ASSESSMENT OF PRE-SERVICE SCIENCE TEACHERS' PREFERENCE OF FACE-TO-FACE AND ONLINE LEARNING MODES IN TEACHER TRAINING INSTITUTIONS

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Abstract
The study assessed pre-service science teachers' preference for face-to-face and online learning modes in teacher training institutions. Two research questions and two hypotheses were used to direct the study based on the objectives. The study used the descriptive survey research design. From a population of 715 undergraduate final year pre-service science teachers at the school of sciences, Alvan Ikoku Federal College of Education in Owerri, Imo State, Nigeria, 400 pre-service science teachers were selected as a sample. A 4-point Likert-style questionnaire titled "Pre-service Science Teachers Preference of Face-to-Face and Online Learning Modes (PSTPFOLM)" was created by the researcher as the tool for data collection. The instrument had a reliability coefficient of 0.86 determined using Cronbach's alpha formula. The data generated were analyzed using mean and standard deviation to answer research questions while the hypotheses were tested at 0.05 level of significance using a t-test statistical tool. The result of the study revealed that pre-service science teachers preferred face-to-face learning mode to online learning mode. The pre-service science teachers' preference for face-to-face learning mode was not dependent on gender. Based on the findings, it was recommended that online learning mode should be introduced in pre-service science teachers' education through blended learning.
Keywords: Pre-Service Science Teachers, Face-to-Face, Online, Learning Mode, Training

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Introduction
The teaching and learning process results in the acquisition of useful knowledge for learners' appropriate functioning in academic society. Ozdaş (2018) defines teaching-learning is a process in which pre-service teachers acquire experiences and ideas regarding teaching, learning, the teacher, and the student, as well as positive and negative notions regarding school concepts. According to Saban (2014), the teaching-learning process in a teacher-centred approach generally concentrates on imparting knowledge to students, which is then memorised so that it can be recalled exactly in the future. This process does not include learning activities that foster critical thinking and problem solving. A learner's behaviour is permanently altered as a result of learning. According to Resien et al. (2020), learning is the process of altering behaviour as a result of interactions between individuals and their environment. Changes in behaviour include modifications to knowledge, comprehension, attitudes, skills, motivation, interests, and cognitive capacities, among others. Suparman argues in Sitorus et al. (2019) that "learning is a process of behaviour change that others, including teachers, can observe." Teaching, on the other hand, is the structured process of imparting knowledge to a student. According to Sequeira (2012), teaching is a series of external events designed to support the internal process of learning. Amidon, cited by Isola (2019), defined teaching as "an interactive process predominately involving classroom conversation between the instructor and the student, which takes place during certain definable activities." Frimpong, as cited in Ababio (2013), defined teaching as the process by which a teacher imparts knowledge, skills, attitudes, and values to a learner or group of learners in a manner that respects the learner's intellectual integrity and capacity to change their behaviour. Learning is an active process that requires student participation, engagement, and involvement,

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according to Krishnan (2016). Along the way, the teaching and learning environment has shifted from face-to-face mode in traditional classrooms to online mode in virtual classrooms to a combination of the two in hybrid learning mode. Our education system has long utilised the traditional face-to-face method of scientific instruction. However, the introduction of information and communication technology (ICT) in education has resulted in the development of various learning modalities that have altered how teachers instruct and students learn.

Face-to-face learning is conducted in the classroom with both the teacher and the students present. Students receive direct instruction from the teacher and can request and receive information directly from the instructor. Face-to-face learning is the more traditional method of instruction in teacher preparation programmes, where students and instructors attend a session together in person. Typically, the instructor directs the class, and students learn passively. Face-to-face (F2F) learning, according to Zoncita and Norman (2020), is a pedagogical approach in which both students and instructors are present and actively engaged in the learning and teaching processes and classroom activities. In addition, face-to-face education engages students academically, physically, socially, emotionally, and interactively. According to Esani (2010), there are evident classroom discussions, laboratory exercises, and oral and written examinations in a face-to-face setting. In every session, instructors have consistent contact with students and can assess their prior learning and cognitive knowledge levels. They rely on a number of subtle visual signals from their students to improve their delivery. There are a number of advantages associated with the implementation of face-to-face instruction. According to Top Hat (n.d.), it permits live interaction between a learner and an instructor. It is the most conventional form of educational instruction. Additionally, learners benefit from increased interaction with their peers. In face-to-face education, pupils are held accountable for their progress at the specific class meeting date. Face-to-face instruction improves students' comprehension and retention of course material and provides an opportunity for class members to form bonds. Students can focus more intently on their studies when there are fewer distractions. It is associated with collaborative learning activities. There are challenges associated with face-to-face learning in pre-service teacher education, despite its many advantages. In face-to-face learning, all students learn at the same time and tempo, as teachers do not provide individualised instruction. Face-to-face learning requires pre-service instructors to travel from one location to another, incurring transportation costs. In recent years, however, due to the COVID-19 pandemic and other environmental concerns, the teaching and learning process has progressively shifted from the traditional face-to-face (F2F) mode to the online learning (OL) mode.

Online learning is the process of acquiring knowledge through the internet using devices such as computers, smartphones, and tablets. According to Batmang et al. (2021), online learning is a process that traditionally occurs not in the classroom but synchronously or asynchronously via the Internet. According to Bowden (2017), online learning typically contains prerecorded videos. Occasionally, these are straightforward recordings of lectures with or without accompanying transparencies. According to Deshmukh et al. (2012), in an online environment, the teacher's function shifts from "the sage on the stage" to "the guide on the side." Online learning environments permit both horizontal (i.e., student-to-student) and vertical (i.e., student-to-instructor) communication simultaneously (Schwartz, n.d.). Consequently, students are found to be more collaborative, reflective, and able to implement the acquired knowledge (Krishnan, 2016). Online education reduces travel costs and increases study and family time. It has encouraged students to assume greater responsibility for their knowledge acquisition. Age is not a barrier to the value that pupils can derive from online learning when they are able to meet the technical requirements (Dambo & Kayii, 2019; Ituma, 2011). Online students have the opportunity to study at their own pace and according to their aptitudes. According to Esani (2010), online instructors can teach from anywhere on the globe with an internet connection. No class time is missed due to illness, conferences, holidays, or natural disasters. In addition to convenience, the online environment offers learners and instructors both enthusiasm and new challenges. Despite the benefits of online learning, there are significant challenges associated with it, including inactivity in the absence of internet connectivity, the absence of electronic devices, a lack of personnel, and the susceptibility of students to distractions. Otter et al., as cited by Markose and Cherukara (2020), discovered that students in online-only courses felt less connected to their peers and lecturers, more self-directed in their studies, and less supported by their lecturer than lecturers believed they did.

Assessment of pre-service science teachers' preference of face-to-face (f2f) and online learning (ol) modes in teacher training institutions

In higher education, both face-to-face and online learning modalities are effective for teaching and learning. However, learners have varying levels of satisfaction with them. In a comparison of participants' contentment with face-to-face courses and online courses, Lauren, Jennifer, and Marguerite, as cited in Deshmukh et al. (2012), found that participants reported greater satisfaction with face-to-face courses. Krebs (2004) believes that online course participants view online learning environments as allowing them to study at their own pace, be actively engaged in the learning activities, and increase their intrinsic motivation to learn and practice self-study in comparison to those attending traditional face-to-face classes. Curtis and Lawson, cited by Hong et al. (2007), investigated collaborative learning in online learning environments, reported differences in collaborative behaviours in face-to-face contexts and online environments, and attributed the differences to the absence of the "explain and challenge cycle," which is one of the distinguishing characteristics of face-to-face interactions. In a study comparing the preferences of students for online learning versus face-to-face (F2F) learning, Ary and Brune (2011) discovered that students prefer online learning when offered, contingent on the course topic and online course technology platform. Face-to-face (F2F) learning was preferred when courses were offered late morning or early afternoon 2–3 days/week. Given the dichotomy associated with learners' preference for face-to-face and online learning modes, this study dealt with the assessment of pre-service science teachers' preference for the teaching modes.

Purpose of the Study.
The main purpose of the present study was to assess pre-service science teachers' preference for face-to-face and online learning modes in teacher training institutions. Specifically, the study investigated whether,
1) Pre-service science teachers preferred face-to-face(F2F) learning mode to online learning(OL) mode or otherwise.
2) The preference for learning mode is dependent on gender.

Research Questions
The following research questions guided the study;
1) What is the difference between the response mean of pre-service science teachers' preferences between face-to-face and online learning modes?
2) What is the difference between the response means of male and female pre-service teachers in their preferred learning mode?

Hypotheses
The following hypotheses were formulated for the study
Ho_1: There is no significant difference between the response mean of pre-service science teachers' preference for face-to-face and online learning modes
Ho_2: There is no significant difference between the response means of male and female pre-service science teachers in their preferred learning mode.

Methodology
The study employed a descriptive survey research design to ascertain the preferred mode of instruction for pre-service science teachers. The study population consists of 715 final-year undergraduate pre-service science teachers from the School of Sciences at Alvan Ikoku Federal College of Education, Owerri, who have been exposed to both face-to-face and online learning modes. The stratified random sampling method was used to select four hundred (400) pre-service science teachers, 157 of whom were male and 243 of whom were female. The data collection instrument was a researcher-created 4-point Likert-type questionnaire titled "Pre-service Science Teachers Preference of Face-to-Face and Online Learning Modes (PSTPFOLM)". The instrument was divided into two parts: Part A sorted the demographic variables of respondents, while Part B focused on questions relating to the study's objectives. An expert in measurement and evaluation and two specialists in teacher education from the School of Education at Alvan Ikoku Federal College of Education in Owerri validated the instrument. When necessary, their expert opinion supervised the restructuring of the instrument. The instrument was administered to 30 respondents outside the study sample and the reliability of the instrument was determined using Cronbach's alpha formula and this gave a reliability coefficient of 0.86 which was acceptable for the study. The instrument

was administered to the respondents on a face-to-face basis by the researchers, they were allowed to fill and return the instruments on the spot, and the entire exercise lasted for a week. The data generated were analyzed using mean and standard deviation to answer research questions, any response means within and above the criterion mean of 2.50 was accepted while any below was rejected. The hypotheses were tested at a 0.05 level of significance using a t-test statistical tool.

Results

Research Question 1: What is the difference between the response mean of pre-service science teachers' preferences between face-to-face and online learning modes?

Table 1: Summary of descriptive statistics on the preference responses on difference between the response mean of pre-service science teachers' preferences between face-to-face and online learning modes

S/N	Item	Mean	SD	Decision
	Face-to-face(F2F) learning mode			
1	I interact with lecturers in face-to-face learning mode	3.75	0.42	*
2	It enables me to interact and share ideas with my coursemates	3.42	0.45	*
3	It enables a better understanding of concepts taught	3.14	0.53	*
4	I am satisfied with this mode of learning	3.20	0.51	*
5	It enhances practical knowledge of concepts taught	3.53	0.44	*
6	Active participation is encouraged in this mode of learning.	3.08	0.51	*
7	The collaborative learning opportunity is encouraged by this mode.	3.33	0.52	*
8	It enhances access to learning materials	2.51	0.74	*
9	The learning mode does not permit distraction	2.86	0.68	*
10	It encourages flexibility during learning	2.04	0.76	-
11	It's not expensive to attend	3.10	0.48	*
12	Progress of learning is monitored by the lecturer in this mode	3.49	0.54	*
	Average	**3.12**	**0.55**	*
	Online Learning(OL) Mode			
1	I interact with lecturers in online learning mode	2.52	0.73	*
2	It enables me to interact and share ideas with my coursemates	2.56	0.69	*
3	It enables a better understanding of concepts taught	2.40	0.77	-
4	I am satisfied with this mode of learning	2.30	0.81	-
5	It enhances practical knowledge of concepts taught	2.25	0.83	-
6	Active participation is encouraged in this mode of learning.	2.65	0.73	*
7	The collaborative learning opportunity is encouraged by this mode.	2.81	0.65	*
8	It enhances access to learning materials	3.22	0.51	*
9	The learning mode does not permit distraction	2.15	0.82	-
10	It encourages flexibility during learning	3.02	0.40	*
11	It's not expensive to attend	2.37	0.83	-
12	Progress of learning is monitored by the lecturer in this mode	2.43	0.82	-
	Average	**2.56,**	**0.72**	*

Key: *accept,   - reject

Table 1 shows that 11 items of face-to-face(F2F) learning mode were accepted as they had a response mean greater than the criterion mean, while 1 item was rejected as it had a response mean less than the criterion mean. The average response means stood at 3.12 with a standard deviation of 0.55 which indicated a high level of preference for face-to-face(F2F) learning mode among pre-service teachers. Also, 6 items were accepted as they had a response mean greater than the criterion mean and 6 items were rejected as they had a response mean less than the criterion mean. The average response mean score stood at 2.56 with a standard deviation of 0.72 which

indicated a moderate preference level among pre-service teachers. A difference in response mean of 0.56 in favour of face-to-face was observed.

Research Question 2: What is the difference between the response means of male and female pre-service teachers in their preferred learning mode?

Table 2: Summary of descriptive statistics on face-to-face gender preference

Gender	N	Mean	SD	Diff in mean
Male	157	3.09	0.58	
Female	243	3.13	0.53	0.04

Table 2 shows that male pre-service teachers had a response mean of 3.09 and a standard deviation of 0.58. Also, their female counterparts had a response mean of 3.13 and a standard deviation of 0.53. These gave a difference in mean of 0.04 in favour of female pre-service teachers.

Ho$_1$: There is no significant difference between the response mean of pre-service science teachers' preference for face-to-face and online learning modes.

Table 3: Summary of paired-sample t-test analysis on the difference between the response mean of pre-service science teachers' preference for face-to-face and online learning modes

Learning mode	N	Mean	SD	df	t$_{-cal}$	t$_{-crit}$	Decision
Face-to-face	400	3.12	0.55	399	15.56	1.960	S
Online	400	2.56	0.72				

S=Significant

Table 3 shows that the t-cal value of 15.56 is greater than the critical value of 1.960 at 399 degrees of freedom. Based on the result, the null hypothesis is rejected at a 0.05 level of significance and the alternative is upheld. This implies that there is a significant difference between the response mean of pre-service science teachers' preference for face-to-face (F2F) and online learning(OL) modes.

Ho$_2$: There is no significant difference between the response means of male and female pre-service science teachers in their preferred learning mode.

Table 4: Summary of t-test analysis on the difference between the response means of male and female pre-service science teachers in their preferred learning mode

Gender	N	SD	df	t-cal	t-crit	Decision
Male	157	0.58	398	0.67	1.960	NS
Female	243	0.53				

NS=Not Significant

Table 4 shows that the t-calculated value of 0.67 is less than the critical value of 1.960 at a 0.05 level of significance and degree of freedom 398. Based on the result the null hypothesis is upheld.

Discussion
The primary objective of this study was toward assessing pre-service science teachers' preferences for face-to-face (F2F) and online learning (OL) modes in teacher training institutions. Even though both means were within and above the criterion mean, the response mean score for pre-service science teachers' preference for face-to-face (F2F) learning mode was greater than that of online learning (OL) mode. Further statistical analysis revealed a significant difference between the mean responses for face-to-face (F2F) and online learning (OL) among pre-service science instructors. The outcome suggested that pre-service teachers preferred face-to-face (F2F) learning over online learning. This result is likely attributable to the nascent stage of online introduction in Nigerian higher education and its support of social presence and interaction. This result is consistent with the findings of Bali and

Liu (2018), who found a significant difference between the students' perceptions of face-to-face learning and online learning in terms of satisfaction and supported the notion that face-to-face learning led to more positive perceptions, higher levels, and a stronger sense than online learning. However, this result contradicts the findings of Hurst et al. (2013), who found no statistically significant difference between online and face-to-face learning participants in terms of learning perspectives. Even though face-to-face learning was perceived to be more satisfying, many students chose online learning over face-to-face classes due to the convenience of time and the ability to work at their own pace.

The study revealed that the preference of pre-service science teachers for face-to-face (F2F) learning over online learning (OL) was independent of gender. There was no statistically significant difference between the response means of male and female pre-service science teachers with regard to their preferred learning mode, face-to-face (F2F) learning. This result is consistent with the findings of Wong and Fong (2014), who concluded that there is no significant gender disparity in attitudes towards face-to-face learning and that both male and female students place a high value on opportunities for social interaction in the classroom.

Conclusion

This study assessed pre-service science teachers' preference for face-to-face(F2F) and online learning(OL) modes in teacher training institutions. The result revealed that pre-service science teachers found online learning useful in their study, however, they preferred the face-to-face (F2F) learning mode for its support of social presence and interaction which is imperative in their training. Also, the pre-service science teachers' preference for face-to-face (F2F) learning mode was not dependent on gender.

Recommendations

Based on the findings of the study, it was recommended that:

1) Online learning (OL) mode should be introduced in pre-service science teacher education through blended learning to enable them to get used to it.
2) Pre-service science teacher educators should improve their digital skills through conferences and workshops to enable them to utilize them in and outside the classroom.
3) The Government and Non-Governmental Organizations should support teacher training Institutions with digital facilities to enable pre-service teachers to use them in their learning process.

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