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Exploring undergraduate students' connectedness in online learning

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Abstract

In recent years, higher learning institutions have been forced to integrate online learning into their curriculum. However, despite the increasing popularity of online learning, students' engagement and interaction within this environment remain a crucial aspect to explore. This study investigates how connected the students are during their online learning, focusing on teacher-student interaction, comfort level, and social media engagement. The sample comprised 73 undergraduate physics students from the Department of Science Education, University of Ilorin. A researcher-designed questionnaire was used for data collection, and the responses were analysed using frequency, percentages, mean, and standard deviation. The findings revealed that overall, the students were connected to their learning online. It was concluded that the students were highly connected to the online learning mode, particularly in terms of their comfort with the system and interaction with their teacher. However, limitations concerning live interactions, peer collaboration, and focus require attention. It was recommended that educators consider incorporating synchronous elements, such as live video sessions and interactive virtual whiteboards, to enhance real-time engagement and active demonstration of understanding in online classes.

Keywords: online learning; social media; Nigeria; teacher-student interaction.

Introduction

In today's digitally driven world, where connectivity is a constant hum in the background, the education paradigm is undergoing a profound shift. While online learning, with its digital classrooms and endless communication channels, might seem to promise enhanced student connection, the reality often diverges. Research indicates that students can experience isolation and poor interaction with teachers and peers in virtual spaces. In the context of higher education in Ilorin, Nigeria, these challenges are compounded by infrastructural limitations, varying levels of digital literacy, and socio-economic factors. Despite these hurdles, online learning—education that uses the internet—holds significant potential for expanding access and flexibility in education. Singh and Thurman (2019) describe it as a learning experience facilitated by internet-connected devices, occurring synchronously, through live lectures and interactions; or asynchronously, via email, recorded lectures, and discussion boards (Hrastinski, 2008).

Numerous innovations driven by new technologies have provided new opportunities to improve current human practices in areas such as artificial intelligence, the Internet of Things (IoT), renewable energy, the World Wide Web, mobile technologies and smartphones, and cloud computing. These rapidly increasing technology-driven innovations have undoubtedly resulted in a steady increase in the adoption of technology tools for educational purposes. Additionally, factors such as technological advancement, increase in technological availability, and the Covid-19 pandemic, have contributed to a dramatic shift toward online education by higher institutions in the last decade. This shift has helped online and blended learning become commonplace in 21st-century higher education (Yudiatmaja et al., 2022) with online courses now becoming a core feature of most colleges and universities (Sutton and Nora, 2008; Layne et al., 2013; Ornelles et al., 2019; Mishra et al., 2020). Online education is fast rising as a potential strategy to diversify education choices at all levels of education. For instance, the number of students who enrol in online courses offered by institutions of higher education in the United States has seen dramatic growth over the past years. Seaman et al. (2018) reported that 31.6% of all students enrolled at U.S. institutions took at least one online course, and over 3 million took all of their courses online in the Fall of 2016.

On the other hand, Nigeria has over the years invested its effort into the realisation of sustainable online learning for undergraduates. A noteworthy development is the

establishment of the National Open University of Nigeria (NOUN) as a Federal Open and Distance Learning (ODL) institution by the Nigerian government. The National Open University of Nigeria (NOUN) which was initially established in July 1983, but fully began operation in April 2001, birthed the possibility of large-scale, nationwide online learning in Nigeria. By 2018, the NOUN boasted a total of 515,000 students enrolled on different courses at the university, with 150,000 of them actively undertaking their respective courses across the 78 study centres of the institution (Agency Report, 2018). Although the adoption and implementation of online learning in Nigeria is rather slow compared to more developed countries like the United States and the United Kingdom, the Nigerian government, in recent years, has through the Commonwealth of Learning, intensified its efforts towards promoting online learning in the National Open University of Nigeria and across several other universities, such as the University of Ilorin, the University of Ibadan, and so on. This has been done through investments in ICT infrastructure, management information systems, email access, and library information services (Ogunlela and Ogunleye, 2014).

Online learning is more affordable and practical than traditional educational settings and gives more students the chance to further their education. Studies have shown that most students choose online learning because it is more flexible and practical, especially for those who have employment commitments or other living circumstances that make it challenging to attend class in person (Hannay and Newvine, 2006). For instance, Craciun (2023) noted that online learning has several advantages such as convenience, flexibility, accessibility, and the ability to learn at one's pace. Online students can easily access programmes and instructors without the need for relocation. Another advantage, as pointed out by Adenuga (2019) is that there are no actual class meetings; instead, students may listen to lectures and complete homework online without having to travel to the school.

Nevertheless, e-learning has been thought to be less interactive than face-to-face learning mainly due to the restricted face-to-face interaction between students and instructors, lack of social engagement, social presence, and student happiness. These factors, coupled with other drawbacks such as learner distraction, low level of participant interaction, unstable network connections, lack of reliable electricity, online harassment and bullying, and truancy among students (Adenuga, 2019; Balida, 2023) have contributed majorly to the high dropout rates recorded for students who take online courses. Similarly, studies

have shown that lack of student-instructor interaction, an online environment's isolation, and disconnectivity of students are some of the main causes of student dropout from courses (Kanuka and Jugdev, 2006; Angelino et al., 2007; Kara et al., 2019).

Literature reveals studies on connectedness in online learning that have been conducted globally (Bolliger and Inan, 2012; Cook and Thompson, 2014; Arslan 2021; Don et al., 2022; Kaufmann and Vallade, 2022). However, the bulk of the research in the literature did not investigate student comfort when learning online and within the context of teacher-learner interaction and social media engagement. For instance, Cook and Thompson (2014) investigated the trend in medical students' comfort and experience with online learning but mainly focused on students' comfort with computers. Additionally, Kaufmann and Vallade (2022) only explored the connections in the online learning environment regarding student perceptions of rapport, climate, and loneliness. The present research, therefore, seeks to provide an understanding of students' connectedness in online learning, drawing insights from the nature and extent of teacher-learner interaction; the level of comfort that the students experience; as well as the causes of distractions during online learning.

Research questions

The following questions were developed to guide this study:

1. What is the level of interaction between teachers and undergraduate physics students during online learning sessions?
2. How comfortable are undergraduate physics students with learning online?
3. What are the social media practices of undergraduate physics students during online learning?

Literature review

Student connectedness in online learning

According to Bolliger and Inan (2012), connectedness is the sense of belonging and acceptance. It is the feeling held by a person. A person experiences connectedness when he or she believes that a relationship exists between him or her and at least one other

individual. When a person feels socially connected and integrated, they are said to be connected; however, when they feel isolated, s/he may feel alone or disconnected from his/her social world. Few studies have explored the role of social isolation and connectedness in online learning and found that student isolation is one of the major problems for online learners (Kaufmann and Vallade, 2022).

According to Zembylas et al. (2008), who conducted a qualitative study on the emotions of 92 online learners, one of the main categories related to negative feelings was loneliness and isolation. In their diary entries, interviews, final reports, phone chats, and emails, students described their emotional states using phrases like alone, desperation, hopelessness, anxiety, stress, and distress. Furthermore, a study by Arslan (2021) involving 333 undergraduate students from a university in Turkey found that belongingness or connectedness can moderate the effects of isolation that may in turn provide strategies to foster students' psychological health and well-being.

Teacher-learner interaction

Interaction as a two-way process between two or more persons enables easy manipulation and enhancement of ideas, data, and information into new knowledge. In the context of teaching and learning, interaction can be broadly categorised into three: interaction with content, interaction with instructors, and interaction with peers (Moore, 1989; Zimmerman, 2012). Thus, interaction between the teacher and learners plays a significant role in the learning process, whether online or face-to-face. In a study conducted by Armstrong (2011) on students' perceptions of online learning and instructional tools, it was found that students perceived the negative outcomes of the technology in learning as not being inherent to the technology itself but in its use and implementation. This implies that the tools were not as important as the quality of the technology use and communication between the teacher and the student. The findings of Armstrong (2011) therefore suggest that the success of any online course depends largely on the instructor. As such, instructors need to ensure that students get the opportunity to interact with them and also communicate with one another during lessons.

Interaction between the teacher and students constitutes a bedrock for the effective facilitation of an online course. Studies have shown that student satisfaction and learning in both face-to-face and online environments are significantly influenced by the level of

interaction (Bali and Liu, 2018; Miao et al., 2022). Furthermore, previous research has confirmed that interaction is an essential factor affecting students' satisfaction with online learning (Bray et al., 2008; Kuo et al., 2014). Consequently, the interaction level between teacher and student can be applied to anticipate the effectiveness of online classes. Duc.Sinh et al. (2021) researched students' perceptions of online learning during the Covid-19 pandemic in Vietnam. The findings of the study showed, among others, that interaction is a factor that influences students' perception of online learning, indicating that students feel more connected in the transactional learning space if they can maintain an interaction with the instructor.

Students' comfortability with online learning

Online learning takes place over the internet, where no physical presence of the learner and instructor is needed; therefore, students have to be comfortable with the entire learning system. In this sense, comfort in online learning refers to students' willingness to engage in computer-mediated communication with classmates and teachers through emails, discussion boards, chat boxes, etc., as well as their assurance in using these resources (Smith, 2005). Conversely, students who do not feel comfortable or safe in the learning environment are more likely to limit their interactions with an instructor and peers or less likely to ask for support (Shin, 2003); this can result in missed learning opportunities. In addition, Warden et al. (2022) found that students who are uncomfortable with technology are less socially adept, resulting in reduced participation in online learning environments.

A study by Bali and Liu (2018) reported that students are more comfortable learning online than in face-to-face learning. Furthermore, Cook and Thompson (2014) conducted a study on 371 medical students' comfort and experience with online learning. The purpose of the study was to determine how the students' comfort using computers and perceptions of prior online learning experiences changed within eight years (2003 – 2011) and how these were associated with learning outcomes. The results revealed that students maintained a steady level of comfort with computers across the years, and the comfort showed no significant association with knowledge scores after completing the course modules. Similarly, Luu (2022) conducted a study that focused mainly on learners' comfort and self-directed learning ability. Analysis of the information collected from a sample of 304

undergraduates in Ho Chi Minh City through a self-evaluation survey showed that the students had an average level of comfort with e-learning.

Methods

Participants

The population of the study consists of undergraduate students at the University of Ilorin. A sample of 73 Physics Education students from the Department of Science Education, University of Ilorin were selected using the convenience sampling method to participate in this study. This sampling method was considered appropriate since it was practically impossible to develop a sample frame needed to conduct a random sampling. The students who participated were either in their second, third, or final year of study, and they were required to have at least taken an online course delivered by lecturers of the university. The link to the Google Forms was sent to the groups of each student's level through their respective class representatives to request their participation in the study. Participants were provided with a consent form on the first page of the survey to seek their consent to participate in the study, ensuring that their participation was completely voluntary. The data collection exercise lasted for three weeks. All ethical issues such as non-disclosure of the personality of the respondents, non-exposure of the participants to any form or risks, and not compelling or intimidating the participants in any form were strictly adhered to.

As illustrated in Table 1, 63% of the participants were male while 37% identified as female. The majority of the participants (57.5%) were between the ages of 21 – 25 years. On the other hand, 30.1% were between 16 – 20 years of age, while 12.3% were 25 years and above.

Table 1. Background information of the participants.

Variable	Frequency	Percentage (%)
Gender		
Male	46	63
Female	27	37
Total	73	100.0
Age Group		
16 - 20	22	30.1
21 -25	42	57.5
25 - 30	5	6.8
30 and Above	4	5.5
Total	73	100.0

Instrument

An online survey created with Google Forms was used as the instrument to collect information from the respondents due to its mobile-friendly interface and ability to create unlimited forms of multiple types. The survey was divided into four sections. Section 1 collected the respondents' demographic information. Section 2 elicited information about the level of interaction between the teacher and the students. Section 3 collected information on students' comfortability with learning online, while Section 4 elicited information about the students' use of social media during online learning. Sections 2 and 3 of the survey were designed using a 5-point Likert scale of Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree, with four different scores assigned in descending order i.e. 5, 4, 3, 2, and 1, respectively.

The collected data were subjected to descriptive analyses: frequencies, percentages, mean, and standard deviation using the SPSS version 25. The analyses were carried out based on the research questions raised in the study. Face and content validity of the survey was determined by the lead researcher and two senior lecturers in the Department of Science Education, University of Ilorin before disseminating the survey to the participants. This was to ensure that the items measured what they were intended to measure (Cohen and Swerdlik, 2018). The internal reliability of the final version of the instrument was determined using the Cronbach's Alpha test and the overall reliability

coefficient was found to be 0.907. A reliability coefficient of 0.70 or higher is considered acceptable (Taber, 2018; Robertson and Evans, 2020).

Results

Teacher-students interaction in online classes

The students were required to answer questions about how interactive they thought their online classes were. The results of the analysis of each student's responses as shown in Table 2 reveals that teachers and students adequately interact with one another through the asking of questions. The students believed that their teacher continuously asks questions during the body of the lessons ($\bar{x}$ =3.95) and also gives them opportunities to ask questions when they do not understand a concept ($\bar{x}$ =4.26). Similarly, the teachers were perceived as being highly responsive to their questions ($\bar{x}$ =3.60), suggesting that instructors pay attention to questions raised and take the time to respond to them. This finding is supported by the mean score of 3.67 recorded for the item, 'My instructor participates in online discussions'. Furthermore, there is a high perception of the teacher's effort to thoroughly clarify difficult and ambiguous concepts during the lesson ($\bar{x}$ =3.75). Learners agree that their instructors properly demonstrate while explaining a concept ($\bar{x}$ =3.67).

On the other hand, relatively low mean scores were recorded for items about students showcasing their learning process during the online lessons. The statements, 'Instructors allow students to demonstrate their learning or response during the online lesson', and 'Students are permitted to annotate their response/opinion on an e-material or virtual whiteboard during the lesson' recorded mean values of ($\bar{x}$ =3.22) and ($\bar{x}$ =3.15), respectively. These results indicate that the students are restricted when it comes to live interactions similar to those experienced in physical classes. However, the overall mean score of 3.61 for teacher-student interaction during online lessons indicates a high level of interactivity between the online instructor and the learners.

Table 2. Teacher-students interaction in online classes.

Items	$\bar{x}$	SD
My instructor always asks questions (s) during the body of the lesson	3.95	1.08
My teacher allows the students to ask questions	4.26	0.96
My teacher thoroughly clarifies ambiguous concepts during the lesson	3.75	1.06
My teacher properly demonstrates while explaining a concept	3.67	1.17
Instructors allow students to demonstrate their learning or response during the online lesson	3.22	1.22
Students are permitted to annotate their response/opinion on an e-material or virtual whiteboard during the lesson	3.15	1.15
My online instructors are responsive to my questions	3.60	0.95
I receive frequent feedback from my online instructors	3.42	1.04
My instructor always participates in online discussions	3.67	1.04
In my online courses, the instructors encourage interaction between learners	3.44	1.17
AGGREGATED MEAN SCORE	**3.61**	

Note: $\bar{x}$ <2.5 (Low Interaction), 2.5 – 3.5 (Moderate Interaction), 3.5 – 5.0 (High Interaction).

Students' comfortability with e-learning

According to the statistical data in Table 3, the mean scores for most of the items are between 2.86 and 3.59. In general, students perceived that it is easier to join e-learning classrooms ($\bar{x} = 3.59$); collaborate with colleagues on projects ($\bar{x} = 3.58$); and submit their quizzes and assignments through the online learning platform ($\bar{x} = 3.71$). The statement, 'I can effortlessly contact my teacher for study and non-study purposes' recorded the lowest mean score of 2.86, indicating that the online teachers are not as accessible as would have been expected. Conversely, the statement, 'If I need to, I will ask for help from my classmates' obtained the highest mean score of 4.14. This implies that students turn to one another for help with their coursework since the teachers might not be easily accessible. Furthermore, the findings from this study revealed that although students may turn to each other for help with their online coursework, they generally feel less comfortable asking other students for assistance ($\bar{x} = 3.49$). The mean scores, 3.44 and 3.30 obtained for the statements 'I have no difficulties expressing my thoughts in my online

lessons', and 'I feel comfortable expressing my opinions and feelings in online courses' indicate that students express themselves less.

Table 3. Students' comfortability with e-learning.

Items	$\bar{x}$	SD
I find it easy to join the e-learning classrooms	3.59	1.13
I am focused when attending the online lectures	3.16	1.23
I find it less stressful to submit my quizzes and assignments	3.71	0.86
It is easier to collaborate with my colleagues on projects and assignments	3.58	1.11
I experience less classroom distraction during online learning	3.48	1.11
I can effortlessly contact my teacher for study and non-study purposes	2.86	1.02
If I need to, I will ask for help from my classmates	4.14	0.75
I feel comfortable expressing my opinions and feelings in online courses	3.30	1.04
I feel comfortable asking other students in online courses for help	3.49	1.00
I have no difficulties expressing my thoughts in my online courses	3.44	1.09
AGGREGATED MEAN SCORE	**3.50**	

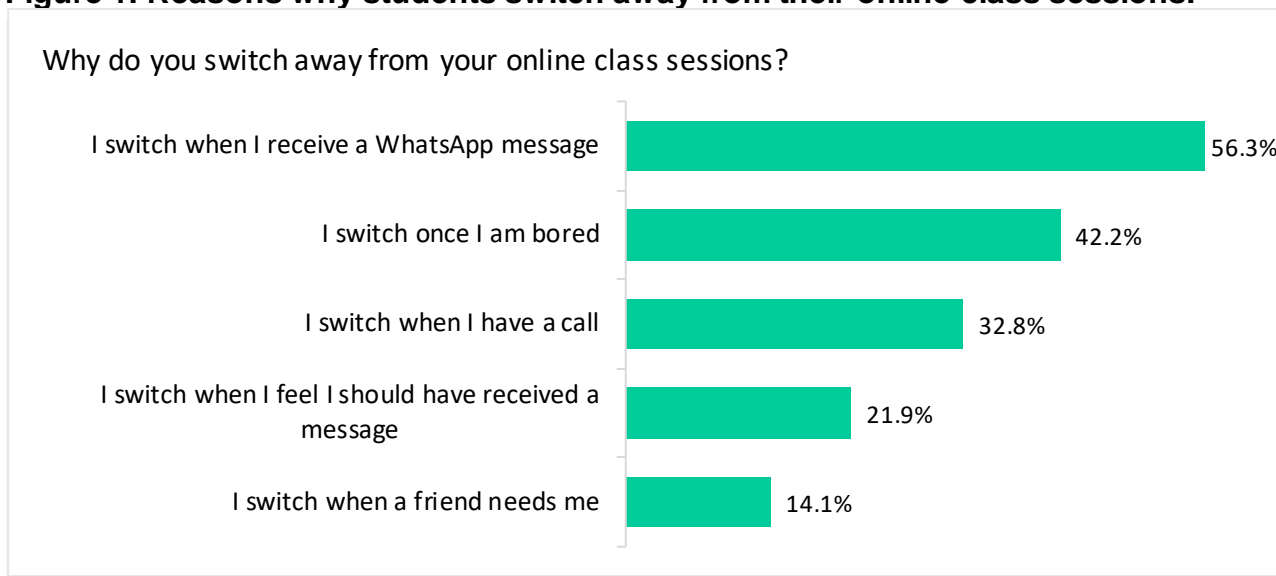Note: 1–2.4 (Low comfortability), 2.5–3.4 (Mid comfortability), 3.5–5.0 (High comfortability).

Managing online classes and social media engagement

The results of the analysis, as shown in Table 4, reveal that the majority of the students (81%) agreed to switching between social media-related activities and their online learning sessions. Furthermore, the findings of this study indicate that the students engage in these distracting social media activities for several reasons. The most prominent reasons were checking WhatsApp messages (56.3%), boring classes (42.2%), and the need to pick up an incoming call (32.8%), which are shown in Figure 1.

Table 4. Do you switch between online classroom and social media-related activities?

	Frequency	Percentage (%)
Yes	58	79.5
No	14	19.2
No response	1	1.4

Figure 1. Reasons why students switch away from their online class sessions.

Why do you switch away from your online class sessions?

I switch when I receive a WhatsApp message	56.3%
I switch once I am bored	42.2%
I switch when I have a call	32.8%
I switch when I feel I should have received a message	21.9%
I switch when a friend needs me	14.1%

Note: percentages represent all students who answered 'yes' to each option.

The frequency at which students switch between online lessons and social media-related activities varied among the learners. As shown in Figure 2, 19.7% of the students shift their attention away from the online learning environment every 10 minutes. Furthermore, every 2 minutes and 5 minutes, 12% and 13.6% of the students typically drift away from their online learning activities respectively, while more than half (54.5%) of the students noted that on average, they switch from the class to other unrelated activities after time intervals greater than 10 minutes.

Figure 2. Frequency of switching away from online lessons.

Beyond 10 minutes	54.5%
Every 10 minutes	19.7%
Every 5 minutes	13.6%
Every 2 minutes	12.2%
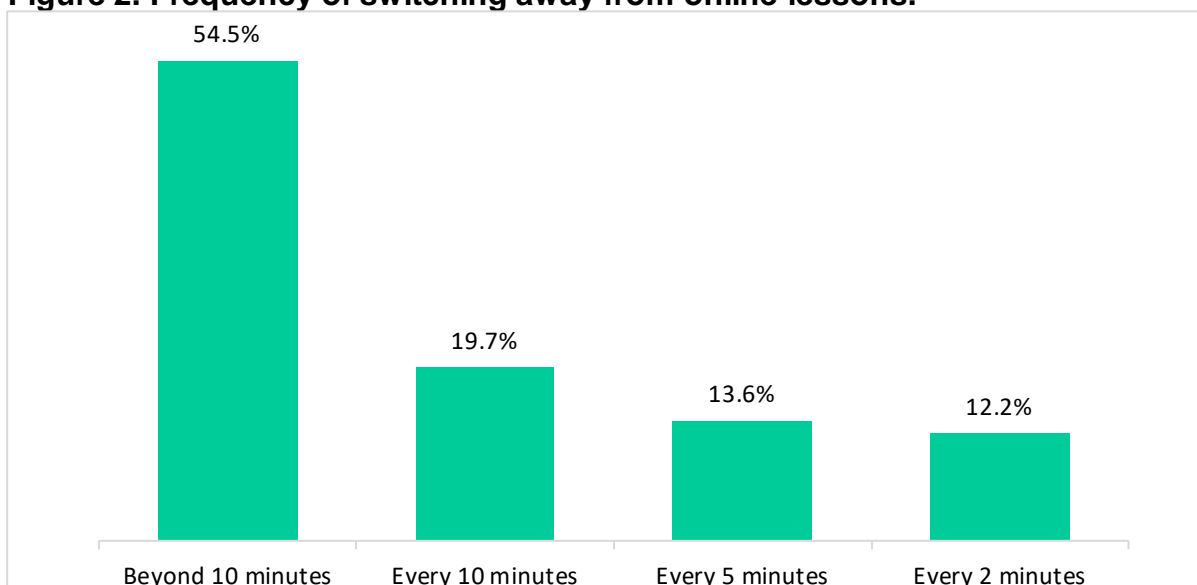
Limitations

The survey responses are based solely on undergraduate students from the University of Ilorin. Thus, the sample does not fully represent the students in Ilorin or Nigeria, and subsequently, the results obtained do not fully reflect the behaviour of all students in Ilorin or Nigeria as a whole. Furthermore, since it was a self-reported and questionnaire-based study, the issues of respondent bias cannot be completely ruled out.

Discussion

This study sought to provide an understanding of students and a sense of connectedness to online learning. Thus, understanding students' perceptions of their learning experience was central to this study. The findings regarding teacher-student interaction in online classes revealed a generally positive perception among students indicating that the students are highly connected to the e-learning system. Students believe that their instructors are interactive and responsive, with high mean scores recorded for elements such as the teachers continuously asking questions, responding to students' questions, and providing opportunities for students to seek clarifications. This contributed to a better understanding of course content and fostered a sense of connection between students and their instructors. This finding aligns with previous research, which highlights the importance of active engagement between teachers and students in online education (Bernard et al., 2009).

However, this study also identified some limitations in online teacher-student interaction. Students expressed that they had limited opportunities to demonstrate their learning or annotate their responses, suggesting a lack of live-interaction experiences. This observation underscores the challenge of recreating the interactive classroom environment in an online setting. This issue has been discussed in the literature, with studies indicating that online classrooms often lack the immediate feedback and dynamic interactions that are typical in face-to-face settings (Dixson, 2010). To address these limitations, educators might consider incorporating synchronous elements, such as live video sessions or interactive virtual whiteboards, to enhance real-time engagement and ensure that students can actively demonstrate their understanding. Furthermore, a more comprehensive

exploration of instructional methods and strategies to enhance live interactions in virtual classrooms may be beneficial (Kebritchi et al., 2017).

The results regarding students' comfort with e-learning highlighted a mixed perception among students. While students indicated a high willingness to seek help from their peers, they also expressed discomfort in doing so. This finding underscores the complex dynamics of peer collaboration in online education. Students may be more inclined to turn to classmates for assistance, indicating the significance of peer support networks in e-learning environments (Qayyum, 2018). On the contrary, students' hesitation in seeking help from peers presents potential challenges in establishing effective collaborative learning environments in the online context. As pointed out by Shin (2003), students who feel uncomfortable in the learning environment are less likely to interact with an instructor and peers or to ask for support, resulting in missed learning opportunities. The lower mean scores for statements related to students' comfort in expressing their thoughts and opinions in online classes indicate the absence of a stimulating environment and the need for improved support and resources for students to engage actively in online discussions and express their viewpoints. This finding is consistent with studies showing that online learning environments can sometimes hinder open communication and active participation (Watson et al., 2016). Addressing this would require instructors to encourage and facilitate online discussions, set clear expectations for student participation, and create a safe space for diverse opinions and ideas, thus promoting a more inclusive and supportive online learning environment that ensures all students' voices are heard and valued.

Furthermore, the students' comfort with joining e-learning classrooms and submitting assignments reflects their preference for online activities and aligns with the convenience and flexibility associated with e-learning, a trend that has been on the rise in recent years (Allen and Seaman, 2017). Consequently, this supports the need for user-friendly online learning platforms that facilitate these activities and promote a seamless learning experience (Bhuasiri et al., 2012).

The analysis of the data regarding students' propensity to switch between online classes and social media activities revealed a significant challenge in online education. The majority of students admitted to engaging in social media-related activities during online learning sessions. This aligns with current research that highlights the challenges of maintaining student focus in the digital age, where distractions are readily available (Junco

et al., 2013; Maqableh and Alia, 2021). The reasons for these distractions, such as WhatsApp messages, phone calls, and perceived boredom, resonate with studies on the impact of social media on academic performance (Junco, 2012; Amez and Baert, 2020; Chathuranga and Jaysundara, 2020). Another noteworthy finding of this study is the fact that about 70% of the students get distracted every 10 minutes and beyond, while 23% of them shift their attention between every 2 and 5 minutes. This implies that students learning online have a 70% likelihood of becoming distracted when instructional activities extend beyond 10 minutes. This finding aligns with research showing that students have different attention spans and capacities for sustained focus (Siehoff, 2023) and emphasises the need for strategies to minimise disruptions.

Conclusion

In conclusion, this study has provided valuable insights into students' sense of connectedness to online learning. The results of this study showed that overall, students are highly connected to the online mode of learning, particularly in terms of their interaction with the teacher and comfortability with the system. The findings indicate a generally positive perception among students regarding teacher-student interaction in online classes. This positive perception is aligned with the notion that online learning has evolved into a comfortable educational environment, fostering a strong connection between students and their instructors. However, it is essential to acknowledge the limitations identified in online teacher-student interaction, particularly the challenge of replicating live interaction experiences. As such, educators must explore innovative strategies to bridge this gap. This could involve the integration of synchronous elements, such as live video sessions and interactive virtual whiteboards, to foster real-time engagement and enable students to actively demonstrate their understanding.

The mixed perception of students regarding their comfort with e-learning, however, underlines the complex dynamics of peer collaboration in online education. In light of this, creating effective peer support networks in online education is essential. While students expressed a willingness to seek help from their peers, their discomfort in doing so suggests the need for well-structured peer collaboration activities and peer mentoring programmes. Addressing students' hesitation in seeking help from peers requires the creation of stimulating environments that support active participation and open

communication. This would not only enhance peer support but also foster a stimulating environment for active participation and open communication among students. The significant challenge of students frequently switching between online classes and social media activities calls for a proactive approach to minimise distractions. Strategies to enhance student focus, such as incorporating interactive elements and engaging content in online classes, need to be explored to enhance student engagement and learning outcomes.

While this study has shed light on the connection undergraduate students feel towards online learning, it highlights areas needing further exploration. Future research should aim to replicate this study with a larger sample size across various learning institutions in Nigeria to validate these findings. Additionally, comparative studies across regions globally could provide a broader understanding of students' connectedness to e-learning and highlight contextual differences and commonalities.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Educators should consider incorporating synchronous elements like live video sessions and interactive virtual whiteboards to enhance real-time engagement and active demonstration of understanding in online classes.
2. Efforts should be made to establish effective peer support networks in online education to encourage students to seek help from their peers comfortably. This could involve structured peer collaboration activities and peer mentoring programmes.
3. Instructors should encourage and facilitate online discussions, set clear expectations for student participation, and create a safe space for diverse opinions and ideas. This will promote inclusivity, active participation, and open communication in online learning environments.
4. Strategies to minimise distractions, such as incorporating engaging and interactive elements in online classes, should be explored to enhance student focus and learning outcomes.

Acknowledgements

References

Adenuga, O. A. (2019) 'Implementation of online learning in Nigeria: significance of teachers' preparedness', *West African Journal of Open and Flexible Learning*, 7(2).

Agency Report (2018) 'Enrolment at Nigeria's National Open University hits 515,000', *Premiumtimesng.com*, 26 November. Available at: https://www.premiumtimesng.com/news/more-news/297622-enrolment-at-nigerias-national-open-university-hits-515000.html (Accessed: December 23, 2023).

Allen, I. E. and Seaman, J. (2017) *Digital compass learning: distance education enrollment report 2017*, Babson survey research group.

Amez, S. and Baert, S. (2020) 'Smartphone use and academic performance: a literature review', *International Journal of Educational Research*, 103(101618), p.101618. Available at: https://doi.org/10.1016/j.ijer.2020.101618

Angelino, L.M., Williams, F.K. and Natvig, D. (2007) 'Strategies to engage online students and reduce attrition rates', *Journal of Educators Online*, 4(2). Available at: https://doi.org/10.9743/jeo.2007.2

Armstrong, D.A. (2011) 'Students' perceptions of online learning and instructional tools: a qualitative study of undergraduate students use of online tools', *Turkish Online Journal of Educational Technology,* 10(3), pp.222-226.

Arslan, G. (2021) 'School belongingness, well-being, and mental health among adolescents: exploring the role of loneliness', *Australian Journal of Psychology*, 73(1), pp.70-80. Available at: https://doi.org/10.1080/00049530.2021.1904499

Bali, S. and Liu, M. C. (2018) 'Students' perceptions toward online learning and face-to-face learning courses', *Journal of Physics: Conference series*, 1108(1), p.012094. Available at: https://doi.org/10.1088/1742-6596/1108/1/012094

Balida, D. A. R. (2023) 'Ethical challenges in online teaching and learning: a case study of a virtual class', *Russian Law Journal*, 11(3), pp.1901-1916.

Bernard, R.M., Abrami, P.C., Borokhovski, E., Wade, C.A., Tamim, R.M., Surkes, M.A. and Bethel, E.C. (2009) 'A meta-analysis of three types of interaction treatments in distance education', *Review of Educational Research*, 79(3), pp.1243-1289.

Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J. and Ciganek, A. P. (2012) 'Critical success factors for e-learning in developing countries: a comparative analysis between ICT experts and faculty', *Computers & Education*, 58(2), pp.843-855.

Bolliger, D. U. and Inan, F. A. (2012) 'Development and validation of the online student connectedness survey (OSCS)', *The International Review of Research in Open and Distributed Learning*, 13(3), pp.41-65. Available at: https://doi.org/10.19173/irrodl.v13i3.1171

Bray, E., Aoki, K. and Dlugosh, L. (2008) 'Predictors of learning satisfaction in Japanese online distance learners', *International Review of Research in Open and Distributed Learning*, 9(3), pp.1-24.

Chathuranga, M. M. N. and Jaysundara, J. M. D. P. (2020) 'Impact of smartphone usage on academic performance: a study on undergraduates in FMSC of University of Sri Jayewardenepura, Sri Lanka', *Journal of Management (Oluvil)*, 15(1), pp.14-32. Available at: https://doi.org/10.4038/jm.v15i1.7593

Cohen, R. J. and Swerdlik, M. E. (2018) *Psychological testing and assessment: an introduction to tests and measurement*. McGraw-Hill Education.

Cook, D. A. and Thompson, W. G. (2014) 'Comfort and experience with online learning: trends over nine years and associations with knowledge', *BMC Medical Education*, 14(1). Available at: https://doi.org/10.1186/1472-6920-14-128

Craciun, C. (2023) 'Online learning: advantages and disadvantages', *Studiul Artelor şi Culturologie: istorie, teorie, practică*, 2(43), pp.145-149. Available at: https://doi.org/10.55383/amtap.2022.2.26

Dixson, M. D. (2010) Creating effective student engagement in online courses: what do students find engaging?', *Journal of the Scholarship of Teaching and Learning*, 10(2), pp.1-13.

Don, M. A. M., Rosli, M. R., Senin. M. S. B. M., Ahmad, M. F., Rahmat, N. H. (2022) 'Exploring connectedness in online learning', *International Journal of Asian Social Science*, 12(4), pp.135-146. Available at: https://doi.org/10.55493/5007.v12i4.4477

Duc.Sinh, B., Hoang.Thy, N., Van.Tien, N., Van.Thuy, N., and Le.Kha.Tran, P. (2021) 'Students' perception of online learning during Covid-19 pandemic in Vietnam - a case study on the students of banking university of Ho chi Minh City', *NVEO NATURAL VOLATILES & ESSENTIAL OILS Journal | NVEO*, 8(2), pp.190-201. Available at: https://doi.org/10.53555/nveo.v8i2.3686

Hannay, M. and Newvine, T. (2006) 'Perceptions of distance learning: A comparison of online and traditional learning', *Journal of Online Learning and Teaching*, 2(1), pp.1-11.

Hrastinski, S. (2008) 'Asynchronous and synchronous e-learning', *Educause Quarterly*, 31, pp.51-55.

Junco, R. (2012) 'The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement', *Computers & Education*, 58(1), pp.162-171. Available at: https://doi.org/10.1016/j.compedu.2011.08.004

Junco, R., Elavsky, C. M. and Heiberger, G. (2013) 'Putting Twitter to the test: assessing outcomes for student collaboration, engagement and success', *British Journal of Educational Technology,* 44(2), pp.273-287. Available at: https://doi.org/10.1111/j.1467-8535.2012.01284.x

Kanuka, H. and Jugdev, K. (2006) 'Distance education MBA students: an investigation into the use of an orientation course to address academic and social integration issues', *Open Learning: The Journal of Open Distance and e-Learning*, 21(2), pp.153-166. Available at: https://doi.org/10.1080/02680510600715578

Kara, M., Erdogdu, F., Kokoç, M. and Cagiltay, K. (2019) 'Challenges faced by adult learners in online distance education: a literature review', *Open Praxis*, 11(1), pp.5-22.

Kaufmann, R. and Vallade, J. I. (2022) 'Exploring connections in the online learning environment: student perceptions of rapport, climate, and loneliness', *Interactive Learning Environments*, 30(10), pp.1794-1808. Available at: https://doi.org/10.1080/10494820.2020.1749670

Kebritchi, M., Lipschuetz, A. and Santiague, L. (2017) 'Issues and challenges for teaching successful online courses in higher education: a literature review', *Journal of Educational Technology Systems*, 46(1), pp.4-29.

Kuo, Y.C., Belland, B.R., Schroder, K.E. and Walker, A.E. (2014) 'K-12 teachers' perceptions of and their satisfaction with interaction type in blended learning environments', *Distance Education*, 35(3), pp.360-381.

Layne, M., Boston, W. E. and Ice, P. (2013) 'A longitudinal study of online learners: shoppers, swirlers, stoppers, and succeeders as a function of demographic characteristics', *Online Journal of Distance Learning Administration*, 16(2), pp.1-12.

Luu, T. M. V. (2022) 'Readiness for online learning: learners' comfort and self-directed learning ability', *International Journal of TESOL & Education*, 2(1), pp.213-224.

Maqableh, M. and Alia, M. (2021) 'Evaluation online learning of undergraduate students under lockdown amidst COVID-19 pandemic: the online learning experience and students' satisfaction', *Children and Youth Services Review*, 128, pp.106160. Available at: https://doi.org/10.1016/j.childyouth.2021.106160

Miao, J., Chang, J. and Ma, L. (2022) 'Teacher-student interaction, student-student interaction and social presence: their impacts on learning engagement in online learning environments', *The Journal of Genetic Psychology*, 183(6), pp.514-526. Available at: https://doi.org/10.1080/00221325.2022.2094211

Mishra, L., Gupta, T. and Shree, A. (2020) 'Online teaching-learning in higher education during lockdown period of COVID-19 pandemic', *International Journal of Educational Research Open*, 1, pp.100012. Available at: https://doi.org/10.1016/j.ijedro.2020.100012

Moore, M. G. (1989) 'Three types of interaction', *American Journal of Distance Education*, 3(2), pp.1-7. Available at: https://doi.org/10.1080/08923648909526659

Ogunlela, V. B. and Ogunleye, B. O. (2014) 'Promoting quality assurance practices for ODL programmes in West African higher education institutions: the role of RETRIDAL', *International Open and Distance Learning Journal*, pp.95-108.

Ornelles, C., Ray, A. B. and Wells, J. C. (2019) 'Designing online courses in teacher education to enhance adult learner engagement', *International Journal of Teaching and Learning in Higher Education*, 31(3), pp.547-557.

Qayyum, A. (2018) 'Student help-seeking attitudes and behaviours in a digital era', *International Journal of educational technology in higher education*, 15(1). Available at: https://doi.org/10.1186/s41239-018-0100-7

Robertson, O. and Evans, M. S. (2020) 'Just how reliable is your internal reliability? An overview of Cronbach's alpha (α)', *Psychology postgraduate affairs group*. Glasgow, UK: PsyPAG.

Seaman, J. E., Allen, I. E. and Seaman, J. (2018) *Grade increase: tracking distance education in the United* States. Babson Survey Research Group.

Shin, N. (2003) 'Transactional presence as a critical predictor of success in distance learning', *Distance Education*, 24(1), pp.69-86. Available at: https://doi.org/10.1080/01587910303048

Siehoff, R. V. S. (2023) *The effect of TikTok exposure on young adults' sustained attention span and the comprehension of information in digital texts and videos*. Radboud University. Available at: https://theses.ubn.ru.nl/handle/123456789/14815

Singh, V. and Thurman, A. (2019) 'How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018)', *The American Journal of Distance Education*, 33(4), pp.289-306. Available at: https://doi.org/10.1080/08923647.2019.1663082

Smith, P. J. (2005) 'Learning preferences and readiness for online learning', *Educational psychology*, 25(1), pp.3-12.

Sutton, S. C. and Nora, A. (2008) 'An exploration of college persistence for students enrolled in Web-enhanced courses: a multivariate analytic approach,' *Journal of College Student Retention: Research, Theory and Practice,* 10(1), pp.21-37. Available at: https://doi.org/10.2190/cs.10.1.c

Taber, K. S. (2018) 'The use of Cronbach's alpha when developing and reporting research instruments in science education', *Research in Science Education*, 48(6), pp.1273-1296. Available at: https://doi.org/10.1007/s11165-016-9602-2

Warden, C.A., Yi-Shun, W., Stanworth, J.O. and Chen, J.F. (2022) 'Millennials' technology readiness and self-efficacy in online classes', *Innovations in Education and Teaching International*, 59(2), pp.226-236. Available at: https://doi.org/10.1080/14703297.2020.1798269

Watson, S.L., Watson, W.R., Richardson, J. and Loizzo, J. (2016) 'Instructor's use of social presence, teaching presence, and attitudinal dissonance: a case study of an attitudinal change MOOC', *The International Review of Research in Open and Distributed Learning*, 17(3), pp.55-74.

Yudiatmaja, W.E., Yoserizal, Y., Edison, E., Kristanti, D., Tovalini, K., Samnuzulsari, T. and Malek, J.A. (2022) 'Adoption of online learning in Indonesian higher education during the COVID-19 pandemic', *The Journal of Behavioral Science*, 17(2), pp.73-89.

Zembylas, M., Theodorou, M. and Pavlakis, A. (2008) 'The role of emotions in the experience of online learning: challenges and opportunities', *Educational Media International*, 45(2), pp.107-117. Available at: https://doi.org/10.1080/09523980802107237

Zimmerman, T. D. (2012) 'Exploring learner to content interaction as a success factor in online courses', *International Review of Research in Open and Distance Learning*, 13(4), pp.152-165.

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Licence

Appendix: data collection instrument

1. Teacher-students interaction in online classes

Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
My instructor always asks questions (s) during the body of the lesson					
My teacher allows the students to ask questions					
My teacher thoroughly clarifies ambiguous concepts during the lesson					
My teacher properly demonstrates while explaining a concept					
Instructors allow students to demonstrate their learning or response during the online lesson					
Students are permitted to annotate their response/opinion on an e-material or virtual whiteboard during the lesson					
My online instructors are responsive to my questions					
I receive frequent feedback from my online instructors					
My instructor always participates in online discussions					
In my online courses, the instructors encourage interaction between learners					

2. Students' comfortability with e-learning

Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I find it easy to join the e-learning classrooms					
I am focused when attending the online lectures					
I find it less stressful to submit my quizzes and assignments					

It is easier to collaborate with my colleagues on projects and assignments					
I experience less classroom distraction during online learning					
I can effortlessly contact my teacher for study and non-study purposes					
If I need to, I will ask for help from my classmates					
I feel comfortable expressing my opinions and feelings in online courses					
I feel comfortable asking other students in online courses for help					
I have no difficulties expressing my thoughts in my online courses					

3. Why do you switch away from your online class sessions?

I switch when I receive a WhatsApp message (   )

I switch when I am bored   (   )

I switch when I have a call   (   )

I switch when I feel I should have received a message   (   )

I switch when a friend needs me   (   )

4. How often do you switch between e-learning and social media-related activities?

I switch every 2 minutes   (   )

I switch every 5 minutes   (   )

I switch every 10 minutes   (   )

I switch beyond 10 minutes   (   )