

**AWARENESS AND UTILIZATION OF INNOVATIVE TEACHING STRATEGIES (ITS) FOR TEACHING SCIENCE SUBJECTS AMONG SECONDARY SCHOOLS IN OGBIA LOCAL GOVERNMENT AREA OF BAYELSA STATE, NIGERIA**

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***Abstract***

*Innovative teaching strategies (ITS) are teaching methods involving the use of new ways of interaction in the classroom teaching and learning process between teachers and students. This study examined the extent of the awareness and utilization of Innovative Teaching Strategies (ITS) such as Study Aid, Demonstration, Problem Solving, Classification, Cooperative Learning, Team Teaching, Laboratory, Field Trip, and Computer Assisted Learning among others and their application by teachers at the secondary school level in Ogbia Local Government, Bayelsa State. Five research questions were raised to guide the study while the design adopted was a descriptive survey. A simple random sampling technique was used to select a sample of 298 teachers from a target population of size of 748 who responded to the researchers' designed questionnaire known as Innovative Strategies Questionnaire (ITSQ) items on 25 selected ITS used in teaching. The instrument was validated for data collection determined by test-retest method using Pearson Product Moment Correlation Coefficient where a reliability index of 0.86 was obtained. The data gathered were analysed using the Spearman Rho Rank Order Correlation Coefficient. A mean awareness of 0.60 and above as well as a mean utilization of 1.20 and above was considered adequate. Also, the t-test*

*and ANOVA were used to test the hypotheses at 0.05 significant level. The study found that the level of teachers' awareness of innovative strategies was high, only a few of the strategies were being effectively utilized by the teachers and the level of utilization of innovative teaching strategies is similar for biology teachers irrespective of their years of teaching experience. Recommendations made include effective teaching application techniques of the various ITS to student-teachers in training and organizing workshops on the effective use of these strategies to science teachers by experts.*

**Key Words:** *Awareness, Innovative, Strategies, Teaching, Utilization*

### **Background to the study**

The purpose of education, in addition to making one literate is to improve learners' knowledge, skills, rational thinking, and have self-esteem. Going by the common saying that no nation can rise above its education standard, education therefore, is a vital tool for national development, growth, and progress. This can be achieved via imparting knowledge, right type of values, skills, and build human capacity. These positive attributes breed and drive innovation and economic growth of a nation. Science and technology as part of education, have helped several nations in promoting self-reliance, development in health, agriculture, manufacturing, and telecommunication among others.

In Nigeria, the National Policy on Education (2004) stated in clear terms the objectives of science education from pre-primary to tertiary levels of education. At the secondary school level where this study is focused, the objectives of science teaching entails equipping students to live an effective life in the modern age of science and technology. However, since science is a process that helps the individuals to develop the society, the rising knowledge explosion and new wave in science and technology have globally challenged the secondary school science curriculum, hence, the demand for quality science teaching (Oyovwi, 2012).

Several literatures have shown that in Nigeria, science education is faced with numerous challenges that need to be urgently addressed by the relevant authorities (Omorogbe & Ewansiha, 2013). Such problems among others are the inability of the students to effectively apply knowledge learnt in school to real life situations, and engaging in complex problem-solving activities (Samo, Drhim, & Kartasasmita 2018; Okebukola, 2005). Addressing these problems will enable the students to actively live well in this digital age as well as acquiring the appropriate mental wellbeing, physical skills, social abilities and competence capable of contributing to the national development. With the progress in scientific knowledge, the school system requires the availability of well-trained, efficient, skillful, and knowledgeable teachers who are versatile enough to discharge their duties and responsibilities (Buseri, 2010). However, the persistent students' poor academic performance in science subjects at the school certificate level is an indication that most science subject teachers in the public secondary schools in Nigeria possibly may not be using varying but adequate forms of teaching strategies, hence they find it difficult to cope with some specific/difficulties associated with the teaching of science subjects at secondary

school level (Umoren and Ogong 2007; Ogbeba, 2009). This simply means that most teachers who are knowledgeable in science subjects are not good in the pedagogical aspect of teaching or having good teaching strategies.

Teaching strategy is a term associated with a classroom that is carefully designed for interaction between the teacher and the learner or among learners that could be systematically followed to teach a topic, concept, or an idea (Hornby, 2010; Ofeimu & Kolawole, 2017). Similarly, an innovative teaching approach is a teaching strategy or design full of purposively or newly reconstructed existing idea. In science education, innovation is highly needed for the fostering of greater scientific literacy and understanding. However, there are innovative and challenging new ways of teaching and learning in science education, nonetheless, it can only be fully put to practice when teachers feel faithful to exploring them (Zamora-Polo, Corrales-Serranto, Sanchez-Martin, & Espejo-Antinez, 2019).

Innovation as put by researchers is the introduction of something new, ideas or doing something in a new way at any point or breaking new grounds. In teaching, innovation may be regarded as revolutionary application of educational technology in the classroom which produces new and radically changed course structure (Hornby, 2010; Naz, & Murad, 2017). The implementation of improved new ideas, methods, materials, tools, processes that lead to new and better results, processes and services is innovation (Suprayogi, Valcke, & Godwin, 2017). In the classroom, innovative teaching proves to assist students to develop a wide range of

capabilities to contribute to the wider world/community.

In Nigeria, majority of public secondary schools and post-secondary school students do not have a deep knowledge of the basic skills to live independent life after schooling as well as contributing to national development (Okoro, 2021). A simple explanation is that these students do not have the ability to engage in complex problem activities, and applying school acquired knowledge to real life situations. Hence, there is the need for secondary school teachers to be aware of the different teaching strategies which are effective and efficient in imparting the desired skills and knowledge to students. It is, however, apparent that the present methods used in teaching science subjects in secondary school in Nigeria are not producing the maximum results for the acquisition of scientific skills by the students. Therefore, there is the need for teachers to use multiple teaching strategies in order to meet the different learning styles in the modern age constructivist classroom.

Utilization of ITS such as inquiry-based learning, problem solving, jigsaws, peer teaching, blended learning, etc, as put forward by researchers is assumed that appropriate instructional materials have not been identified, provided, and selected for the classroom teaching and learning process (Anchor, Samba & Ogbeba, 2010; Anderson & Neri, 2012; Gbadamosi, 2019). This also is applicable to teaching strategies. Students may have learning difficulties and when such difficulties remain unresolved, it leads to emotional build up which effect on the students is falling below the expectations or standards set by teachers, parents, school authorities,

or government. However, such difficulties can be resolved by teachers using appropriate innovative teaching strategies. Interestingly, a strong support for teachers' effective utilization of innovative strategies and productivity level of any academic programme is teachers' awareness of policies relating to such programmes (Abubakar, 2016). When teachers are aware of the principles and content policy of a programme, they tend to cultivate the right type of attitude capable of resulting in an improved academic productivity which is students' high academic performance (Foster & Shah, 2020). Teachers' awareness and decision on the utilization of innovative strategies depends on teachers' knowledge of the existence of such innovative strategies. Hence, teachers who are not aware of innovative strategies will neither put them to use or better still not adequately nor correctly use such innovative strategies (Achor, Samba, & Ogbeba 2010).

In science education, several teaching strategies exist such as Study Aid, Demonstration, Problem Solving, Classification, Cooperative Learning, Team Teaching, Laboratory, Field Trip, and Computer Assisted Learning among others. Nonetheless, there is apparent unabated or poor teaching and learning of science subjects in secondary schools. There is then the need to critically examine which among the numerous teaching strategies are learners centered and which are teachers centered. In addition, there is the need to employ specific and other strategies that are useful at the appropriate time relevant for that purpose, topic and idea to be taught. The possibility of this is when teachers are

aware of the existence of such innovative strategies, capable and willing to use them.

### **Statement of the Problem**

A good and fast medium for planned transformation of any society is via Science Education at all school levels as technology now plays a crucial role in the creation of wealth, improvement in quality of life, and economic growth. Putting aside the importance of science education to mankind, efforts of researchers to improve its teaching, and being the center of science subjects, most secondary school students in Nigeria still perform better in non-science subjects than science subjects. This poor academic performance has severally been ascribed to inadequate science teachers and teaching materials, using none effective teaching methodologies among others in secondary schools in Nigeria. Researchers have investigated the effectiveness of several innovative teaching methods such as cooperative learning, computer assisted instruction, problem solving, inquiry, individualism among others and even compared them with conventional methods, but did not examine in-service teachers' awareness of the existence of such innovative teaching strategies. Hence, this study was set out to examine public secondary school teachers' awareness and utilization of innovative teaching strategies in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria.

### **Purpose of the study**

This study aimed at determining science teachers' awareness and utilization of innovative strategies for teaching science subjects among secondary schools in Ogbia Local Government Area of Bayelsa State.

The specific objectives of this study are to:

- 1) determine the level of awareness of the ITS by science teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria;
- 2) find out the extent to which the ITS are put into use by science subjects teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria;
- 3) find out the difference in the utilization of the ITS among science subjects teachers based on science subjects teachers' teaching experience in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria;
- 4) find out the difference in the utilization of the ITS by science teachers in secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria based on science subject teachers' educational qualification.
- 5) determine the difference in the utilization of the ITS by science teachers in secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria based on science subject teachers' gender.

### **Research Questions**

- 1) What is the level of awareness of the ITS by science teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria?
- 2) To what extent are the ITS put into use by science subjects teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria?
- 3) What is the difference in the utilization of the ITS among science subjects

teachers based on science subjects teachers' teaching experience in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria?

- 4) What is the difference in the utilization of the ITS by science teachers in secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria based on science subject teachers' educational qualification?
- 5) What is the difference in the utilization of the ITS by science teachers in secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria based on science subject teachers' gender?

### **Hypotheses**

**HO<sub>1</sub>:** There is no significant difference in the utilization of ITS by experienced and less experienced secondary school science subjects teachers in Ogbia Local Government Area of Bayelsa State, Nigeria.

**HO<sub>2</sub>:** There is no significant difference in the utilization of ITS by qualified and non-qualified secondary school science subjects teachers in Ogbia Local Government Area of Bayelsa State, Nigeria.

**HO<sub>3</sub>:** There is no significant difference in the utilization of ITS by male and female secondary school science subjects teachers in Ogbia Local Government Area of Bayelsa State, Nigeria.

### **Methodology**

This study adopted a descriptive research design using a survey method.

The population of this study was made up 748 science subject teachers in 27 public secondary schools in Ogbia Local Government Area of Bayelsa State. A

sample of 350 respondents representing 46.8% of the total population was obtained using purposive and stratified sampling methods.

Three hundred and fifty (350) copies questionnaires were randomly distributed among the 748 teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State and 298 were retrieved giving a retrieval rate of 85% which truly represented the target population.

The data for this study were collected using a researchers' self-developed questionnaire titled "Innovative Teaching Strategies Questionnaire (ITSQ)", made up of Sections A, B, and C. Section A was used to elicit information on teachers' demographics. Section B which was based on teachers' awareness of 25 identified innovative teaching strategies had 2-option rating scale of Aware and Not Aware. Section C which was based on the extent of utilization of the innovative strategies by science teachers had a 3-option rating scale of Frequently Used, Seldom Used, and Never Used.

The instrument went through the test-retest reliability process within 2 weeks after it

was given to 20 teachers in secondary schools similar to the teachers used in this study. Using the Pearson Product Moment Correlation Coefficient method, a reliability coefficient of 0.86 was established which showed that the instrument was reliable.

The Spearman Rho Rank Order Correlation Coefficient was used to analyze the data collected. For the decision making on teachers' awareness of the innovative teaching strategies for teaching science subjects in public secondary schools, a mean awareness of 0.60 and above was considered as adequate, while any mean below 0.60 was considered inadequate. Whereas, for decision making on the extent of teachers utilizing innovative teaching strategies for the teaching of science in secondary schools, a mean utilization of 1.20 and above was considered adequate, while any mean below 1.20 was considered inadequate. The t-test and one-way ANOVA were used to test the hypothesis at 0.05 significant level.

**Results**

**Teachers' Demographics**

Table 1: Distribution of teachers according to teachers' years of work experience in public secondary schools in Ogbia Local Government Area, Bayelsa State, Nigeria

Teachers' Years of Working Experience			
< 10 n(%)	11-15 n(%)	16-20 n(%)	21 & Above n(%)
48 16%	98 33%	122 41%	30 10%

**Source: Field work**

From Table 1 above, majority the teachers (41%, n=122) have taught between 16-20 years followed by teachers who have taught between 11-15 years with 98 teachers representing 31%, and teachers who have taught less than 10 years had a teachers' population of 48 representing 16% of the total teachers' population while those teachers who have taught for more than 21 years were 30 teachers representing 10% of the teachers' population for this study.

Table 2: Distribution of teachers according to teachers' age from public secondary schools in Ogbia Local Government Area, Bayelsa State, Nigeria

Gender of Teachers		
35-39 n(%)	40-44 n(%)	45 & Above n(%)
110 37%	134 45%	54 18%

**Source: Field work**

From Table 2, the results showed that majority of the teachers fall within the age bracket 40-44 years (n=134; 45%) which is closely followed by teachers under the age bracket of 35-39 years (37%; n=110). The age bracket of 30-34 years had 54 students representing 18% while teachers of age 45 and above were 36 teachers representing 12% of the total teachers' population for this study.

Table 3: Distribution of teachers according to teachers' gender from public secondary schools in Ogbia Local Government Area, Bayelsa State, Nigeria

Gender of Teachers	
Male n(%)	Female n(%)
119 39.9%	179 60.1%

**Source: Field work**

From Table 3, a majority (n=179; 60.1%) of the teachers were female while the male teachers were 119 teachers representing 39.9% of the total teachers' population for this study.

**Research Question One:** Are the Science Teachers in Ogbia Local Government Area of Bayelsa State aware of the selected innovative teaching strategies? A set of 25 innovative teaching strategies - Study Aids, Problem Solving,

Demonstration, Classification, Team Teaching, Cooperative Learning, Models, Computer Assisted Instruction, Laboratory, Active Learning, Analogy, Project Based Learning, Role Playing, Field Trip, Acronym Memory, Choral Response, Multimedia, Individual Learning, Unknown-Known constructivism, Vee Mapping, Check List, Mind Mapping, Socratic Method, Minimalism- were presented to teachers to indicate whether they are aware or not aware of each of them. The results showed a high level

(88.0%) of respondents is aware of the innovative teaching strategies. This implies that innovative teaching strategies can be applied for the teaching of science in secondary schools as most teachers have come across these innovative teaching strategies while in training or during their professional development.

The Spearman Rank Order Correlation Coefficient Statistics was conducted on the responses of respondents and the results shown in Table 4 below.

**Table 4: Ranked Response of Awareness of the Innovative Teaching Strategies**

<b>Item number</b>	<b>Item</b>	<b>Score</b>	<b>Rank</b>
<b>A22</b>	Study Aids	1.00	1 <sup>st</sup>
<b>A18</b>	Problem Solving	0.98	2 <sup>nd</sup>
<b>A10</b>	Demonstration	0.97	3 <sup>rd</sup>
<b>A6</b>	Classification	0.95	4 <sup>th</sup>
<b>A23</b>	Team Teaching	0.95	4 <sup>th</sup>
<b>A9</b>	Cooperative Learning	0.94	6 <sup>th</sup>
<b>A16</b>	Models	0.91	7 <sup>th</sup>
<b>A7</b>	Computer Assisted Instruction	0.90	8 <sup>th</sup>
<b>A13</b>	Laboratory	0.88	9 <sup>th</sup>
<b>A2</b>	Active Learning	0.87	10 <sup>th</sup>
<b>A3</b>	Analogy	0.87	10 <sup>th</sup>
<b>A19</b>	Project Based Learning	0.84	12 <sup>th</sup>
<b>A20</b>	Role Play	0.82	13 <sup>th</sup>
<b>A11</b>	Field Trip	0.79	14 <sup>th</sup>
<b>A1</b>	Acronym Memory	0.76	15 <sup>th</sup>
<b>A5</b>	Choral Response	0.76	15 <sup>th</sup>
<b>A17</b>	Multimedia	0.76	15 <sup>th</sup>
<b>A12</b>	Individual Learning	0.73	18 <sup>th</sup>
<b>A24</b>	Unknown -Known	0.71	19 <sup>th</sup>
<b>A8</b>	Constructivism	0.62	20 <sup>th</sup>

A25	Vee Mapping	0.56	21 <sup>st</sup>
A4	Check List	0.51	22 <sup>nd</sup>
A14	Mind Mapping	0.48	23 <sup>rd</sup>
A21	Socratic Method	0.40	24 <sup>th</sup>
A15	Minimalism	0.30	25 <sup>th</sup>

**Source: Field work**

Results from Table 4 showed that items A22, A18, A10, A6, and A23 had a high awareness. Precisely, results indicated that item A22 (Study Aids), with a mean score of 1.00 was ranked (1<sup>st</sup>). This was closely followed by item A18 (Problem Solving) with a mean rank of 0.98 2<sup>nd</sup>. Item A10 (Demonstration) had a mean rank of 0.97 (3<sup>rd</sup>). Items A6 and A23 (Classification and Team Teaching) had a mean raking of

095 (4<sup>th</sup>). Whereas, item A25, A4, A14, A21, and A15 had very low mean raking of A25 (Vee Mapping) with a mean ranking of 0.56 (21<sup>st</sup>), A4 (Check List) had a mean rank of 051 (22<sup>nd</sup>), A14 (Mind Mapping) a mean rank of 048 (23<sup>rd</sup>), A21 (Socratic Method) a mean rank of 0.40 (24<sup>th</sup>), and A15 (Minimalism) with the lowest mean rank of 0.30 (25<sup>th</sup>).

- 6) **Research Question Two:** To what extent are the ITS put into use by science subjects teachers in public secondary schools in Ogbia Local Government Area of Bayelsa State, Nigeria?

**Table 5: Ranked Response of Innovative Teaching Strategies put into use in teaching of Science Subjects**

Item number	Item	Score	Rank
B10	Demonstration	1.95	1 <sup>st</sup>
B6	Classification	1.89	2 <sup>nd</sup>
B18	Problem Solving	1.86	3 <sup>rd</sup>
B22	Study Aids	1.83	4 <sup>th</sup>
B2	Active Learning	1.82	5 <sup>th</sup>
B3	Analogy	1.71	6 <sup>th</sup>
B1	Acronym Memory	1.67	7 <sup>th</sup>
B9	Cooperative Learning	1.62	8 <sup>th</sup>
B13	Laboratory	1.62	8 <sup>th</sup>
B23	Team Teaching	1.55	10 <sup>th</sup>
B20	Role Play	1.54	11 <sup>th</sup>
B5	Choral Response	1.49	12 <sup>th</sup>
B16	Models	1.47	13 <sup>th</sup>
B19	Project Based Learning	1.46	14 <sup>th</sup>

<b>B4</b>	Check List	1.39	15 <sup>th</sup>
<b>B11</b>	Field Trip	1.36	16 <sup>th</sup>
<b>B12</b>	Individual Learning	1.35	17 <sup>th</sup>
<b>B17</b>	Multimedia	1.34	18 <sup>th</sup>
<b>B8</b>	Constructivism	1.30	19 <sup>th</sup>
<b>B24</b>	Unknown-Known	1.29	20 <sup>th</sup>
<b>B7</b>	Computer Assisted Instruction	1.28	21 <sup>st</sup>
<b>B14</b>	Mind Mapping	1.18	22 <sup>nd</sup>
<b>B15</b>	Minimalism	1.12	23 <sup>rd</sup>
<b>B25</b>	Vee Mapping	1.10	24 <sup>th</sup>
<b>B21</b>	Socratic Method	0.99	25 <sup>th</sup>

**Source: Field work**

Results from Table 5 showed that items B10, B6, B28, B22, and B2 had a high utilization based on teaching experience. Precisely, results indicated that item 10 (Demonstration), with a mean score of 1.95 was ranked (1<sup>st</sup>). This was closely followed by item B6 (Classification) with a mean rank of 1.89 (2<sup>nd</sup>). Item 18 (Problem Solving) had a mean rank of 1.86 (3<sup>rd</sup>). Items B22 (Study Aids) had a mean rank of 1.83 (4<sup>th</sup>), and B2 (Active Learning) had a mean ranking of 1.82 (5<sup>th</sup>). Whereas, item B7, B14, B15, B25, and B21 had very low mean ranking of B7 (Computer Assisted Instruction) with a mean ranking of 1.28 (21<sup>st</sup>), B14 (Mind Mapping) had a mean rank of 1.18 (22<sup>nd</sup>), B15 (Minimalism) a mean rank of 1.12

(23<sup>rd</sup>), B25 (Vee Mapping) a mean rank of 1.10 (24<sup>th</sup>), and B21 (Socratic Method) with the lowest mean rank of 0.99 (25<sup>th</sup>).

**Research Question Three:** To what extent does the utilization of Innovative Strategies differ based on science teachers' teaching experience?

**Research Hypothesis 1:** There is no significant difference in the utilization of innovative teaching strategies between experienced and less experienced science teachers.

In order to determine whether the level of the utilization of innovative teaching strategies significantly differ between experienced and less experienced science teachers, a t-test was conducted and the results is as shown in Table 6 below.

**Table 6:** t-test Analysis Output for Significance Difference in the Utilization of the Innovative Teaching Strategies on the Basis of Teachers' Teaching Experience

Variable	N	Mean	SD	Df	t cal	P value	Decision
Less Experienced	201	36.61	8.671	298	0.908	0.365	Accept HO <sub>1</sub>
Experienced	97	37.46	7.151				

Significant at  $p < .05$

From Table 6, the results showed that there is no significant difference in

utilization level for less experienced (36.61) and experienced (37.46) which

yielded a t-statistics of 0.9.8 and p-value of 0.365. This result was not statistically significant since the obtained p-value (0.365) is more than 0.05 level of significance. Consequently, there is no significance difference in the level utilization of innovative teaching strategies based on teaching experience of the biology teachers. The simple implication of this result is that the level of utilization of innovative teaching strategies is similar for biology teachers irrespective of their years of teaching experience.

**Research Question Four:** Does the qualification of the biology teachers influence the utilization of the Innovative Teaching Strategies?

**Research Hypothesis 2:** There is no significant difference in the utilization of the innovative teaching strategies based on the qualification of the science teachers.

In order to determine whether the level of the utilization of innovative teaching strategies significantly differ for science teachers based on their academic qualification, an Analysis of Variance (ANOVA) test was conducted and the results are as shown in Table 7 below.

**Table 7:** Analysis of Variance (ANOVA) Output for Significant Difference in the Utilization of Innovative Teaching Strategies on the Basis of Teachers’ Academic Qualification.

Source	Sum of Squares	df	Mean Square	F cal	P value	Decision
Academic Qualification	1,185.56	3	395.19	7.108	0.000	Reject HO <sub>2</sub>
Error	16,456.72	296	55.60			
Corrected Total	17,642.28	299				

Significant at  $p < .05$

Results from Table 7 showed that the ANOVA analysis yield  $F(3,296)=7.108$  and p-value of 0.000. This result is deemed to be statistically significant as the obtained p-value is less than 0.05 level of significance. Hence, there is a significant difference in the level of the utilization of the innovative teaching strategies based on the academic qualification of the biology

teachers. The simple implication of this result is that the utilization level of the innovative strategies differs from one group of academic qualification to the other. Therefore, in order to ascertain the academic qualification of the teachers based on the groups, a Duncan Multiple Range post-hoc test was carried out and the results shown in Table 8 below.

**Table 8:** A Duncan Multiple Range post-hoc test output to ascertain the academic qualification of the teachers based on the groups

Academic Qualification	N	Mean	Group
B.Sc	128	35.34	BC
HND	35	37.77	B
B.Sc (Ed)	79	39.56	AB
NCE	58	41.57	A

Source: Field Work

Results from Table 8 indicates that teachers with NCE (41.57%) and B.Sc (Ed) (39.56%) had significantly higher level of utilization than their counterparts with either HND (37.77%) or B. Sc (35.34%). Thus, utilization level of innovative teaching strategies seems to be higher for teachers holding a qualification in Education as against those without any qualification in Education.

**Research Question Five:** How does the utilization of innovative Teaching

Strategies differ based on the science teachers' gender?

**Research Hypothesis 3:** There is no significant difference in the utilization of innovative teaching strategies between male and female science teachers.

In order to determine whether the level of the utilization of innovative teaching strategies significantly differ between male and female science teachers, a t-test was conducted and the results are as shown in Table 9 below.

**Table 9:** t-test Analysis Output for Significance Difference in the Utilization of the Innovative Teaching Strategies on the Basis of Biology Teachers' Gender

Variable	N	Mean	SD	Df	t cal	P value	Decision
Male	119	35.55	7.35	296	3.042*	0.003	Reject HO <sub>1</sub>
Female	179	38.27	7.72				

Significant at p<.05

From Table 9, the results showed that there is a significant difference in utilization level for male science teachers (35.55) and female science teachers (38.27) which yielded a t-statistics of 3.42 and p-value of 0.003. This result was statistically significant since the obtained p-value (0.003) is less than 0.05 level of significance. Consequently, there is a significance difference in the level utilization of innovative teaching strategies based on teachers' gender of the biology teachers. The simple implication of this result is that female science teachers had a higher level of utilization of innovative teaching strategies than their male counterpart.

**Discussion of Findings:**

This study found out that most science teachers in Ogbia Local Government Area of Bayelsa State had a high level of awareness of the carefully chosen innovative teaching strategies with a

corresponding awareness level of 88%. Obviously, the science teachers at this instance are placed on a vantage position upon which to impact science knowledge to students as the teacher has a number of teaching strategies to utilize. The findings of this study are in line with Achor, Samba, & Ogbeba, (2010) whose study found that the level of teachers' awareness of innovative strategies was high but that only a few of the strategies were being effectively utilized by the teachers. In a nutshell, this study finding showed that the most popular Innovative Teaching Strategies were Study Aids, Problem Solving, Demonstration, classification, and Team Teaching, while, it was observed that Mind Map, Socratic method, and Minimalism were the unpopular ITS. Invariably, the less popular ITS may be seen to be either too difficult to comprehend or apply by teachers at the secondary school level.

The findings of this study revealed that majority of secondary school teachers (91%) utilize the most popular selected ITS in the teaching and learning process in the classroom. Therefore, it is worthy to conclude or infer that in every 10 science teachers, 9 science teachers try to make use of these ITS in the classroom. This finding is in line with Oyelekan, Igbokwe & Olorunde (2021) whose findings showed no significant difference in science teachers' level of utilization of the innovative teaching strategies based on experience and qualifications. It was recommended among others that science teachers avail themselves of the opportunities provided by these innovative strategies in improving the performance of their students. With such a high level of utilization of the selected ITS by science teachers, it is so expected that the academic performance of secondary school students in science subjects (biology) would improve. In this study, Demonstration, Classification, Problem Solving, Study Aids, and Active Learning were identified as most used ITS. Whereas, Mind Mapping, Minimalism, Vee Mapping, and Socratic Method were least utilized ITS by science teachers in the classroom teaching and learning process.

On the influence of teachers' gender difference, this study found out that female science teachers had a significantly higher utilization of ITS than their male counterpart in the teaching and learning of science subjects in secondary schools. This finding differs from Papadakis (2018) whose study found out there is no gender and age difference regarding the purpose for using smart mobile devices. Suffice

therefore to state that or imply that teachers; gender have been so proven to have an influence on the mode, manner, and level of teachers' utilization of the most popular ITS. The implication of this findings showing gender difference in the utilization of ITS in the classroom teaching and learning process is that female teachers have been found to have more concern about the academic performance of their students than their male counterparts.

For science teachers' educational background influencing their utilization of ITS in the classroom teaching and learning process, this study found out that science teachers with higher educational background make use of ITS in the classroom than teachers with less educational background. This finding is in support of Lawrence & Tar (2018) whose study identified teachers' level of education among other factors that may influence teachers' decision to adopt and integrate ICT in teaching and learning process. Hence, it could be concluded that teachers' level of educational qualification significantly affects the level of the utilization of ITS in the classroom teaching and learning process.

As for science teachers' years of teaching experience and its effect on the utilization of ITS, this study found out that there is no significant difference in the utilization of ITS by science teachers based on their years of teaching experience. The implication of this finding is that irrespective of the years of teaching experience, there is a similarity in the use of the selected ITS in the classroom teaching of science subjects as teachers with different years of teaching experience

described in similar terms the importance of the use of ITS in the classroom and on students' academic performance. The results of this study are not in line with Samba, Achor, and Ogbeba (2010) who found out that experienced teachers make use of ITS in the classroom teaching of science subjects than teachers with less teaching experience.

### Conclusion

Based on the findings of this study, it can be concluded that science teachers' level of awareness of ITS is high. However, teachers need to improve on their awareness as some of the ITS (such as Mind Map, Socratic Method, and Minimalism) are known to the teachers.

For the utilization of ITS in the classroom, the level of science teachers' utilization of the selected ITS by biology teachers is high as up to 88% of the ITS are being used by the science teachers. However, the extent of the use of ITS by science teachers is found to be positive in terms of teachers' gender and educational background.

Teachers' teaching experience has no significant effect on teachers' use of ITS as both experienced and less experienced science teachers shared the same attitude towards the use of ITS. Teachers' level of academic background has an effect on teachers' use of ITS as teachers with higher educational background tend to use ITS more than teachers with less educational background. For gender of science teachers having effect of ITS utilization by secondary school teachers, this study found out and can be concluded that female science teachers tend to make use of ITS more than their male

counterparts in the classroom teaching and learning process.

### Recommendations

From the results of this study the following recommendations among others are made:

- 1) Government should organize workshops, seminars, and symposia for science teachers to improve their awareness of ITS.
- 2) Government should organize in-service training for science teachers to encourage their utilization of ITS.
- 3) Government should post qualified teachers to secondary schools to give room for more effective utilization of ITS.

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