

POST COVID-19 PANDEMIC, STUDENTS' ATTITUDE TOWARDS ONLINE BIOLOGY INSTRUCTIONS IN PRIVATE SECONDARY SCHOOLS IN ENUGU STATE, NIGERIA

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*The authors declare
that no funding was
received for this work.*

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Received: 26-January-2026

Accepted: 20-February-2026

Published: 03-March-2026

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This article is published in the **MSI
Journal of Multidisciplinary Research
(MSIJMR)** ISSN 3049-0669 (Online)

The journal is managed and published
by MSI Publishers.

Volume: 3, Issue: 3 (March-2026)

ABSTRACT: Educational institutions across the world were closed down due to COVID-19 pandemic in 2020, thus leading to sudden shift to online learning. This study assessed post COVID-19 pandemic students' attitude toward online Biology instructions in private secondary schools in Enugu State, Nigeria. Ex-post facto research design was employed, and the sample comprised 447 SSIII students (206 boys, 241 girls) from eleven private secondary schools in Enugu State. Data were collected using structured questionnaire with Cronbach's alpha of 0.84, indicating high reliability. The data were analyzed using mean, standard deviation, t-test and analysis of variance (ANOVA), by SPSS version 20. The findings revealed positive perceptions of online learning with no significant gender differences. The study also showed that the private secondary school students have positive attitudes to online Biology instructions amid COVID-19 pandemic, but with no significant gender differences. However, the result revealed that varied challenges were experienced by the

students in the application of the online Biology instructions during sit-at-home due to COVID-19 pandemic. The study recommends integrating hybrid/blended learning into school curricula as well as encouraging daily online platform use by teachers and students, and providing infrastructure support to enhance learning effectiveness to take of disruption of academic activities in future disease pandemic. By addressing these challenges, online learning can be made more effective and productive for students, even with or without disease pandemic.

Keywords: *COVID-19 pandemic, students' attitude, biology instructions, private secondary schools*

Introduction

In Nigeria, secondary school education, a 6-year programme in two stages namely Upper Basic Education and Senior Secondary schools is aimed at preparing the recipients for tertiary level of education and for useful living in the society (FRN, 2013). Secondary school students, be it public or private, transit to tertiary level of education upon obtaining a minimum entry subject requirements in Senior Secondary School Certificate Examination (SSSCE) organized the West African Examination Council (WAEC) and/or National Examinations Council (NECO). Therefore, students' performances in these external examinations determine to a large extent, entry into higher Institutions as well as their employability in the labour market for middle class labour. That being the case, any event factor capable of preventing students from taking such certificate examinations, could be very devastating. Preparing the students for exams, irrespective of environmental disruptions like disease pandemic, requires uninterrupted appropriate teaching and learning techniques for all relevant subjects of which one of them is Biology.

Biology, which has its learning content to life in general (Mussyeri *et al.* (2022), is a core science subject for senior secondary school students in Nigerian educational curriculum (FRN, 2013). It is a central subject to many science-related professional courses such as Medicine, Nursing, Pharmacy, etc. Considering the significance of Biology, it becomes necessary that it has to be effectively taught to foster a deeper understanding of the subject in schools, no matter any external factors that are militating against it. Therefore, this study sought to find out the extent to which

online modes of teaching and learning influence Biology instructions during COVID-19 pandemic.

Researches have indicated that wars, industrial actions, Boko haram insurgency and attacks on schools' facilities, learners and education personnel (EIEWG, 2018), outbreak of diseases and the likes, do disrupt academic activities, thereby affecting the academic progress of the students. Apart from disruption of academic programme, Alam & Tiwari (2021) indicated that such crisis are capable of making private school enrolments to decline substantially with some students migrating to public schools, and delay in entry or dropping out of the students. Academic activities require an interactive classroom environment which, according to Debbarm & Durai (2020) is referred to as an effective communication environment that enhances meaningful knowledge acquisition. An increase in interaction based on modes of instructions applicable is capable of improving students' learning enthusiasm, motivation and concentration. In an ideal situation therefore, teaching and learning techniques ought to be well thought out and organized without disruptions of any kind.

However, the entire school system in the world was disrupted and brought to a standstill from 2019 and beyond, by the disease described as coronavirus disease 2019 (COVID-19). The COVID-19 pandemic was a new type of disease termed severe acute respiratory syndrome that had never previously affected humans (WHO, 2020). The signs and symptoms of COVID-19 infection include but not limited to acute respiratory problems, fever, cough, kidney failure and even death (Hui *et al*, 2020). The outbreak of COVID-19 pandemic was first spotted in Wuhan City, China in December 2019; labelled a pandemic by the WHO (Callaway in Aliyu, 2021), and its spread resulted in a downturn in global economic activities (Ibrahim, Akran, Audu & Hamza, 2021). The modes of transmission (Abayomi, 2021) are through close contact with individuals already infested by the virus, and touching contaminated objects by the healthy persons (Parry, 2020).

The preemptive measures of COVID-19 include but not limited to avoiding physical contact, regular washing of hands with water and soap, sanitizing with alcohol base hand sanitizer, use of nose masks, circumventing touching of eyes, nose and mouth

and self-isolating (NCDC, 2020) as well as restriction of movements as enforced by government (Bedford *et al.*, 2020, Gostin & Wiley, 2020). It was noted that enforcement of the preventive measures (Sadhika in Allahnana *et al.*, 2021) generated some psychological effects such as traumatic disorder, anxiety and behavioural disorders in humans (Darmody *et al.*, 2020). Due to the fact that the dreaded disease is contagious and had no cure in focus, it created fear of burden and so people were scared of contracting it. The emotional distress generated also led to the perception of COVID-19 pandemic eliminating all human on earth. Social distancing and restrictive movement policies (Sumitra & Roshan, 2021) had significantly disturbed traditional educational practices, so much so that there was fear of losing 2020 academic year or even more years ahead. There were, therefore, varied general perceptions of COVID-19 as some people equally believed that it affected only aged people, and that the virus could be killed easily in hot environment like in Africa (Sule, 2021). Since the private school students are part of the society, the researcher deemed it fit to ascertain their perceptions of COVID-19 pandemic.

UNESCO (2020) posited that the outbreak of COVID-19 inflicted mayhem across the world and education became the worse hit. The influence of the disease pandemic on education was both exceptional and ubiquitous in education history, affecting nearly every student in the world (Lee *et al.* 2021; Sumitra & Roshan, 2021; UNICEF, 2020; United Nations, 2020) as the academic activities became paralyzed. Alam & Tiwari (2021) noted that the education market disruptions by the pandemic pose significant risks to the effective continuity of learning for millions of learners worldwide. The unanticipated influx of COVID-19 pandemic and ensuing school closures (Zhao & Watterston, 2021) which generated massive effort to innovate and adapt new techniques of teaching and learning by educators and school systems had varied and severe implication on the modes of learning by students at home. Subsequently, most institutions as well as some private secondary schools, in a way to mitigate the negative impact of the pandemic, decided to switch completely to remote teaching and learning in a matter of few days (Daniel, 2020; Kamanetz, 2020; Mohamad *et al.* 2020; Pietro *et al.*, 2020; Sun *et al.*, 2020) for the continuation of academic programme (Biao *et al.*, 2021; Vaghjee & Vaghjee, 2022).

In addition to the adoption of online instructions by most schools (Alam & Tiwari, 2021), the Nigerian government equally introduced radio and television (TV) lessons (Adelakun, 2020) for students especially in certificate classes during COVID-19 pandemic era. Bangay in TEP (2020) posited that use of radio as alternative to online technique is more beneficial to learners in that it has the widest reach at lowest cost and quickest start-up period. Literature has it that many students were not ready to use learning technique with online system (Surani & Hamidah, 2020), however, they were left with no choice as the traditional face-to-face method of instructions became impossible. However, TEP (2020) asserted that use of radio/TV and other online learning modes such as zoom, video conferencing etc. can never be as effective as physical classroom learning.

Online learning platforms have been established prior to the onset of the COVID-19, thus providing alternative means of learning outside of the physical school environment (Anderson, 2011). Jatto & Bakare (2022) declared that online learning technique which moved fast the initial hype during the shutdown due to COVID-19 pandemic necessitated the migration of all and sundry to this domain of which the private sector was not immune. Apart from maintaining academic programme in institutions (Pietro et al., 2020; TEP, 2020), online learning is alluring to most students in developed nations, but its adoption in private and public secondary schools in Nigeria still lags behind, just like in other undeveloped countries (Tokede & Appah, 2020).

Private schools being institutions established by individuals are tenaciously managed to increase their financial status. However, as business entities, these institutions are also employers of labour and so, help to reduce unemployment in the society, and as such are stakeholders which cannot be overlooked (Deji-Folutile, 2020). Persuasively, some parents prefer private schools, reasons being that they are safe environment with dedicated teachers, and parents' involvement in the affairs of their wards, assured (Ewuzie in Ilodibe & Patrick, 2020). In Nigeria, there is tremendous rise in private schools spanning from pre-schools to tertiary institutions (Jatto & Bakare, 2022), and so, this calls for an understanding of the perception and attitude

of the private school students towards the adoption of online classes amid COVID-19 pandemic.

According to educational psychologists, attitude is regarded as the sum of one's values and principles that come across in the way one carries oneself, speaks or relates to people or reacts to object. Attitudes are seen as more or less positive and encompass emotions, beliefs, values and behavior and hence affect someone's way of thinking, acting and behaving (Uzorka & Makeri, 2020) which has a lot of implications to teaching and learning. Attitudes, though not directly observable, are inferred from observable responses and behaviours which reflect a pattern of beliefs and emotions (Langat, 2015). Studies show that attitude is emotional tendencies towards events, phenomenon, people, place, situation and ideas (Mustafa, 2018; Olufemi, 2012). It is also noted that students' attitude to school activities as well as working in collaboration with others can be seen as a disposition towards effective learning (Kpolovie *et al.*, 2014). There are three main components of attitude (Wood & Wood in Olufemi, 2012) vis-à-vis affective, behavioural and cognitive (ABC) (Fareo, 2019; Marcela & Dana, 2016). The ABC model usually controls one's emotion in any circumstance, and in particular, the tendency to behave in accordance with favourable and unfavourable experiences with learning (Marcela & Dana, 2016; Lee *et al.*, 2021).

Students' attitude to teaching and learning determine the overall academic performance and future prospect in their lives, a significant factor ensuring students' success (Hussaini *et al.*, 2015). Literature has it that attitude provides a background that makes it easier for one to decide how to act in a new situation. Unfortunately, the disruption by COVID-19 resulting to closure of schools in 2019/2020 might have affected the attitude of the students towards teaching and learning modes. This is precisely why this study attempted to assess the attitude of private secondary school students towards the use of online modes in Biology instructions after the pandemic of 2019. The fact that no study known to the researcher has investigated the influence of the COVID-19 on students' attitude to use of online modes in Biology instructions in private schools, necessitated and justified this study.

In another dimension, the influence of environmental factors like COVID-19 on the attitude of students on use of online modes in Biology instructions could be linked with gender.

Gender differences in academic activities and achievement have long been concern for educational researchers and school administrators with various hypotheses attempting to explain observed disparities (Ezechi & Adukwu, 2018). Gender is the societal meaning assigned to male and female with distinct roles each should play (Ezeh, 2013), thus signifying responsibility of male and female in families, societies and culture. For instance, girls are generally trained to confine themselves in the house, thus carrying out family chores (Ezechi & Adukwu, 2018) while boys appear to remain outside the house most of the time, indulging themselves in different activities. Some of these innate characters are capable of influencing attitudinal disposition towards online modes in Biology instructions during the COVID-19 pandemic and beyond.

Mohamad *et al.* (2020) noting that COVID-19 pandemic which changed the educational landscape by adopting online method, observed that gender differences in satisfaction with online learning have yielded mixed results, with some studies indicating male learners are more satisfied, while others report the opposite (Morante *et al.*, 2017). This disparity suggests that gender's impact on online learning satisfaction is complex and influenced by various factors. Therefore, the need to provide answers to whether there are intersexual differences in attitude towards online modes in Biology instructions among students in private secondary schools due to COVID-19 pandemic is quite necessary, as there was no sufficient empirical studies to establish that.

The sudden shift to remote learning during COVID-19 posed significant challenges, particularly in Nigeria, where technology integration in education is still evolving (Ebohon *et al.*, 2021; Eze *et al.*, 2021; Biak & Adeniran, 2020). Worst still, at secondary school level, most students and even teachers are not familiar with online teaching and learning environment (Baber, 2021; EdTech Hub & eLearning Africa, 2020). Generally, key hurdles of use of online techniques include but not limited to limited infrastructure (inadequate internet access), teacher preparedness and students

accessibility (Eze *et al.*, 2021; Zhong, 2020). Apart from lack of physical interaction between the instructor and students (Baber, 2021), some other challenges experienced by the students could manifest in form of irregular supply of power (Crawford *et al.* 2020; Zhong, 2020), access to procurement of online devices (e.g. android phone, laptops) as well as lack of ICT knowledge and training (Zhong, 2020). Therefore, the researcher considered the need to determine the challenges of online modes of learning by private secondary school students in Enugu State in post COVID-19 era.

Statement of the Problem

The private secondary school system being part of education sector was brought to a standstill in 2019 and beyond due to COVID-19 pandemic. Private schools, being private business and highly competitive, may have been severely affected by COVID-19 pandemic due to school shutdown leading to possible students' disillusion to studies as well as low enrolment and drop in population in the schools. In Nigerian, there are noticeable increase in the show of apathy to schooling among adolescents. The education market distruction by COVID-19 which posed a high risk of effective continuation of academic activities as well as introduction of uncommon online learning might have aggravated the general laissez-faire attitude of students to learning.

The study therefore assessed how the students reacted and thought about online learning and what was their attitude towards it, amid COVID-19 pandemic. Hence, the problem of this study arose as to what were the COVID-19 pandemic and secondary school students' attitude towards the use of online modes in Biology instructions in private schools in Enugu State?

Purpose of the Study

The purpose of the study was to determine students' attitude towards use of online modes in Biology instructions in private secondary schools due to their perceived influence of the COVID-19 pandemic in Enugu State. Specifically, the study intended to:

1. determine the private secondary students' perceptions of the COVID-19 pandemic
2. determine the students' attitude to the use of online modes in Biology instructions in Enugu State private secondary schools amid COVID-19 pandemic
3. assess the challenges to online learning experienced by private secondary school students amid COVID-19 in Enugu State
4. investigate the influence of gender on students' attitude to the use of online modes in Biology instructions in Enugu State private secondary schools during COVID-19 pandemic

Significance of the Study

This study has significance in two key areas: theoretical and practical. Theoretically, it was anchored on Functionalist Theory of attitude by Daniel Katz (1960) and Theory of Distance Learning by Keegan (1986). The findings of the study established the assumption of the theories of Distance Learning that distance education could be operated any place where for the convenient of the students without the teacher being physically present. Therefore, the theory of distance learning is related to this study in that despite the closure of schools due to COVID-19 pandemic, online mode of learning was considered as an alternative.

The finding also established the assumption of the functionalist theory of attitudes which indicates that attitudes are molded according to how an individual meets ones needs. To a functionalist, one's personal benefit can determine one's attitude. For instance, one's attitude can alter when one's need changes. Therefore, the functionalist theory is related to the study in that the lockdown during COVID-19 pandemic which forced secondary school students to stay at home, is capable of affecting their attitude towards use of online modes of Biology instructions, thus making them to adjust to the alternative modes of learning.

Practically, this study would essentially benefit the students, teachers, school administrators, government, curriculum planners/designers as well as school guidance counselors, future researchers and parents. This study will provide a deep understanding of the effects of COVID-19 pandemic on private secondary school

students' attitude towards online Biology instructions. To the teachers, if the findings are disseminated through the appropriate media, would make them to be better informed of the influence of pandemic diseases on the attitude of students towards learning, and thus guide them on the effective use of online modes of teaching during disease pandemic.

The outcome of the study would assist the school administrators in providing enabling learning environment as well as providing necessary infrastructural support and mechanisms to maintain teaching and learning during disease pandemic. The findings could be useful to government in making policies that would enhance uninterrupted teaching and learning during pandemic disease. To the curriculum planners as well as Ministry of Education, if the study is published or disseminate through seminars and conferences, the findings of this study may ginger them to provide better curriculum materials for effective teaching and learning of science subjects such as Biology in both public and private schools especially duiring the emergence of pandemic diseases.

Findings of the study if disseminated through conferences and seminars could be of benefit to the school Guidance Counselors in providing better understanding of the influence of disease pandemic on the secondary school students' attitude to the use of online modes in Biology instructions in schools. The report of the study would be beneficial to future researchers as useful additional information to the existing literature on the same and related study areas.

Research Questions

The following research questions are raised by the researcher to guide the study:

1. What are the private secondary school students' perception of the COVID-19 pandemic?
2. What are students' attitude to the use of online modes in Biology instructions in private secondary schools amid COVID-19 pandemic?
3. What are the challenges to online learning in Biology instructions experienced by private secondary school students amid COVID-19 pandemic in Enugu State?

4. How has gender influenced the students' attitude to use of online modes in Biology instructions in private secondary schools during COVID-19 pandemic?

Research Hypotheses

The null hypotheses formulated to guide the study include:

- H₀₁: There is no significant difference between the perceptions of male and female private secondary school students on the meaning of COVID-19 pandemic
- H₀₂: There is no significant difference between the attitude of male and female private secondary school students towards use of online modes in Biology instructions amid COVID-19 pandemic.
- H₀₃: There is no significant difference between the challenges encountered by male and female private secondary students to use of online modes in Biology instructions during COVID-19 pandemic
- H₀₄: There is no significant interaction effect on students' attitude and gender to use of online modes in Biology instructions in private secondary schools during COVID-19 pandemic.

Literature Review

The outbreak of COVID-19 pandemic, the coronavirus disease in humans believed to be common in certain species of animals like camels and bats originated from China (WHO, 2020). It became a global threat (Elsner *et al.*, 2022) which affected the lives of all society (Hammerstein *et al.*, 2021), and in particular created the largest disruption of educational systems in human history (Sumitra & Roshan, 2021). Of great effect in education is the lockdown to curtail the spread of the pandemic disease which disrupted all school activities, thus creating fear in students for non-completion of academic programme within the recorded period, and other personal psychological despairs. The sudden shutdown of all schools due to the dreaded disease resulted to inability of the students to continue with the traditional face-to-face teaching and learning. The global pandemic disease forced all institutions to use of online modes in instructions (Vaghjee & Vaghjee, 2022; Suleiman *et al.*, 2023) which most students are not familiar with (Henriksen *et al.*, 2020) especially private

secondary school students. Tokede & Appah (2020) noted that the online education remained the only option in Nigeria as obtainable developed countries.

Online instruction is a form of teaching and learning that embraces distance learning system where internet innovation is used to encourage the instructor to teach the intrigued students (Baber, 2020; Team Leverage Edu, 2023). It is student-centred and often offers a great deal of flexibility in terms of time and location (Agbele & Oyelade, 2020). Research indicates that online learning goes with many challenges such as technical know-how on the part of students and even teachers, poor electric power, internet connectivity problems as well as access to data.

The study is anchored on three theories of educational learning viz; Social Cognitive theory by Albert Bandura (1986), Functionalist theory of attitude by Daniel Katz (1960) and theory of Distance Learning by Keegan (1986). These theories explain the importance of learning among students themselves during the time of environmental distortion. Theory of independence and autonomy of learning, for instance, establishes the fact that there could still be alternative means of teaching and learning when there is pandemic disease hindering academic programme. However, students' perceived attitude to involvement in such alternative methods of teaching and learning as against traditional face-to-face method needed to be examined. The functionalist theory shows that attitude of the students can change when their needs change too. The review literature indicates that Social Cognitive learning explains how the environmental and cognitive components collaborate to affect individual learning and behaviour pattern.

Some empirical studies revealed that students' attitude are strong predictor variables that affect online teaching and learning (Mirahmadizadeh *et al.*, 2020; Unger & Meiran, 2020; Uzorka & Makeri, 2020; De Silva, 2021; Langat, 2021; Kumar *et al.*, 2021; Bamidele & Olufemi, 2022; Sahu *et al.*, 2022; Yazgan, 2022;). As at the time of environmental distortion, it has been shown that students' attitude to use of online modes in teaching and learning may be high, positive, average, negative or low depending on the type of attitude developed by the students towards learning. Therefore, there seems to be a contradiction in the report of the studies reviewed on

the relationship of students' attitude and online teaching and learning. This situation therefore calls for further studies on the possible influence of students' attitude towards use of online modes in Biology instructions, post COVID-19 pandemic.

Also, some studies have shown that gender have great influence on students' attitude towards use of online methods in instructions (Alordiah *et al.*, 2015; Chua & Mageswary, 2015; Ali *et al.*, 2021; Nath, 2021; Greier *et al.*, 2022; Ishimoto *et al.*, 2022; Kauts & Gulati, 2022; Nomie-Sato *et al.*, 2022), but these studies have been inconclusive. The disparity in students' attitude towards the use of online modes in teaching and learning between male and female students in private secondary schools reported by some researchers have been attributed to so many factors. The diverse and conflicting views regarding the influence of gender and students' attitude towards use of online modes in Biology instructions during COVID-19 pandemic are pointer to the fact that researchers have not reached a consensus. Hence, the present study attempted to assess the students' attitude towards the use of online modes in Biology instructions with respect to gender amid COVID-19 pandemic.

From the review of related literature, the researcher discovered that lots of works have been carried out on COVID-19 pandemic but no work has been carried out on post-COVID-19 pandemic and students' attitude to use of online modes in Biology instructions in Enugu State private secondary school students. This is the gap that the present study sought to fill or cover.

Methods

Ex-post facto research design was adopted in this study, due to the fact that the independent variables have already occurred (Verrette, 2015; Kerlinger, 1973). The study was carried out in Enugu and Nsukka education zones in Enugu State, Nigeria with 141 and 44 private secondary schools respectively, making a total of 185 schools (Ministry of Education Enugu, 2023). The population of the study comprised 8040 senior secondary three (SSIII) students (4310 girls and 3730 boys) from the two education zones, with 447 SSIII students (206 boys and 241 girls) randomly sampled from eleven private secondary schools namely as in table 1. Multistage sampling

technique involving purposeful, stratified and simple random sampling techniques was adopted in determining the sample size putting gender into consideration.

Table 1: Distribution of Sampled Private secondary Schools

S/N	Name of Schools	Education zone	Gender		Total No Students
			Male	female	
1	Corner Stone Sec. School Enugu	Enugu zone	26	25	51
2	Osisatech Boys Sec, School Enugu	Enugu zone	38	0	38
3	Doyen British High School Enugu	Enugu zone	7	3	10
4	Purple Springs International School	Enugu zone	1	1	2
5	Lady Ibiam Girls Sec. School Enugu	Enugu zone	0	65	65
6	WINSOPHIA Primary-Secundary Sch	Enugu zone	23	25	48
7	Coal City College Enugu	Enugu zone	10	15	25
8	Life Streams Nursery, Primary & Sec. Sch	Enugu zone	3	3	6
9	Royal Crown Academy Intl. College Nsukka	Nsukka zone	77	86	163
10	Bernad Edoga Intl. College Aku	Nsukka zone	10	9	19
11	Sinai Sec. School Uzo-Uwani	Nsukka zone	11	9	20
Total			206	241	447

The research instrument: structured questionnaire, consisting of three sections with 40 items on four-point Likert scale ranked: Strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2 and Disagree (D) = 1; was designed and adopted to address the

research questions guiding the study. The questionnaire were validated through face validity by three research experts from Faculty of Education: one lecturer from Department of Measurement and Evaluation and two lecturers from Department of Science Education, all in Enugu State University of Science and Technology, Enugu.

A trial testing to determine the reliability of the research instrument was done in Annunciation Secondary Schools, Abakaliki, Ebony State, and data collected analyzed using Cronbach's alpha method. The reliability coefficients (r) for the three sections of the research instrument were 0.86, 0.78 and 0.87 respectively. The overall r was 0.84.

The researcher with the help of research assistants administered the questionnaire to the respondents at the sampled schools, and retrieved back accordingly. Arithmetic mean (\bar{x}) and standard deviation (SD) were employed to answer the research questions while the null hypotheses were tested using the t-test and analysis of variance (ANOVA) at 0.05 level of significance, all in SPSS version 20. To reach decision for the reseach questions, the mean of 2.50 and above was agree, while mean score below 2.50 disagree. For the decision rule in the application of t-test and ANOVA, the null hypothesis was rejected if the significant value was less than 0.05 but not rejected if it was greater than 0.05.

RESULTS

Research Question One: What are the private secondary school students' perceptions of the COVID-19 pandemic?

Table 2: The Mean and Standard Deviation Response Scores of Private Secondary Schools Students' Perceptions of COVID-19 Pandemic (PSSSPCP)

S/N	Students' Perceptions of COVID-19 Pandemic	Mean	SD	Decision
1	COVID-19 is caused by virus, and it is contagious	2.54	1.14	Agree
2	COVID-19 pandemic created fear of burden on others when infected	2.65	1.14	Agree
3	One felt that COVID-19 would eliminate all human beings on earth	2.54	1.11	Agree

4	One was scared of contracting COVID-19 due to its rapid spread throughout the world	2.76	1.10	Agree
5	One was afraid since there was no end in sight regarding COVID-19	2.50	1.15	Agree
6	COVID-19 infested mainly aged people	2.43	1.10	Disagree
7	COVID-19 virus can be killed easily in a hot environment like in Africa	2.44	1.14	Disagree
8	COVID-19 can make the sufferer feel isolated and different from the rest of the world	2.52	1.11	Disagree
9	COVID-19 generated emotional distress and dull moment to young people throughout sit-at-home period	2.75	1.12	Agree
10	Lack of physical movement resulted during COVID-19 leading to emotional disorder	2.53	1.10	Agree
11	One was afraid of continuing educational career because COVID-19 halted all academic activities	2.51	1.10	Agree
12	Lockdown due to COVID-19 made me feel like dropping out of school	2.62	1.15	Agree
	Grand Mean & SD	2.57	1.11	Agree

Table 2 shows that the respondents are in agreement with items 1-5 and 8-12 with the mean above 2.50, which is the criterion mean for the study. Therefore, these items are accepted by the respondents to their good reasons for the perception of COVID-19 pandemic. Conversely, students' rejection of items 6 and 7 only indicate that their perception of the COVID-19 pandemic does not show that the pandemic affects mainly aged people and that, the virus can be killed easily in a hot environment. The grand mean of 2.57 with the overall standard deviation 1.11 indicates that majority of the respondents are in agreement with the most items presented as the perception of COVID-19 pandemic.

Research Question Two: What are students' attitude to use of online modes in Biology instructions in private secondary schools amid COVID-19 pandemic?

Table 3: The Mean and Standard Deviation Response Scores of Private Secondary School Students' Attitude to use of Online Modes (PSSSAUOM)

S/N	Students' attitude to use online Biology instruction amid COVID-19 pandemic	Mean	SD	Decision
13	Hope was a bit restored when online modes and radio/TV lessons were introduced to take care of traditional face-to-face teaching and learning method during COVID-19 lockdown	2.55	1.12	Agree
14	One is convinced that the adoption of online learning in secondary school will enhance academic performance of students	2.55	1.14	Agree
15	One stayed focused in Biology instructions when getting involved in online modes and use of radio/TV lessons during COVID-19 pandemic	2.55	1.14	Agree
16	One always looked forward for the online modes and the radio/TV lessons during sit-at-home due to COVID-19 pandemic	2.54	1.11	Agree
17	One is comfortable with self-directed online teaching and learning	2.47	1.10	Disagree
18	One was actively jotting down points in Biology instructions during online and radio/TV lessons	2.50	1.15	Agree
19	One exchanges views with classmates about what we study online	2.43	1.10	Disagree
20	One has become more interactive and participative in online discussions than in physical classes	2.44	1.14	Disagree
21	One looks forward to using distance learning involving online modes and radio/TV lessons in future	2.44	1.11	Disagree
22	Online modes of instructions allows one to learn at flexible times	2.65	1.12	Disagree
23	One would encourage friends to study through online distance learning	2.53	1.10	Agree
24	Biology learning was very difficult during the COVID-			

	19 pandemic due to loss of hope for continuity of academic programme	2.51	1.10	Agree
25	One feels isolated in an online learning	2.62	1.15	Agree
26	One experienced physical problems like headache, eye problem after attending online Biology and/or radio/TV lessons during COVID-19 pandemic	2.51	1.16	Agree
27	One prefers face-to-face contact with the Biology teacher and colleagues for more efficient learning than online instructions	2.52	1.11	Agree
28	One did not feel like we were receiving the same quality education as in traditional face-to-face method with online Biology instructions	2.53	1.13	Agree
	Grand Mean & SD	2.52	1.12	Agree

Table 3 reveals that the respondents agreed to items 12, 14-16, 18 and 22-28 which have mean scores above the criterion mean score of 2.50 set for the study. However, the items 17, 19, 20, and 21 have mean scores below the criterion mean of 2.50 set for the study. The grand mean score of 2.52 with standard deviation of 1.12 indicates that most private secondary school students have positive attitude to use of online modes in Biology instructions during COVID-19 pandemic.

Research Question three: What are the challenges to online learning in Biology instructions experienced by private secondary school students amid COVID-19 in Enugu State?

Table 4: The Mean and Standard Deviation Response Scores of Private Secondary School Students' Challenges to Use of Online Modes (PSSSCUOM)

S/N	The challenges to online learning in Biology instructions during COVID-19 pandemic	Mean	SD	Decision
29	Lack of access to online devices/tools e.g. android phone, laptop	2.49	1.13	Disagree
30	Low internet connectivity	2.51	1.11	Agree
31	Technical knowhow is a great challenge/Lack of			

	access to necessary application	2.76	1.16	Agree
32	Lack of training on online Instruction	2.64	1.10	Agree
33	Irregular power supply	2.86	1.15	Agree
34	Complexity of the online environment	2.79	1.11	Agree
35	Lack of ICT knowledge to effectively utilize the services	2.58	1.10	Agree
36	Struggling to communicate on online platforms	2.44	1.16	Disagree
37	Lack of skills required for online learning	2.42	1.10	Agree
38	Inability to have regular supply of data	2.60	1.12	Agree
39	Distraction from home environment is great	2.56	1.10	Agree
40	Lack of support from family members	2.57	1.10	Agree
	Grand Mean & SD	2.59	1.11	Agree

Table 4 shows that the respondents agreed to items 30-35 and 37-40 having mean scores above the criterion mean of 2.50 set for the study. The grand mean is 2.59 with SD; 1.11 indicating that the private secondary school students experienced lot of challenges in getting involved in the use of online modes in Biology instructions amid COVID-19 pandemic. However, the students disagreed with items 29 and 36 which have mean scores below 2.50 set for the study, indicating that the private secondary school students had no problem with access to online devices as well as complexity of the online environment.

Research Question Four: How has gender influenced the students' attitude to use of online modes in Biology instructions in private secondary schools during COVID-19 pandemic?

Table 5: The Mean and Standard Deviation Response Scores of Gender Influence on Students' Attitude to the Use of Online Modes in Biology Instruction amid COVID-19 Pandemic

Variables	Gender	N	Mean	SD
Students' attitude_to_the_use_of_online_modes in Biology instructions in private secondary schools during COVID-19 pandemic	Male	206	2.46	1.10
	Female	241	2.58	1.10

Table 5 showing mean score 2.46 with SD 1.10 for the male students and mean score 2.58 with SD 1.10 for the female students indicates that there is disparity in gender influence on the students' attitude to the use of online modes in Biology instructions in private secondary schools in Enugu during COVID-19 pandemic. Therefore, from the results, it shows that the female students developed higher attitude to the use of online platforms in Biology instructions than their male counterparts.

Hypothesis One: There is no significant difference between the perception of male and female private secondary school students on the meaning of COVID-19 pandemic

Table 6: Independent Samples t-Test Extract of Private Secondary School Male and Female Students' Perception of the COVID-19 Pandemic

Gender	N	Mean	SD	F	t	Df	Sig (2-tailed)
Male	206	2.50	1.10	.071	.424	445	.672
Female	241	2.46	1.11				

Table 6 shows that t-test calculated value of .424 is significant at 0.672 of significance, which is greater than 0.05 level of significance set for the study ($t = .424, P > 0.05$). Therefore, the null hypothesis is not rejected as stated. This means that the perception of the male and female private secondary students on the meaning of COVID-19 pandemic does not vary significantly.

Hypothesis Two: There is no significant difference between the of male and female private secondary school students to the use of online modes in Biology instructions amid COVID-19 pandemic

Table 7: Independent Samples t-Test Extract of Male and Female Students' Attitude to Use of Online Modes in Biology Instructions in Private Secondary Schools amid COVID-19 pandemic

Gender	N	Mean	SD	F	t	df	Sig (2-tailed)
Male	206	2.46	1.10	.063	1.234	445	.218
Female	241	2.58	1.10				

Table 7 shows that t-test calculated value of 1.234 is significant at 0.218 of significance, which is greater than 0.05 level of significance set for the study ($t =$

1.234, $P > 0.05$). Therefore, the null hypothesis is not rejected as stated. This means that the male and female private secondary students' attitude to the use of online modes in Biology instructions amid COVID-19 pandemic does not differ significantly.

Hypothesis Three: There is no significant difference between the mean perception scores of male and female Biology students regarding the challenges to online modes in Biology instructions during COVID-19 pandemic

Table 8: Independent Samples t-Test Extract of the Challenges to Online Learning in Biology Experienced by Private Secondary School Students amid COVID-19 in Enugu State

Gender	N	Mean	SD	F	t	df	Sig (2-tailed)
Male	206	2.62	1.12	.020	.296	445	.767
Female	241	2.59	1.12				

Table 8 shows that t-test calculated value of .296 is significant at 0.767 of significance, which is greater than 0.05 level of significance set for the study ($t = .296, P > 0.05$). Therefore, the null hypothesis is not rejected as stated. This means that the challenges to online learning in Biology instructions experienced by male and female private secondary school students amid COVID-19 pandemic in Enugu State do not differ significantly.

Hypothesis Four: There is no significant interactive effect on students' attitude and gender on use of online modes in Biology instructions in private secondary schools during COVID-19 pandemic

Table 9: The Extract of Analysis of Variance, ANOVA for Interaction Effect on Students' Attitude and Gender on the Use Online Modes in Biology Instruction in Private Secondary Schools during COVID-19

Source	Type II Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	40.980 ^a	31	1.322	1.100	.329
Intercept	2751.412	1	2751.412	2290.044	.000
	5.078	3	1.693	1.409	.240

Attitude	2.060	3	.687	.571	.634
Gender*Attitude					
Error	498.609	415	1.201		
Total	3291.000	447			
Corrected Total	539.588	446			

Table 9 shows that F-calculated value of .571 is significant at .634 of significance, which is more than 0.05 level of significance initially set for the study (F-ratio, 447 = .571, $P > 0.05$). Therefore, the null hypothesis which says that there is no significant interactive effect on students' attitude and gender on the use of online modes in Biology instructions during COVID-19 pandemic not rejected. This means that the interactive effect on students' attitude and gender on the use of online modes in Biology instructions in private secondary schools during COVID-19 pandemic do not differ significantly.

Discussion of Findings

Private Secondary School Students' Perceptions of COVID-19 Pandemic (PSSSPCP)

The research finding as in table 2 shows that private secondary school students have good perception of COVID-19 pandemic. This is confirmed by the grand mean score ($\bar{x} = 2.57$) for the 12 items developed for determining the PSSSPCP. Thus, the finding is in line with the outcome of Okoroiwu *et al.* (2022), Musyeri *et al.* (2022), Alghamdi (2021), Hasan & Bao (2020) and Madmood *et al.* (2020) studies which indicate that students have a good knowledge of COVID-19 pandemic. The good perception of COVID-19 pandemic by the respondents must have contributed effectively to their adoption of the innovative use of online learning platforms during the disease pandemic. This is line with the submission by Musyeri *et al.* (2022) that students' positive perceptions of online Biology learning process in Indonesia was considered the best option during COVID-19 pandemic lockdown.

Similar to the findings of Debbarmn & Durai (2021) and Hasan & Bao (2020), the results also indicate that COVID-19 generated emotional distress and dull moment to young people throughout the sit-at-home period.

In carrying out t-test analysis for hypothesis one, table 6 indicates that there is no variation in the perception of COVID-19 pandemic between the male and female private secondary school students in Enugu State. This is in line with the finding of Ogolodom *et al.* (2022) and Alghamdi (2021) which indicated that there is no significant relationship between the gender and the general knowledge of the disease pandemic. The result contradicts the findings of Nomie-Sato *et al.* (2022) and Abdulmuhsin *et al.* (2021) which showed that female students had higher stress, anxiety, loneliness and difficulty in learning than the male students during COVID-19 pandemic.

Students' Attitude to Use of Online Modes in Biology Instructions amid COVID-19 Pandemic

The grand mean score of 2.52 as in table 3 establishes that private secondary school students have positive attitude to use of online modes in Biology instructions amid COVID-19 pandemic. The finding collaborates those of previous works by Bamidele & Olufemi (2022), Hollister *et al.* (2022), Mayuri *et al.* (2022), Almahasees *et al.* (2021), De Silva (2021), Kumar *et al.* (2021), Sanpanich (2021), Mirahmadizadeh *et al.* (2020) and Uzorka & Makeri (2020) that the students have positive attitude to use of online modes in teaching and learning during the pandemic period.

Out of the 16 items developed in aspect of the research instrument: 'Private Secondary School students' attitude to Use of Online Modes (PSSSAUOM)', the one which states that 'Online modes of instructions allows one to learn at flexible times' has the highest mean score ($\bar{x} = 2.65$), thus showing the importance and relevant of online teaching and learning during schools' shut down for a long period of time due to the pandemic disease. The finding points out to the fact that learning flexibility is considered the most important aspect for students in online learning in that some platforms can easily be accessed any time by the learners. Similar finding was found in the studies of Almahasees *et al.* (2021) which carried out work on faculty's and students' perception of online learning during COVID-19 and Sanpanich (2021) which investigated factors affecting students' attitude toward hybrid learning. The second highest mean score ($\bar{x} = 2.55$) of PSSSAUOM confirmed that the paradigm shift from the traditional face-to-face method of teaching and learning to online

modes during the sit-at-home due to COVID-19 era restored their hope as the students were convinced that its adoption would enhance their academic performance in future. The results of the studies of De Silva (2021) and Hollister *et al.* (2022) collaborate with the present finding with the indication that the students had positive impressions as they were relatively engaged during the online classes amidst COVID-19 pandemic.

Nonetheless, the study indicates that there is negative attitude of the students towards the preferences of online teaching and learning to the traditional face-to-face method as they felt that they were not receiving the same quality of education as in the later method of knowledge acquisition. Contrary to the finding of this study, Bamidele & Olufemi (2022) indicating that students showed positive attitude to use of mobile devices in online learning amid COVID-19, they submitted that there was no significance difference in the students' attitudes and m-learning and traditional classroom methods of teaching and learning. As in table 3, the respondents also indicated negative attitude to use of online modes in science instructions as regards social interactions among the students as well as interactions between the students and teachers. This is contrary to the finding of Almahasees *et al.* (2021) which showed that the students accentuated that they are satisfied with the student-teacher interaction during online teaching and learning amidst COVID-19 crisis.

The research question four sought to determine the how gender influenced the students' attitude to use of online modes in Biology instructions amid COVID-19 pandemic. The result as in table 5 indicates that the female private secondary students are found having slightly greater positive attitude to use of online modes in Biology instructions amid COVID-19 pandemic era than their male peers. This finding agrees with the study of Konwar (2017) whose results indicate that female students have slightly higher attitude towards e-learning than male students. The little variation could be attributed to the gender interest in online learning modes. However, the finding of the study in the context of mean scores contradicts the result of Singh (2021) which shows that the male students are found having slightly greater mean scores of attitudes towards online learning than their female counterparts.

In the t-test analysis employed in testing the null hypothesis three, the result as in table 7 indicates there is no significant difference between gender and private secondary school students' attitude to use of online modes in Biology instructions in Enugu State. This agrees with the findings by Kauts & Gullati (2022), Ogododom *et al.* (2022), Salami (2021), Singh (2021) and Mirahmadizadeh *et al.* (2020) as against the results of Chua & Mageswy (2015) which indicated that there is significant relationship between the attitude of the intersexual students and online learning. The results of the studies of Nath (2021) and Morante *et al.* (2017) also contradict the finding of the work as the researchers indicated that female students engage more in online learning environment than their male counterparts.

Challenges to Online Learning by Private Secondary School Students amid COVID-19 Pandemic

The findings as in table 4 that the private secondary school students experienced some challenges such as low internet connectivity, lack of ICT skills and knowledge of proper application of the online platforms, lack of regular supply of electricity, inadequate online environment, lack of sufficient fund for procurement of data, distractions from home environment and lack of support from family members. This evidenced by the mean score responses of 2.59 for the total of 12 items in the research instrument: Private Secondary School Students' Challenges to Use of Online Modes (PSSSUOM). The research finding is in collaboration with the previous studies such as those of Butoi *et al.* (2022), Hollister *et al.* (2022), Sato *et al.* (2022), Suleimam *et al.* (2022), Almahasees *et al.* (2021), Barzani & Rayan (2021), Chalurvedi *et al.* (2012), Debbarmn & Durai (2021), Eze *et al.* (2021), Olayemi *et al.* (2021), Mohamad *et al.* (2020), Owusu-Fordjour *et al.* (2020), Tadesse & Muluye (2020) and Uzorka & Makeri (2020). These previous researchers revealed varied challenges encountered by the students during the online classes organized to ensure continuous and uninterrupted teaching and learning during COVID-19 pandemic. For instance, Almahasees *et al.* (2021) posited that the adaptation to online teaching and learning during the sit-at-home amidst disease pandemic posed such challenges like lack of ICT competency, lack of proper access to internet (cost of fiber network), time management as well as lack of interaction

with the teachers and the students as well as lack of data privacy since their online devices (e.g. laptops) were kept at home. Uzorka & Makeri (2020) posited that lack of e-learning facilities has an impact on students' attitude towards learning during COVID-19 pandemic as most students pointed out that they have no computer in home, no smart phones, no regular supply of power and instability of internet network. According to Mohamad *et al.* (2020), slow internet coverage is the biggest challenge among students in online distance learning. Hollister *et al.* (2022) also elaborated that the students experienced technical issues like unreliable WiFi and other devices, poor physical environment and lack of social interaction and peer connection among the students. Olayemi *et al.* (2021) highlighted the major challenges of effective application of online learning as high cost of data, poor internet services, epileptic supply of power, online/e-library inaccessibility, and non-availability access to computers. The researcher comes to agreement with Debbarmn & Durai (2021) and Uzorka & Makeri (2020) who indicated that online learning is a new concept for many students and teachers especially at the secondary school levels where the use of online gadgets such as smartphones by students are often not encouraged by the school authorities, if not for lockdown due to COVID-19 pandemic. It is possible that some of these challenges could be capable of affecting the students' interest in and attitude to effective use of online modes in Biology instructions, but fortunately the findings of this study proved otherwise.

The t-test analysis is used to test hypothesis four which states that there is no significant difference between the mean scores of male and female Biology students regarding the challenges to online modes in Biology instructions during COVID-19 pandemic. Nonetheless, the findings of this study show that there is no significant difference between the male and female students on the challenges to online Biology instructions experienced by the private secondary school students amid COVID-19 pandemic in Enugu State. This is supported by the studies of Salami (2021); Singh (2021), and Ebuoh (2011) as against the findings of Ishimoto *et al.* (2022), Nomie-Sato *et al.* (2022), Ali *et al.* (2021); Nath (2021); Alordiah *et al.* (2015); Chua & Mageswary (2015) which showed that there is significant relationship between gender and online learning challenges. For instance, while studies of Salami (2021) and Singh (2021) indicated that there is no significant difference in gender attitude

towards the use of mobile learning, Ali *et al.* (2021) posited that female secondary school students have significantly higher attitude towards learning than their male counterparts. However, the extract of analysis of variance in table 8 shows that the challenges experienced by the private secondary school students in Enugu State amid COVID-19 pandemic do not differ significantly.

Conclusion

The emergence of COVID-19 pandemic which resulted to close down of institutions worldwide necessitated the shifting to online teaching and learning so as to maintain or catch up with the provision of the curriculum of the educational system. The curvatures of the education system changed as efforts to prevent the spread of COVID-19 pandemic were made, with online education becoming the primary means of instruction even in private secondary schools. The discernments and readiness of the students for the use of online modes in Biology instructions vis-à-vis their attitude towards this innovative learning technique, putting gender into consideration, is an important thoughtfulness to be documented.

The findings of this study, therefore, indicated that majority of the private secondary school students evinced good discernments of the COVID-19 pandemic as well as positive attitude to the use of online modes in Biology instructions during the disease pandemic era. The online learning enhanced students' future educational plan, motivation for knowledge and skill acquisition. Conversely, the findings showed that the perception of the COVID-19 pandemic does not vary significantly between male and female students. In the same vein, the students' attitude to the use of online modes in Biology instructions amid COVID-19 pandemic does not vary significantly between the male and female students in Enugu State private secondary schools. The result also revealed that there is no significant interaction effect of gender and attitude of the private secondary school students towards the use of online modes in Biology instructions during the sit-at-home as a result of the COVID-19 pandemic.

However, the findings of the study also indicated that varied challenges were experienced by the private secondary school students in the implementation of the online modes in Biology instructions during sit-at-home due to COVID-19

pandemic. As a result, all these factors should be considered when creating an online course/classes in order to make them more effective and productive for the learners.

Recommendations

The following recommendations were made in line with the findings of the study:

1. The online learning such as zoom, Google classroom, message chats etc. should be enshrined in the school curriculum and taught accordingly so that the students should be conversant with them to be applied during emergency teaching and learning due to environmental disruptions.
2. Private secondary school students should be encouraged to have access to laptops or even smartphones to enable them participate actively in online classes.
3. Blended learning, if opportunity is created in future, would help in providing a meaningful learning environment for students.

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