The New Science Teaching and Learning Paradigm: Secondary Students' Perception

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Abstract

Students' perception influences their behaviour and disposition to innovation in teaching and learning science. This study investigates secondary school students' perception of the new science teaching and learning paradigm in Oyo township. Two research questions and six null hypotheses guided the study. A mixed methods type of research design (concurrent triangulation) was adopted, randomly sampled 250 secondary school students from eight public and private schools in Oyo town. Two self-constructed, validated research instruments; The New Science Teaching and Learning Paradigm Questionnaire (NSTLPQ, r=.79) and an unstructured interview were used for data collection. Frequency counts, percentages, t-test ANOVA, and scheffe posthoc test were used for data analysis. The results revealed that there are 176 (70.4%) male respondents, 168 (67.20%) 14-16 years age, 125 (50.0%) J.S. II, 187 (74.80%) Muslims, 125 (50.0%) private secondary school students in the distribution, the students perceived the new science teaching and learning paradigm as an effective tool in enhancing learning outcomes in science, there is significant students' perception of the new science teaching and learning paradigm (x=71.20, t= 127.10, df=249, p<.05), the perception was significantly different based on the students' gender(t =-3.94; df=248; p<.05), age($F_{(3,246)}$=12.12; p<0.05) and religion($F_{(2,247)}$=41.09; p<0.05) while class and school types made no difference. It was therefore recommended that Government and

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DOI: https://doi.org/10.60787/eaued-jms.vol2no2.50

Non-Governmental Organizations (NGOs) should intensify efforts towards establishing laboratories well furnished with adequate soft and hard wares in the schools; professional bodies training and retraining of the teachers to become instructional facilitators seasoned with skills in the new science teaching and learning paradigm.

Keywords: Teaching and learning, Science teaching and learning, New Science teaching and learning paradigm, Secondary students' perception

Introduction

Teaching and learning science is a rewarding activity that permeates mutuality between the teacher and the science students. What the students' decipher from a teaching – learning process is a function of the enabled learning community created by the teaching and the non-teaching staff of a school. The task of influencing learners' learnability has always been a challenge on the teacher most especially the science teachers whose task entails packaging usually unstaring, unstimulating, uninteresting concepts for the consumption of uninterested learners. Much ado about little or nothing if the contents was presented in the old talk and chalk format in this 21st century dispensation when teaching and learning science should be done technologically.

The students generally are not resilient when it comes to sitting down and regurgitating scientific facts, concepts, hypotheses, theories and laws. They are glued and attached to their IPADs, smartphones, laptops and as much of the interphases contain games or online charts, or blogs they are highly untiring and persistent in surfing with technology (Adebiyi, 2019; Olagunju & Adesina, 2017; Matazu, 2024; Abdullahi, 2024). Adapting teaching and learning science into technological gadgets lifts science teaching – learning from the old paradigm of didactic, non-heuristic, non-pragmatic, boring and unstimulating form of science instruction to a new paradigm of science teaching–learning that is hands-on-mind-on, motivating, untiring, interesting, dogged, attitude boosting heuristic instructional mode.

As important as science teaching and learning to human development – educational advancement, transportation

improvement, communication, agriculture, commerce and industrialization, human genome development – the secondary school students' achievement in sciences is still deplorably appalling and abject. The science students have aversive attitude and negative disposition towards science teaching and learning, they are resistant to the old paradigm of cramming reading, recalling, vomiting and regurgitation of scientific concepts, theories and laws. The learners from the primary to the tertiary institutions are preoccupied with their technological gadgets – surfing the internets, chatting on social media, reading news on IPADs or playing games (Olayinka, 2024; Ovuezirie, 2024). If this students' disposition is exploited by launching science concepts, contents, quizzes, tutorial, practical experiments, and scientific games on the technological gadgets interphases, how would the teaching – learning of the science have elicited the requisite and desired learning outcomes, bearing in mind that technology intrigues the learners, stimulates them to activities, enhances their hands-on-mind-on activities, enriches their academic endeavours.

Olagunju and Ige (2013) pinpointed nine heuristic instructional strategies in innovative science teaching and learning as: laboratory/investigative method, discovery or guided inquiry, projects, field trips, demonstration, individualized instruction, problem-solving, case-studies and assignment or Dalton method. The duo recommended that to firmly impress in the mind of the learners, the scientific concepts, facts, laws, theories and principles should be critically selected along relevant instructional materials with appropriately stated objectives, mapped out with different activities for students' learning either individually or in groups, plan the instructions with skills and techniques, organize discussion, debates, quizzes, assignments and projects to stir learners' inquisitiveness..

Despite all the heuristic instructional strategies applied by the science teachers, the performance of secondary students in science in West African Senior Secondary Certificate Examination (WASSCE) is still appalling, dishearten and abject (source of data).

Table 1: West African Senior Schools Certificate Examination, Biology, Chemistry, Mathematics and Physics, 2014 – 2023

Year	Biology Total No. of Candidates	Credits Passes 1 – 6 (%)	Chemistry Total No. of Candidates	Credit Passes 1 – 6 (%)	Mathematics Total No. of Candidates	Credit Passes 1 – 6 (%)	Physics Total No. of Candidates	Credit Passes 1 – 6 (%)
2014	1,638,685	32.89	656,872	62.25	1,665,769	36.45	650,967	43.93
2015	1,693,886	31.99	694,325	64.61	1,725,725	34.99	688,099	42.86
2016	1,749,087	31.09	731,777	66.98	1,785,681	33.53	725,231	41.79
2017	1,804,288	30.19	769,230	69.35	1,845,637	32.07	762,362	40.72
2018	1,859,489	29.29	806,683	71.71	1,905,593	30.62	799,494	39.64
2019	1,914,689	28.39	844,136	74.08	1,965,549	29.16	836,626	38.57
2020	1,969,890	27.49	881,589	76.45	2,025,506	27.70	873,758	37.50
2021	2,025,091	26.59	919,041	78.82	2,085,462	26.24	910,890	36.43
2022	2,080,292	25.69	956,494	81.18	2,145,418	24.79	948,021	35.36
2023	2,135,493	24.79	993,947	83.55	2,205,374	23.33	985,153	34.28

Source: West African Examination Council (WAEC), 2024

Table 1 reveals a steady rise in candidate enrollment across all subjects, yet Biology, Mathematics, and Physics show declining pass rates, necessitating urgent intervention. Failure rates in Biology surged from 67.1% in 2014 to 75.2% in 2023, Mathematics from 63.6% to 76.7%, and Physics from 56.1% to 65.7%, reflecting increasing struggles in these subjects. In contrast, Chemistry showed improvement, with failure rates dropping from 37.8% to 16.5%, indicating better instructional strategies. The growing failure rates highlight the need for a technology-driven instructional shift. AI-powered adaptive learning can provide personalized learning paths, while gamification and virtual labs can enhance engagement, particularly in Mathematics and Physics. Mobile learning platforms can improve accessibility, and data-driven instruction can help educators track and adjust teaching strategies. Traditional methods are proving inadequate in addressing learning difficulties in core science subjects. To enhance student performance and prevent further decline, integrating AI, mobile learning, and digital simulations is essential (Adesina, 2024; Ceylan & Mnzile, 2025; Fauzi et al., 2025). Immediate adoption of these innovations can revolutionize science

education, fostering better learning outcomes and overall academic success.

This implies that a few students would eventually be able to pursue science-related courses in higher institutions which invariably addresses the dwindling manpower development, scientific and technological literacy of the nation. The talk and chalk method with many suggested innovative strategies failed colossally in raising students' achievement in science. The teaching and learning of science should change in tandem with the Next Generation Science Standard (NGSS), teaching science technologically and with reflective thinking. This connotes transferring scientific concepts, contents of instruction, science quizzes, tutorial, drill and practices, scientific experiments, assignments and projects, assignments and projects from the pages of hard copy (books) to the cell phones, computers, IPAD screens where the present learners are eye-glued.

The new science teaching and learning paradigm increases science students' skill development, enhances human development, increase productivity (academic achievement) and sustain positive attitudinal change (Ige, Durowoju & Oke, 2017; Olagunju & Adesina, 2017; Afolabi, Afolabi & Adesina,2018). Adapting or associating technology with scientific concepts, hypotheses, facts, theories and laws into teaching and learning process is highly adaptable to learning to teach, prowess regular and timely, organized instruction with the instructor facilitating sequential learning and current feedback to the learners. Science students can repeat technological instructions tirelessly, they can learn at their own pace; the technological software can be used with greater number of science students even outside the continents of production. Mangal and Mangal (2009) in Olagunju & Adesina (2017) identified computer assisted instructions in tutorials, drill and practice, games, simulations, problem-solving, practical work-oriented computer assisted instruction as technological modes of innovating teaching and learning of science.

The 2019 reports of innovating pedagogy identify ten innovations that are plausible in raising science students' performance: playful learning, learning with robots, decolonizing learning, drone-based learning, learning through wonder, action

learning, virtual studios, place-based learning, making thinking visible, roots of empathy (Herodotou et al., 2019). All the strategies can be highly adapted with the use of technology as technological tools become ubiquitous in the global society and teachers and learners roles become lucid, coherent and facilitative in nature.

The new science teaching and learning paradigm helps in raising students' cognitive, affective and the psychomotor domains of education. Effects of computer mediated power point presentations on students' achievement in Basic science (Arlina, Muhammed & Dwijoko, 2018; Raimi, Bolaji & Adesina, 2016; Anulobi, 2012); Effects of Computer assisted instruction (CAI) on students' achievement in Agricultural Science (Muchiri, 2018; Olagunju & Adesina, 2017; Ugo, 2017; Idowu & Odewumi, 2017); Computer assisted instructional strategies on students achievement in chemical reaction and equilibrium in secondary schools (Achor & Ukwuru, 2014); Computer aided instructional package on students' academic achievement in Biology concepts (Nsofor, Ala & Gambaki, 2013; Afolabi, 2006); Computer Assisted and Textual Programmed Instructions on pre-service teachers learning outcomes in some environmental education concepts in Biology (Olagunju & Oduwaiye, 2011); Gamification approach (Maher, 2019; Ruiz-Ariza, Casuso, Suarez-Manzano, & Martínez-López, 2018., Aremu, Akinyemi & Babafemi, 2017; Lister, 2015; Hanus & Fox 2015).

The new science teaching and learning paradigm is premised on the theories of behaviourists' and the constructivists' conceptions of conditioning scientific concepts, facts, contents, hypotheses, theories and laws in technological gadgets, stimulating, chaining and conditioning science teaching and learning with the view of eliciting the desired improved learning outcomes and succinctly planned instruction to enhance knowledge construction through assimilation or accommodation (Gagne, 1962, Skinner, 1968; Piaget, 1973, Bruner, 1986, Glaserfeld, 1989 in Adesina, 2015). If science teaching and learning are revolutionizable using technology and reflective thinking, what of the learners' perception of the use of the new paradigm? Is the secondary students' perception a strong determinant in the use of the new paradigm? What of the secondary students'

demographic attributes, can it significantly influence their perception? This study investigates these.

Empirically, Mahmood, Nasir and Fahaah (2011) determined the effects of use of ICT: Students' perception at higher education level found out that ICT has strong effects on students' perception of effective teaching and learning and thus recommended ICT use in education. Adesina (2012) empirically investigated students' perception of the efficacy of electronic applications in the teaching and learning of science education found out that the pre-service teachers had strong perception about the efficacy of electronic application in education. Badmus and Olasedidun (2017) reported that the secondary school students in Oyo-West Local Government Area of Oyo state had positive perception about the use of ICT facilities for teaching-learning process. Afolabi, Afolabi and Adesina (2018) investigated primary school teachers' perspectives about advancing Basic Science through technologies in Oyo township, andthe results revealed a significant influence of teachers' perspectives on advancing Basic Science teaching and learning through technologies and the influence was not beclouded by the teachers' gender, teaching experience, class taught and qualification. None of these studies have investigated the perception of secondary school students' perception of the new paradigm in science teaching and learning. Therefore, this study explores this along with the impacts of their gender, age, class, religion and types of school on the perception.

In a study, Inaltekin (2020) explored the perceptions of 396 eighth-grade students in Kars, Turkey, regarding technology-based learning in science courses, highlighting the importance of smart boards and teacher involvement found that students have significant perception of technology-based learning in science courses. Alanazi (2021) investigated Grade 12 secondary school students in Saudi Arabia's perception of evolution teaching. Findings showed students understand its scientific significance, validity, and acceptance, but need further work on science education policies. Khan, Khan and Gulana (2022) examined the perceptions of government secondary school science students in District Dir Lower towards the Science, Technology, Society and Environment (STSE) approach. Data was

collected from 737 students using a self-developed questionnaire. The results showed that students were familiar with STSE and found it helpful in enhancing critical thinking skills.

Furthermore, Godfrey (2023) found that secondary science education, utilizing innovative teaching strategies, is crucial for students' future scientific pursuits and technological advancements, fostering critical thinking, problem-solving, and appreciation for the scientific method. Dawadi (2023) study revealed that students prefer social interaction, group study, ICT-based learning, collaborative learning, note-taking, problem-solving, laboratory methods, and teacher feedback for physics learning, but express negative responses to lecture methods. Mondal et al. (2024) averred that secondary science education is crucial for students' future scientific pursuits and technological advancements. Innovative teaching strategies, focusing on activity-based learning, can foster critical thinking, problem-solving, and appreciation for the scientific method. Bhoi (2024) in a review underscores the importance of various teaching methodologies in biology education, such as personalized learning strategies, differentiated instruction, multimedia resources, formative assessments, and interdisciplinary studies, for preparing students for the 21st century. This study thus investigated the secondary students' perception of the new science teaching and learning paradigm**.**

Research Questions

Two research questions were answered in the study:

- What is the secondary school students' perception of the new science teaching and learning paradigm?
- What are the secondary school students' envisaged problems to the new science teaching and learning paradigm?

Hypotheses

The following null hypotheses are tested at 0.05 level of significance:

Ho_1: There is no significant secondary school students' perception of the new science teaching and learning paradigm;

Ho_2: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on gender;

Ho_3: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on age;

Ho_4: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on class;

Ho_5: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion;

Ho_6: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on types of school.

Methodology

The study adopted a mixed method research design with qualitative and quantitative approach to examine the new science teaching and learning paradigm: secondary students' perception. The design is more fitting as it allows concurrent access to both the qualitative and quantitative data for generation of information to answer the research questions and testing the hypotheses. The population comprises all the public and private secondary students in Atiba, Afijio, East and West Local Government Areas (LGAs) of Oyo State, Nigeria. Cluster random sampling technique was adopted to select 240 students from the population of the study. The researcher selected the sample based on the clusters of types of schools in each of the LGEA that constituted the population of the study. Two research instruments, a self-constructed and validated tool, The New Science Teaching and Learning Paradigm Questionnaire (NSTLPQ) and an unstructured interview were used for data collection. The original NSTLPQ consists of 30 items in 4-likert scale format of strongly agree, agree, disagree and strongly disagree with scoring of 4, 3, 2, 1 for positively worded items and the reverse for the negative items. NSTLPQ was given to experts in test and measurement for content, construct and face validity which reduced the items to twenty-five.

The valid instrument was trial-tested on 25 secondary school students similar to the study population, their responses were coded and subjected to Cronbach's Alpha reliability that yielded 0.79 index. The unstructured interview questions focused on the research questions to generate qualitative data for the study. The validated NSTLPQ was administered on 240 secondary school students by the researchers and the assistants. The unstructured interview was also randomly conducted with some of the respondents based on their time availability. The instruments were retrieved on the spots with a hundred percent returns. The collated data was subjected to qualitative and quantitative data analyses. The thematic approach was used to analyze the qualitative data to provide answers to the research questions. Simple frequency counts and percentages were used for socio-demographic attributes of the respondents while parametric statistics of t-test and Analysis of Variance (ANOVA) were used to test the null hypothesis at 0.05 level of significance.

Results

Table 1: Respondents' socio-demographic variables

Variables	Frequency	Percentage (%)
Gender		
Male	176	70.4
Female	74	29.6
Total	250	100.0
Age group		
8-10 Yrs	4	1.60
11-13 Yrs	38	15.20
14-16 Yrs	168	67.20
17-19Yrs	40	16.00
20 & above	250	100.0
Total		
Class		
J. S II	125	50.00
S. S, II	125	50.00
Total	250	100.0
Religion		
Christianity	47	18.80
Islam	187	74.80

ATR	16	6.40
Others	0	0.00
Total	250	100.0
Types of school		
Private	125	50.00
Public	125	50.00
Total	250	100.0

Table I indicated that there are 176 (70.4%) male respondents, 168 (67.20%) 14-16 years age, 125 (50.0%) J.S. II, 187 (74.80%) Muslims, 125 (50.0%) private secondary school students in the distribution.

Answers to the research questions

- What is the secondary school students' perception of the new science teaching and learning paradigm?
  From the qualitative data collected from the unstructured interview, the secondary school students perceived the new science teaching and learning paradigm as effective in enhancing teaching and learning of science. They opine that there technological gadgets i.e. Smartphone can be used to learn science, browse the internet, submit assignments, answer test (CBT), write examinations and discuss science with friends.

Five of their excerpts are:

i. Increased Engagement and Interest
   "I find science more interesting now because I can use my smartphone to watch science experiments online. It makes learning feel real and exciting."
ii. Enhanced Accessibility and Convenience
   "With my phone, I can browse for science topics, watch videos, and even do my assignments anytime. I don't have to wait for my teacher to explain everything in class."
iii. Improved Collaboration and Communication
   "I like that we can now discuss science topics with classmates in online groups. If I don't understand

something, I ask my friends, and they explain it to me immediately."

iv. Adaptability to Modern Learning Methods
"Using computers and online tests makes exams easier because I am already familiar with the system. I think science should always be taught this way."

v. Better Assessment and Learning Experience
"I prefer answering tests on a computer because it is faster, and I get my results quickly. It also helps me prepare for external exams like UTME and WAEC."

- What problems do secondary school students' envisaged towards the new science teaching and learning paradigm?
The secondary school students express poor power supply, inadequate teaching method, paucity of materials both hardwares and softwares, poor educational financing as problems to the new science teaching and learning paradigm.

Five of the excerpts from the qualitative analyses are:

1. Poor Power Supply
"Sometimes, there is no electricity to charge my phone or the school's computers. This makes it difficult to use technology for learning."
2. Inadequate Teaching Methods
"Some teachers are not used to teaching with technology. They still prefer the old method, so we don't always get to use digital tools in class."
3. Lack of Learning Materials
"We don't have enough computers, projectors, or internet access in school. If more students had access to these, learning science would be much easier."
4. Poor Educational Financing
"Our school doesn't have enough money to buy science gadgets or maintain them. Sometimes, even the few available ones stop working and are not repaired."
5. Software and Connectivity Issues
"Downloading science apps or browsing for information is

difficult because of slow or expensive internet. Not everyone can afford data to study online."

Hypotheses testing

Ho_1: There is no significant secondary school students' perception of the new science teaching and learning paradigm

Table 2: T-test analysis of secondary school students' perception of the new science teaching and learning paradigm

Variable	Number	Mean	SD	Df	t-cal	Sig.	Remarks
perceived impacts	250	71.20	8.86	249	127.10	.000	*S

From Table 2, there is significant secondary school students' perception of the new science teaching and learning paradigm (x=71.20, t-cal= 127.10, df=249, p<.05). Therefore, the null hypothesis which says there is no significant secondary school students' perception of the new science teaching and learning paradigm was not accepted.

Ho_2: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on gender

Table 3: T-test analysis of difference in the secondary school students' perception of the new science teaching and learning paradigm based on gender

perceived impacts	Number	Mean	SD	Df	t-cal	Sig.	Remarks
Male	176	69.81	8.81	248	-3.94	.000	*S
Female	74	74.51	8.12				

From Table 3, it was revealed that there is significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on gender (t-cal=-3.94; df=248; p<.05). Therefore, the null hypothesis that says there is no significant difference in the secondary school students' perception of

the new science teaching and learning paradigm based on gender was not accepted.

Ho_3: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on age

Table 4.0: Analysis of variance of the secondary school students' perception of the new science teaching and learning paradigm based on age

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2514.83	3	838.28	12.12	.000
Within Groups	17021.76	246	69.19		
Total	19536.59	249			

Table 4 indicated that there is significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on age ($F_{(3,246)}$=12.12; $p<0.05$). Therefore, the null hypothesis which says there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on age was not accepted. To know the direction of the difference, scheffe posthoc test was conducted in

Table 4.1: Scheffe Posthoc Test on secondary school students' perception of the new science teaching and learning paradigm based on age

STUDENTS AGE GROUP	N	Subset for alpha = 0.05 1
17-19YRS	40	64.33
8-10YRS	4	66.00
11-13 YRS	38	71.26
14-16 YRS	168	72.95
Sig.		.08

Table 4.1revealed that the students with 14-16 years of age had the highest (72.95) perception of the new science teaching and learning

paradigm followed by those with 11-13 years (71.26), 8-10 years (66.00) while those with 17-19 years (64.33) had the least perception scores.

Ho_4: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on class

Table 5: T-test analysis of difference in the secondary school students' perception of the new science teaching and learning paradigm based on class

perceived impacts	Number	Mean	SD	Df	t-cal	Sig.	Remarks
J.S II	125	71.95	9.51	248	1.34	0.18	NS
S.S.II	125	70.46	8.13				

From Table 5, it was revealed that there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on class (t-cal=1.34; df=248; p>.05). Therefore, the null hypothesis that says there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on class was accepted.
Ho_5: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion

Table 6.0: Analysis of variance of difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4877.17	2	2438.58	41.09	.000
Within Groups	14659.43	247	59.35		
Total	19536.60	249			

Table 6 indicated that there is significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion ($F_{(2,247)}$=41.09; p<0.05). Therefore, the null hypothesis which says there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion was not accepted. To know the direction of the difference, schefee posthoc test was conducted in

Table 6.1: Scheffe Posthoc Analysis of Difference in the secondary school students' perception of the new science teaching and learning paradigm based on religion

STUDENTS' RELIGION	N	Subset for alpha = 0.05 1	2
ISLAM	187	69.81	
CHRISTIANITY	47	71.02	
ATR	16		88.00
Sig.		.813	1.00

Table 6.1reveals that the African Traditionalists had the highest (88.00) perception of the new science teaching and learning paradigm followed by the Christians (71.02) while the Muslims (69.81) had the least perception of the new science teaching and learning paradigm.
Ho_6: There is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on types of school

Table 7: T-test analysis of difference in the secondary school students' perception of the new science teaching and learning paradigm based on types of school

perceived impacts	Number	Mean	SD	Df	t-cal	Sig.	Remarks
Private	125	71.95	9.51	248	1.34	0.18	NS
Public	125	70.46	8.12				

From Table 7, it was revealed that there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on types of school (t-cal=1.34;

df=248; p>.05). Therefore, the null hypothesis that says there is no significant difference in the secondary school students' perception of the new science teaching and learning paradigm based on types of school was accepted.

Discussion

From the research questions answered, it could be inferred that the secondary school students perceived that the new science teaching and learning paradigm is effective in improving their attitudes towards teaching and learning science so also their academic performance. This may be because majority of these students are already conversant with their buddies, Smartphones in discussing and accessing scientific concepts. The secondary school students expressed that poor power supply, inadequate teaching method, paucity of materials both hardwares and softwares, poor educational financing as problems that militate against the new science teaching and learning paradigm. These findings corroborate the results of Mahmood, Nasir and Fahaah (2011), Adesina (2012), Badmus and Olasedidun (2017) that technology usage in Nigeria schools are constrained by host of impediments which inhibited the adaptation of the science classroom to conform to the Next Generation Science Standard (NGSS).

From the tested hypotheses, it was revealed that the secondary school students had a significant perception of the new teaching and learning of science paradigm. The reasons for this may be owing to the ubiquitousness of the new technological strategies of teaching and learning science and the prowess of the students in handling their computer, ipad, smartphone or laptops. The results find supports in Badmus and Olasedidun (2017), Inaltekin (2020), Khan et al. (2022) that the secondary school students had positive and significant perception of using technology in Oyo East local government area of Oyo state. The findings also were in tandem to the results of Afolabi, Afolabi and Adesina (2018) that the primary school teachers are advancing science teaching and learning using technology. Additionally, the result agreed with the findings of Godfrey (2023), Dawadi (2023), Mondal et al. (2024) that secondary school students preferred the new science teaching paradigm with technology as

crucial for students' future scientific pursuits and technological advancements foster critical thinking, problem-solving, and appreciation for the scientific method

Also, from the tested hypotheses, it was deduced that the secondary school students' gender had a significant impact on their perception of the new science teaching and learning paradigm in favour of the female gender. This could be becausethe male students are more prone to use technology for football games and sportbets other than their female counterparts who are likely to utilise their technological gadgets in teaching and learning science. This result is converse to the findings of Afolabi, Afolabi and Adesina (2018) that gender is not a determining factor in perception of advancing science teaching and learning with technology. The secondary students' perception was also influenced significantly by their age, the younger students had better perception than the older students. This may be owing to the high level of inquisitiveness of younger mind to use of the new paradigm than their older counterparts. The students' religion had significant effects on the perception of the new teaching and learning paradigm, the African Traditional Religionist perceived the new paradigm better that both the Christians and the Muslims. This may be explained by the nature and material involvement in their form of worship which the other religions do not accept.

However, the students' perception of the new paradigm of teaching and learning science in not beclouded by the respondents' class and types of school. This may be owing to the ubiquitousness of the new paradigm of teaching and learning science by technology and reflective thinking which is the trending path to the Next Generation Science Standard (NGSS). It would be noted that the high perceiving students are even the younger students in the junior classes who are prone to use even their parents' phone to google and browse the internet.

Conclusion

The secondary school students perceived the new science teaching and learning paradigm, teaching and learning science with technology to be a significant impetus to boosting their attitude and achievement in science. The militating factors of poor electricity

supply, inadequate teaching method, paucity of materials both hardwares and softwares, poor educational financing are identified as impediments among the constraints to the implementation of the new science teaching and learning paradigm. It is therefore affirmed that with the significant perception of secondary school students of the new science teaching and learning paradigm, the heuristic instructional mode should be properly and adequately utilized by the instructional facilitators and the learners irrespective of the students' gender, age, class, religion, and types of school.

Recommendations

From the findings of the study, the following are recommended:

1. The government at all levels should provide functional technological laboratory in schools right from primary to secondary and tertiary institutions. This will facilitate the instilling of the use of technology in schools, raising the perception of both the students and the instructional facilitators thus enhancing the use of the new science teaching and learning paradigm.
2. Educational curriculum planners should incorporate practical technological training course in their curriculum design for students right from primary schools to enhance better perception of the new science teaching and learning paradigm in schools.
3. Workshops, seminars, lectures, symposia and conferences should be organized by government and professional bodies for the Science teachers to keep them abreast of the trending technologies to boost teaching and learning of science in schools.
4. Non-Governmental Organizations (NGOs) to rally round educational industries in the country by supplying both the technological hardware and instructional software to schools and institutions of learning in Nigeria. This will buttress the utilization of the new science teaching and learning paradigm in schools.

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