integrated Science teachers' level of awareness of innovative teaching strategies for promoting capacity building in science and technology?

Table 1: Integrated Science Teachers' Awareness of Innovative Strategies for Promoting Capacity Building in Science and Technology

S/N	Questionnaire Items	Aware	Not Aware	X N(%)	Std. Dev N(%)
1	Knowledge of using innovative teaching strategies would assist me in teaching the students.	121 (85.8)	20(14.2)	0.86	0.35
2	The use of innovative teaching strategies could help me provide better learning experiences for students.	121 (85.8)	20(14.2)	0.86	0.35
3	The use of innovative strategies could be used to complete task that were previously not possible for the students	121 (85.8)	20(14.2)	0.86	0.35
4	Peer instruction could foster students' interaction and same time refocus their attention on the subject matter.	121 (85.8)	20(14.2)	0.86	0.35
5	Peer instruction could provide areas of students' difficulties for further developmental work.	81 (57.4)	60(42.8)	0.57	0.49
6	Interactive method could transform the traditional teaching method into active learning environment.	107 (75.5)	34(24.1)	0.76	0.43
7	Just in time teaching method could provide the teacher with a mechanism for finding out what individual students know and think.	107 (75.5)	34(24.1)	0.76	0.43
8	Innovative strategies could reinforce feed back loop.	93 (66.0)	48 (34.0)	0.66	0.48
9	Innovative strategies could reinforce rapid response system from the students.	121 (85.8)	20(14.2)	0.86	0.35
10	Interactive tutorial could help address common misconceptions during instructions.	134 (95.0)	7 (5.0)	0.95	0.22
11	Activity based tutorial could help students develop qualitative based ideas for solving problems quantitatively.	138 (97.9)	3 (2.1)	0.98	0.14
12	Innovative Strategies could help eliminate the time gap between information provided by lecture and its application.	106 (75.2)	35 (24.8)	0.75	0.43
13	The use of innovative strategies could help provide better learning experiences for students.	127 (90.1)	14 (9.9)	0.90	0.30
14	Cooperative problem solving could help students solve more complex problems.	141 (100)	0 (0)	1.00	0.00

15	Cooperative problem solving helps students resolve misconceptions.	113 (80.1)	28 (19.9)	0.80	0.40
16	Workshops is designed to completely replace traditional laboratories.	110 (78.0)	31 (22.0)	0.78	0.42
17	Studio physics help students perform experiments during instruction.	93 (66.0)	48 (34.0)	0.66	0.48
18	Activities could be used to facilitate interaction between team of students, while they are deeply involved in the material they are studying.	67 (47.5)	74 (52.5)	0.48	0.50
19	Technology enhance aactive learning (TEAL) could be used to create rich collaborative learning experiences by merging lectures, simulations, and hands on desk experiments.	110(71.6)	40 (28.4)	0.72	0.45

Table 1 showed that integratred science teachers are aware of the existence of innovative teaching strategies with a grade mean of 0.78. out of the 19 items meant to show that teachers are aware of innovative strategies. The result shows that teachers are aware of the innovative teaching strategies in 11 items (1,2,3,4,9,10,11,13,14,15 and 16), however the result showed that teachers are not aware in 8 items (5,6,7,8,12,18 and 19)

Research Question 2: What is the teachers' attitude towards innovative teaching strategies in integrated sciecne?

S/N	Questionnaire Items	Strongly Agree	Agree	Disagree	Strongly Disagre	x	Std. Dev
1	I enjoy teaching Integrated Science with innovative strategies.	70 (50.4)	71(50.4)	-	-	3.45	0.50
2	I would work harder if I could use innovative strategies more often to teach integrated science.	95 (67.4)	46(32.6)	-	-	3.67	0.47
3	I believed that it is very important foer me to learn how to use innovative strategies to assist the integrated science students.	52 (36.9)	75(53.2)	14 (9.9)	-	3.23	0.63
4	I think innovative strategies are very easy to use in teaching the integrated science students.	80 (57.7)	43(30.5)	18 (12.8)	-	3.44	0.71
5	Innnovative strategies would improve the performance of integrated science students.	81 (57.4)	29(20.6)	31 (22.0)	-	3.35	0.82
6	Learning about innovative strategies to teach integrated science students is very important to me.	11 (7.8)	17(12.1)	52 (36.9)	57 (40.4)	1.90	0.93
7	I would prefer to learn	118 (7.8)	17(12.1)	113(80.1)	-	1.48	0.98

	how to use innovative strategies to teach integrated science students.						
8	Innovative strategie lessons do not scare teachers to boredomness in teaching integrated science students.	29(20.6)	68(48.2)	44 (31.2)	-	2.89	0.71
9	Innovative strategies would improve the interest of integratred science students.	29 (20.6)	72(51.1)	40 (20.4)	-	2.92	0.69
10	I want to learn more about innovative strategies so as to improve stydents performance in integrated science.	40 (28.4)	44(31.2)	57 (40.4)	-	2.88	0.82
11	Knowing how to use innovative strategies to teach integrated science students is a worthy skill.	83 (58.9)	14 (9.9)	44 (31.2)	-	3.28	0.91
12	I feel innovative strategies are neccesary tools in teaching integrated science.	40 (28.4)	61(43.3)	40 (28.4)	-	3.00	0.75
13	The challenge of learning about innovative strategies to teach integrated science students is exciting.	26 (18.4)	51(36.2)	64 (45.4)	-	2.73	0.75
14	Innovative strategies would increase my productivity in teaching integrated science.	51 (36.2)	33(23.4)	57 (40.4)	-	2.96	0.88
15	Innovative strategies would increase my effectiveness.	30 (21.3)	68(48.2)	26 (18.4)	17 (12.1)	2.79	0.92

Grand Mean = 2.90

Result in Table 2 showed the mean and standard deviation of respondents on the teachers' attitude towards innovative teaching strategies. Result showed that items (1,2,3,4,5,8,9,10,11,12,13,14 and 15) had mean rating of 3.45, 3.67, 3.23, 3.44, 3.35, 2.89, 2.92, 2.88, 3.28, 3.00, 2.73, 2.96 and 2.79 respectively. Since the rating are above 2.50 on the real limit numbers of set criterion level for accepting an item as positive attitude, this mean that the respondents' attitude towards the use of innovative strategies in integrated science is positive. The grand mean of 2.90 showed that the attitude of the tachers is positive.

Hypotheses 1

There is no significant difference between male and female Integrated Science teachers in their awareness of innovative strategies for promoting capacity building in science and technology..

Table 3: t-Test of Male and Female Integrated Science Teachers in their Awareness of Innovative Strategies.

Variable	N	Mean	SD	SE	df	t-cal.	P
Male	83	14.59	5.194	0.570	139	-1.463	0.146
Female	58	15.72	3.349	0.439			

Significant at 0.05 alpha level

Table 3 showed that female integrated science teachers obtain marginally high mean score in awareness of innovative strategies (mean = 15.72; SD=5.194) than their male counterparts (mean = 14.59; SD= 3,349) However t-test indicated there is no significant difference (t=1.463:: df = 139: p>0.05). the null hypotheses which stated that there is no significant difference between male and female integrated science teachers in their awareness of innovative teaching strategies is upheld.

Hypothesis 2

There is no significant difference between the attitude of male and female integrated science teachers towards the use of innovative teaching strategies.

Variable	Mean	SD	SE	df	t-cal.	P
Male	83	48.11	4.055	0.445	139	13.19	0.00
Female	58	38.16	4.941	0.649			

Significant at 0.05 alpha level

From the result in table 4 the mean score of male integrated science teachers is higher in attitude (mean = 48.18; SD = 4.055) than the female integrated science teachers (mean = 38.16; SD = 4.941). This diffference is significant between 13.194; df = 139; p < 0.05). The null hypotheses, which stated that there is no significant difference between the attitudes of the male and female integrated science teachers towards the use of innovative teaching strategies, is therefore rejected. This showed that the attitude of male integrated science teachers towards innovative teaching strategies is significantly higher than their female counterparts

Ho3: There is no significant difference in teachers awareness of innovative strategies in integrated science according to years of teaching experience.

Table 5 Descriptive and ANOVA on the Awareness of Experienced and Less-Experienced Teachers of Innovative Strategies.

Experience	Mean	Std	Std deviation	Error
0-4 years	**30**	**14.83**	**3.67736**	**0.67139**
5-9 years	**43**	**17.23**	**2.32827**	**0.35506**
10 years and above	**68**	**13.78**	**5.40825**	**0.65585**

Source	Sum of Squares	df	Mean	F	P
Between Groups	**316.014**	**2**	**158.007**	**8.453**	**0.000**
Within Groups	**2579.532**	**138**	**18.692**		
Total	**2895.546**	**160**			

Table 5 showed that the the mean awareness of teachers according to years of experiece, the 5-10 years teaching experience had the highest mean score in awareness of innovative strategies in integrated science. The ANOVA result in the table revealed that there is significant difference between the experienced and the less experienced teacjers in their awareness of innnovative teaching strategies in integrated science p-value is less than 0.05; the null hypothesis is rejected.

Hypotheses 4

There is no significant difference in the attitude of Integrated Science teachers towards innovative teaching strategies years of teaching experience for promoting capacity building in science and technology.

Table 6 Descriptive and ANOVA on the Attitude of Experienced and Less-Experienced Teachers of Innovative Strategies.

Experience	Mean	Std	Std deviation	Error
0-4 years	30	51.133	2.44573	0.44653
5-9 years	43	46.4651	2.27145	0.34639
10 years and above	68	39.4118	6.18432	0.74996

Source	Sum of Squares	df	Mean	F	P
Between Groups	3218.911	2	1609.456	76.223	0.000
Within Groups	2952.635	138	21.392		
Total	6171.546	140			

Table 6 above showed the result of the statistics which revealed difference between teacher year of experience and their attitude towards innovative teaching strategies. It is shown that the teachers' attitude on the basis of their years of experiences were 0-4years (51.13), 5-9years (46.47%), and 10years & above (3941). This implied that the lower the teachers years of experience the higher their attitude towards the innovative teaching strategies. The ANOVA results in the table revealed that there is significant difference between the experienced and less experienced Integrated Science teachers in their attitude towards innovative strategies for promoting capacity building in science and technology. since P-value is lesser than 0.05, the null hypothesis is rejected.

DISCUSSION

Result from the study indicated that Integrated science teachers are aware of the existence of innovative teaching strategies. Reasons might be because we are in the era of mobile technology, where information can be source through internet at anytime, people can browse to update their knowledge, just to keep abreast with world best practices. Also, teachers might have realize the importance of the strategies in motivating and engaging students for learning as claimed by Thom (2013) who asserted that innovative teaching makes teaching exciting and fun, engages students, and mostly help students find the passion and resources necessary to design a life for themselves and others. Part of the findings is that Integrated science teachers showed positive attitude to innovative strategies. The perennially poor performance in Integrated science examinations has left teachers with no choice but to migrate from the teacher centered method of teaching, to students centered methods that will enhance learning in all dimensions for capacity building.

The study also revealed that there is no significant difference between male and female teachers in awareness of innovative teaching strategies. This is in agreement with Isah, Olorukooba and Usman (2013) who found no significant relationship between male and female in terms of pedagogical skills in teaching the subject. Findings showed that the female teachers had positive attitude than their male counterparts. This result corroborated the report of Tearle (2004) who observed that gender may influence individual attitude towards their voluntary participation in the use of technology. The finding that the lower the year of experience, the higher the attitude towards the use of innovative strategie. This supports the report of Ruthven et al (2004) who opined that the older fell intimidated by the new technology than the younger generation. However, the present findings is in contrast to the report of Ghadamonsi (2013) who found that teachers experience have no effect on the attitude towards the usage of innovative strategies.

Findings showed that experience had significant influence on awareness of innovative teaching strategies, in favour of 5-9years. This might be because, the 0-4year experience, being junior staff might not be privileged to enjoy seminars, workshops symposiums and in-service training that are innovative teaching oriented.
The senior staff in the category of 10years and above, might be overwhelmed with administrative functions, and then delegates the 5-9 years to always represent them in pedagogical educative meetings, which consequently give this category edge in awareness.

CONCLUSION

Conclusion arising from the findings of this study indicated positive result for Integrated Science teachers awareness and attitude to innovative teaching strategies for promoting capacity building in science and technology. The results showed that no significant difference existed between male teachers and female teachers awareness of innovative traching strategies. However, attitude towards innovative strategies revealed significant difference in favour of female Integrated science teachers. Also, experience influenced both the awareness of and attitude to innovative teaching strategies

RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations are made:
1. In-service training, symposium, seminars and workshops at are innovative teaching strategies red should be organised for Integrated science teachers to promote their awareness, positive attitude and usage of the strategies for good performance needed for capacity building in science and technology.
2. Integrated Science teachers should update their knowledge of pedagogical practice through science educational sites on the internet, to be abreast with the world best practices that breeds future career in science and technology.
3. Government should ensure that teachers are well motivated and remunerated to give their best in giving instruction. for students optimum performance needed for promoting science and technology.
4. Instructional packages should be designed and developed to stimulate teachers' innovations and creativity in teaching Integrated Science.
5. Curriculum planners should incorporate innovative teaching strategies, to enhance teachers skills.

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