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TRAINEE-TEACHERS' PERCEPTIONS ON TRADITIONAL, ONLINE AND HYBRID LEARNING MODES OF MATHEMATICS EDUCATION IN GHANA

Bernice Yawa Tsitsia and Samuel Kwasi Kabbah

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^{1*}**Bernice Yawa Tsitsia**

ICT Tutor: Mathematics/ICT Department of Peki College of Education, Ghana

^{2*}Corresponding Author Email: yawabern@gmail.com

²**Samuel Kwasi Kabbah**

Mathematics Tutor: Mathematics/ICT Department of Peki College of Education, Ghana

Abstract

Purpose: The study examined trainee-teachers' perceptions on traditional, online and hybrid learning modes of Mathematics education.

Methodology: Quantitative research design was employed. The public colleges of education students in Ghana were involved in the study. Purposive sampling technique was used in selecting the sample for the study. In all, data was collected on 315 levels 100 and 200 students. Descriptive data analysis was employed using the Jamovi Statistical Data Analysis (JSDA) tool.

Findings: The results indicate with over 80% frequencies of students and above 4.0 means of choice of responses per variables, students are mostly comfortable interacting and communicating with their tutors and colleagues in face-to-face Mathematics learning environment. The results also confirmed, with about 60.9% and 76.2% frequencies respectively, the students' preferred Mathematics learning mode to be the blended teaching-learning and the face-to-face mode of assessments.

Unique Contribution to Theory, Practice and Policy: With the advent of technologies and the prospects made in technology assisted instructions as revealed by literature, the Management and other stakeholders of the Colleges of Education are urged to facilitate Information Communication Technology (ICT) resources in their respective Colleges. This is to aid the implementation of the integration of face-to-face and the online teaching and learning of Mathematics courses.

Key words: *Face-to-face/traditional, online/e-learning, hybrid/blended, trainee-teachers, colleges of education.*

1.0 INTRODUCTION

Learning, most often, is said to be an acquisition of new mental schemata, knowledge, abilities, skills, etc, which can be used to solve problems potentially more successfully, furthering decision making on the basis of experience, which elevates “doing” as a basis for achieving an effective understanding of the knowledge (Pazos, Azpiazu, Silva & Rodriguez-Paton, 2002).

One cannot underestimate the values of Mathematics in our lives. Mathematics referred to as Arithmetic, is an essential portion of human thought and rationale, and indispensably endeavours at understanding the world and ourselves. Mathematics offers an efficient way to develop mental discipline and energizes consistent thinking and mental thoroughness. It is ultimately one of the imperative subjects among the list of established subjects that constitutes the central educational programmes for essential instruction worldwide (Mereku, 1999). In Ghana’s educational system, Mathematics is one of the core subjects that is being studied at all levels in the pre-tertiary institutions (early grade through to second cycle levels). It is also one of the determinant subjects for students’ academic progressions. Thus, from the Junior High School (JHS) to second cycle institutions and from second cycle to tertiary institutions.

The discipline involves favoured position within the school curriculum because the aptitude to manage with more of it progresses one’s chances of social headway (Mereku, 2000). In different fields and disciplines, Mathematics is applied. Mathematical principles and procedures are used in Science, Engineering, and Economics just to mention a few for problem solving. A key characteristic of people leading more productive lives as positive, caring and reflective citizens is having mathematical literacy.

The focus of this study is on pursuing Ghana’s Colleges of Education trainee-teachers’ (students’, pre-service teachers’, student-teachers’) perceptions on the preferred learning modes of Mathematics teaching and learning environment. The country’s Colleges of Education students are basically trainee-teachers for the basic schools (Early Grade through to Junior High Schools) in the country. The Colleges of Education currently run a 4-Year Bachelor of Education Degree (B.Ed) Programmes. Currently, the students in the Colleges have the opportunity to specialize in basic schools’ specialized programmes with the specified courses. However for Mathematics, aside being an Elective course for students, it is mandatory for all trainee-teachers to study it right from the first year of their programmes irrespective of the area of specialization. Both the pedagogical and the content knowledge competency skills of the Mathematics courses are instilled in the trainees as they progress. The trainee-teachers’ learning of Mathematics is very crucial since it is the pedagogical content knowledge competency skills they are expected to acquire and use when delivering Mathematics lessons in the basic schools.

The teaching modality hitherto, until the advent of COVID-19, at all levels in Ghana’s educational system was mainly traditional (face-to-face) teaching. In the era of COVID-19, there has been a paradigm shift from the age long traditional teaching and learning to online (E-learning) teaching and learning in Ghana’s educational institutions just as in other institutions globally. Traditional teaching-learning also commonly referred to as the face-to-face, the didactic or the conventional teaching-learning is a live convention carried out with both students and instructor(s) present. According to Stone & Perumean-Chaney, (2011) traditional learning involves learners and instructors meeting together in the same place at the same time. In this mode the set time, duration and location for learning is well known to both the students and the

instructors. The information and knowledge flow is also moderated and supervised by the instructors.

The alternate to the traditional teaching-learning mode is the E-learning also referred to as the online or the virtual learning. Many developing nations including Ghana have only formerly resorted to the online learning during the world's COVID-19 pandemic even though the E-learning mode existed for over decades. Chiu, Chui and Chang, (2007) referred to E-learning as online learning or Web-based learning conveyed or retrieved through the Internet, intranet or extranet. Tsitsia, Kabbah, Doyi, Kabe and Safo, (2020) cited that, E-learning is an instructional mechanism that mediates both synchronous and asynchronous teaching and learning practices through the use of information and communication technologies. Similarly, Alonso, López, Manrique, and Viñes, (2005) are of the view that E-learning is a way of enhancing the quality of learning through the use of emerging multimedia technology and the Internet by enabling access to information and facilities as well as remote exchange and collaboration.

The Online teaching-learning mode, as compared to the face-to-face which is characterized by teacher-driven as the instructors teach on the subject area of their expertise, aims at satisfying the needs, interests, learning styles, abilities and aspirations of learners; Online learning is self-directed and flexible in nature (Buzzetto-More, 2013). In online teaching-learning, there are no physical contacts between the learners and the instructors. By the use of the Internet and its techniques, distribution of learning tools, teaching and learning activities are all virtually done (Young, Hausler & Sanders, 2008). Most studies revealed the effectiveness of the use of online teaching-learning environments. Carter (2013) indicated that the E-learning helps students to deliberately develop awareness and deep understanding by negotiating definitions with others through social cognitive and teaching processes.

In the spectrum of the traditional and the E-learning modes, comes another learning mode known as the blended teaching-learning also commonly known as the hybrid learning. The blended learning uses both the features of the traditional and the E-learning to enhance students' learning. According to Marsh and Drexler (2001), blended learning refers to all teaching models that are incorporated with technology, including e-mails, streaming media and the Internet, and are merged with the traditional teaching methods. Blended learning is the combination of traditional learning with web-based online methods. It includes a variety of media and technologies deployed in an E-learning environment Arbaugh (2005). Singh (2003) cited by Dzakiria Mustafa and Bakar (2006, p.11), in a precise form described blended learning as: "offline with online; self-paced with live, collaborative; structured with unstructured; custom content with off-the-shelf and so on".

Most studies revealed that the blended learning has become the most preferred teaching and learning mode for students. The study of Krishnan (2016), on "Students' Perceptions of Learning Mode in Mathematics" reveals that about 62.5% frequency of the students mostly preferred the blended mode of Mathematics learning. The study of Mamattah (2016) in the similar vein also revealed that students preferred mode of study is the hybrid though they showed interest in the online learning. Other studies also revealed no significant differences on perceptions of the different modes of teaching-learning. The study by Fortune Spielman and Pangelinan (2011) found no statistically significant differences in learning preference between those who enrolled in the online and face-to-face learning modes. The study of Paul and Jefferson (2019) also found

no significant difference in students' performance between online and face-to-face learners, whereas the findings of Ary and Brune, (2011) showed that students prefer online learning mostly depending on the topic and the technology.

This current study seeks to examine trainee-teachers' perceptions on traditional, online and hybrid learning modes of mathematics education. The Colleges of Education students have currently experienced the use of all the three learning modes: traditional, online and blended learning environments. Evidently, the just ended online learning in the Colleges was characterized by various challenges. Among these include: poor internet connectivity, high cost of internet data, and home related issues (Tsitsia et al, 2020). There have since been agitations among students on the preferences on the choice of preferred learning modes. It is very necessary to empirically examine students' perception on their preferred learning modes specifically in Mathematics learning environments.

A clearer understanding of the students' perceptions of the complications involved in the various mathematics learning environments is believed to provide insights for Mathematics tutors in the Colleges in developing methods that are helpful in improving trainee-students' Mathematical content and pedagogical requisite knowledge. This study is also expected to pave ways for other researchers and educators to strategize Mathematics learning environment to be beneficial to our student-teachers. The study is as well expected to enlighten the College Management and all other stakeholders on the need to consider the use of the various learning environments that enforce students' learning to enhance effective teaching and learning in the aftermath of the COVID-19 pandemic.

Specific Objectives

The study seeks to examine the following specifics:

- Student-teachers' perception on online, face-to-face and blended learning modes in Mathematics
- Student-teachers' most preferred Mathematics learning instructional mode.

Research Questions

- i. How do student-teachers perceive the various teaching-learning modes in Mathematics learning environment?
- ii. What instructional mode do student-teachers prefer most in Mathematics learning?

2.0 METHODOLOGY

Design

The study examined trainee-teachers' perceptions on Traditional, Online and Hybrid learning modes of mathematics education. Quantitative research design method was utilized in the study. According to Creswell (2009) cited by Tsitsia et al (2020, p. 563) quantitative research is referred to as: "a means for testing objective theories by examining the relationship among variables where the variables in turn can be measured using instruments to produce numbered data that can be analysed using statistical procedures." Purposive sampling technique was used in selecting the sample for the study. In all a total of 315 year one and two students of the Public Colleges of Education in Ghana represented the sample size of the study.

Data Collection Instruments

A survey questionnaire as an instrument was used for the data collections in this study. Mathematics learning environments, face-to-face Mathematics learning mode, online Mathematics learning mode and preference of the Mathematics learning modes. Data was collected online through the use of Google form application template. The students were made to respond to the questionnaire anonymously to ensure anonymity and confidentiality.

Data Analysis

Descriptive quantitative statistical data analysis was employed. Jamovi Statistical Data Analysis (JSDA) tool and Microsoft excel application were the statistical tools used for the analysis of the collected data. Data was presented using tables and figures involving calculated percentage frequencies and mean of the responses.

3.0 RESULTS

The results of the analysed data were presented in tables and figures. The figures 1 to 4 presented data on the students background information. These include students' programmes of study, academic levels, universities of affiliations and age ranges. Tables 1 to 8 also presented the frequencies and descriptive data on the responses of the Likert type questions on each variable, and figure 5 presents data on the variable 'preference of the Mathematics learning modes'.

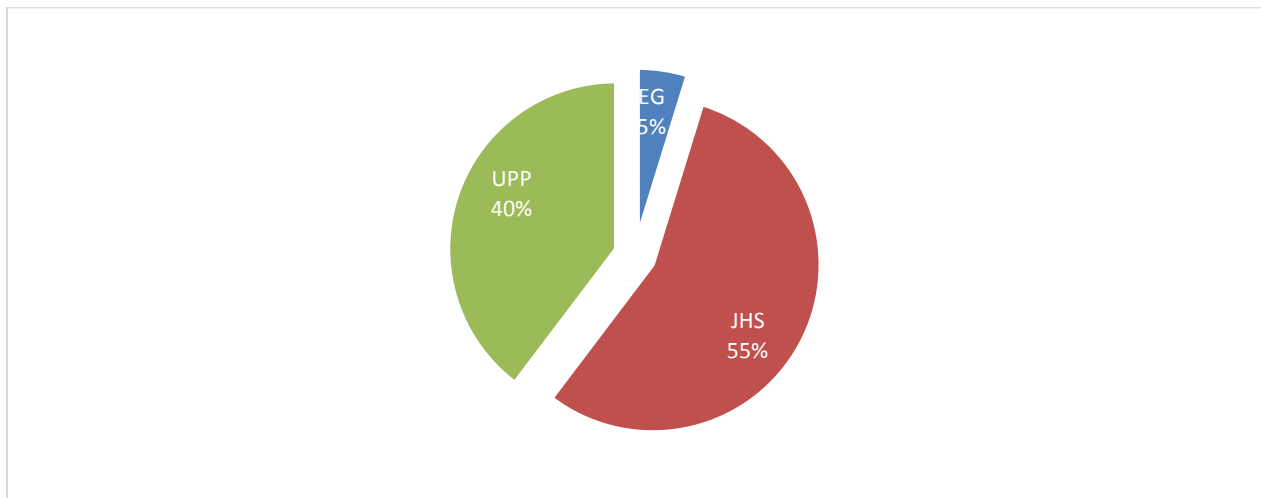


Figure 1: Programmes of Study

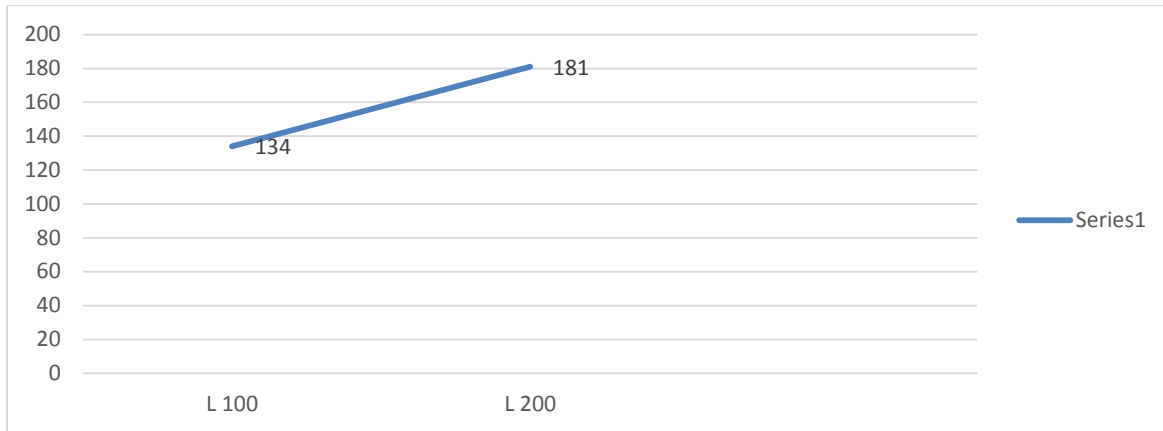


Figure 2: Academic Levels of the Students

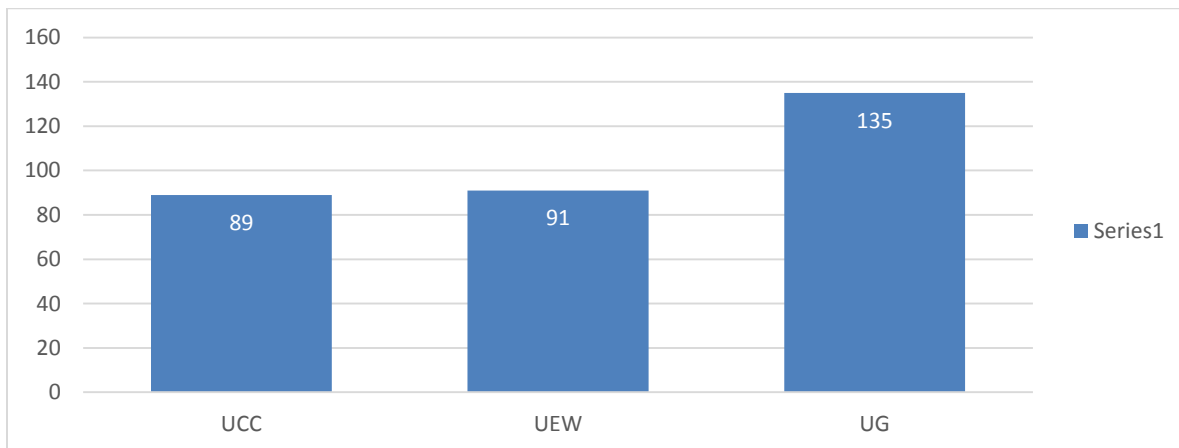


Figure 3: Universities of Affiliation

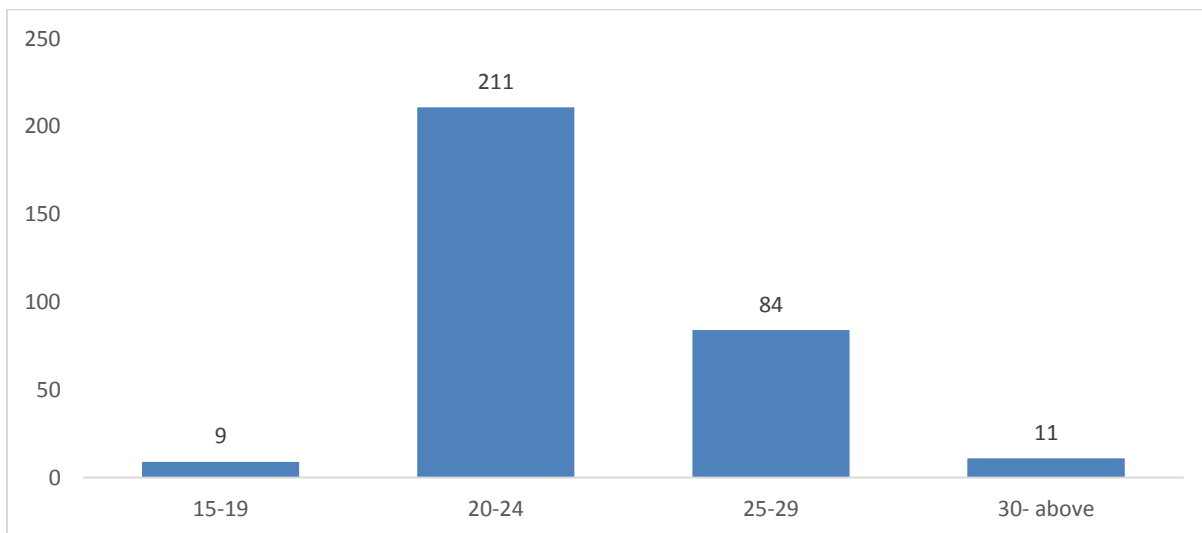


Figure 4: Age Range of the Students

From the figures on the background information, figure 1 represents the students' programmes of study. These programmes include: the Early Grade (EG) Education, the Upper primary/Primary (UPP) Education and the Junior High School (JHS) Education. The frequencies of students on these programmes are 5%, 40% and 55% respectively. The figure 2, shows the academic levels of the students. Levels 100 and 200 (L 100 and L 200) thus first and second year students were represented with 134 and 181 respective frequencies of participation. The figure 3, represents the affiliated universities of the Colleges. There are five public universities of affiliation to the colleges of education in the country. Out of these, the students of the colleges affiliated to the University of Education Winneba (UEW), University of Cape Coast (UCC) and the University of Ghana (UG) were represented. The statistics on students' frequencies of these universities include: 91, 89 and 135 respectively. The age range in years of students are represented on figure 4 as: 15-19, 20-24, 25-29 and 30 and above with their respective frequencies as: 9, 211, 84 and 11. The most popular age range of the students is 20 to 24 years.

Table 1: Frequencies: Mathematics Learning Environment

Statements	SA		A		U		D		SD	
	n	%	n	%	n	%	n	%	n	%
Communicating with my instructors in face-to-face Mathematics learning environment is more comfortable.	211	67.0	81	25.7	5	1.6	10	3.2	8	2.5
Communicating with my instructors in online Mathematics learning environment is more comfortable.	26	8.3	69	21.9	24	7.6	93	29.5	103	32.7
Communicating with my with my classmates in face-to-face Mathematics learning environment is more comfortable.	240	76.2	57	18.1	7	2.2	5	1.6	6	1.9
Communicating with my classmates in online Mathematics learning environment is more comfortable.	22	7.0	72	22.9	23	7.3	93	29.5	105	33.3
Discussing in the face-to-face Mathematics learning environment is more comfortable as compared to the online	215	68.3	47	14.9	18	5.7	15	4.8	20	6.3

Table 2: Descriptive: **Mathematics Learning Environment**

Statements	N	Mean	Median	SD	SE
Communicating with my instructors in face-to-face Mathematics learning environment is more comfortable.	315	4.51	5	0.883	0.0497
Communicating with my instructors in online Mathematics learning environment is more comfortable.	315	2.43	2	1.356	0.0764
Communicating with my with my classmates in face-to-face Mathematics learning environment is more comfortable.	315	4.65	5	0.773	0.0435
Communicating with my classmates in online Mathematics learning environment is more comfortable.	315	2.41	2	1.338	0.0754
Discussing in the face-to-face Mathematics learning environment is more comfortable as compared to the online	315	4.34	5	1.179	0.0664

The frequencies and descriptive analyses from tables 1 and 2 indicate that the respondents are more comfortable communicating with their instructors and classmates, and discussing in the face-to-face Mathematics learning environment. This is evident in table 1 as 92.7%, 94.3% and 83.2% of the respondents respectively confirmed the statements. This further is evident in table 2 as the high mean values of 4.51, 4.65 and 4.34 of the responses respectively affirmed the statements. On the other hand, from table 1, 62.2% and 62.8% of the respondents respectively disagreed with the statement 'communicating comfortably with their instructors and classmates in online environment'. This is further confirmed in table 2 as the low mean values of 2.43 and 2.41 respectively disagreed with the statements. However it is observed from table 1 that 7.6% of the respondents were undecided as to whether or not they are comfortable communicating with their instructors in online Mathematics learning environment.

Table 3: Frequencies: Face-to-face Mathematics learning mode

Statements	SA		A		U		D		SD	
	n	%	n	%	n	%	n	%	n	%
I learn better in Face-to-face Mathematics teaching and learning environment.	274	87.0	34	10.8	3	1.0	2	0.6	2	0.6
I understand Mathematics concepts in this course better in Face-to-face teaching and learning environment.	255	81.1	53	16.8	2	0.6	3	1.0	2	0.6
Face-to-face Mathematics teaching and learning is better for this course.	261	82.9	44	14.0	4	1.3	2	0.6	4	1.3
Communicating in Face-to-face learning environments improves my Mathematics learning ability	251	79.7	57	18.1	1	0.3	3	1.0	3	1.0
I prefer learning Mathematics in the face-to-face class environment	270	85.7	35	11.1	5	1.6	3	1.0	2	0.6

Table 4: Descriptives: **Face-to-face Mathematics Learning Mode**

Statements	N	Mean	Median	SD	SE
I learn better in Face-to-face Mathematics teaching and learning environment.	315	4.83	5	0.526	0.0296
I understand Mathematics concepts in this course better in Face-to-face teaching and learning environment.	315	4.77	5	0.572	0.0322
Face-to-face Mathematics teaching and learning is better for this course.	315	4.77	5	0.630	0.0355
Communicating in Face-to-face learning environments improves my Mathematics learning ability	315	4.75	5	0.607	0.0342
I prefer learning Mathematics in the face-to-face class environment	315	4.80	5	0.569	0.0321

Tables 3 and 4 are devoted to the frequency and descriptive analyses respectively of responses on face-to-face class activities. All the variables in tables 3 and 4 with very high percentage values of the respondents of more than 90.0 and mean values of responses more than 4.7 respectively agreed with the statements about face-to-face class activities.

Table 5: Frequencies: **Online Mathematics Learning Mode**

Statements	SA		A		U		D		SD	
	n	%	n	%	n	%	n	%	n	%
I find it easier communicating with my tutors online during Mathematics learning.	29	9.2	65	20.6	30	9.5	98	31.1	93	29.5
I find it easier communicating with my classmates online during Mathematics learning.	23	7.3	63	20.0	30	9.5	107	34.0	92	29.2
Online Mathematics learning hinders the required coursework completion.	111	35.2	86	27.3	31	9.8	40	12.7	47	14.9
I understand mathematics concepts better in online learning environment.	11	3.5	40	12.7	35	11.1	89	28.3	140	44.4
My Mathematics learning ability is improved using online resources.	23	7.3	57	18.1	32	10.2	83	26.3	120	38.1
I cherish learning mathematics online.	35	11.1	58	18.4	37	11.7	86	27.3	99	31.4

Table 6: Descriptive: **Online Mathematics Learning Mode**

Statements	N	Mean	Median	SD	SE
I find it easier communicating with my tutors online during Mathematics learning.	315	2.49	2	1.35	0.0758
I find it easier communicating with my classmates online during Mathematics learning.	315	2.42	2	1.29	0.0728
Online Mathematics learning hinders the required coursework completion.	315	3.55	4	1.45	0.0818
I understand mathematics concepts better in online learning environment.	315	2.03	2	1.18	0.0662
My Mathematics learning ability is improved using online resources.	315	2.30	2	1.33	0.0751
I cherish learning mathematics online.	315	2.50	2	1.39	0.0781

The frequency and descriptive analyses of responses on online class activities are presented in tables 5 and 6 respectively. Majority of the variables in tables 5 and 6 with percentage values of the respondents of more than 55.0 and low mean values of responses of less than 3.0 respectively disagreed with the statements on online class activities. However, about 10% of the respondents were undecided on each of the statements as evident in table 5. The variable on Online Mathematics learning hinders the required coursework completion, 62.5% of the respondents with the mean value of 3.55 of the responses in tables 5 and 6 respectively affirmed the claim.

Table 7: Frequency: **Preference of the Mathematics learning modes**

Statements	SA		A		U		D		SD	
	n	%	n	%	n	%	n	%	n	%
I prefer the hybrid learning mode for Mathematics learning.	104	33.0	88	27.9	38	12.1	45	14.3	40	12.7
I prefer learning Mathematics online with my study groups.	21	6.7	42	13.3	47	14.9	112	35.6	93	29.5
I prefer the online Mathematics learning environment to the face-to-face.	10	3.2	29	9.2	39	12.4	105	33.3	132	41.9
I prefer assessment in the face-to-face form to the online.	181	57.5	59	18.7	27	8.6	34	10.8	14	4.4

Table 8: Descriptive: **Preference of the Mathematics Learning Modes**

Statements	N	Mean	Median	SD	SE
I prefer the hybrid learning mode for Mathematics learning.	315	3.54	4	1.40	0.0789
I prefer learning Mathematics online with my study groups.	315	2.32	2	1.22	0.0685
I prefer the online Mathematics learning environment to the face- to-face.	315	1.98	2	1.10	0.0617
I prefer assessment in the face-to-face form to the online.	315	4.14	5	1.22	0.0685

The analysis on students' preference on learning modes are presented in tables 7 and 8 respectively. It is clear from the tables that 60.9% and 76.2% of the respondents preferred the hybrid mode of teaching and learning of Mathematics and its traditional manner of assessments respectively. This is further confirmed with the high mean values of responses in table 8 as 3.54 and 4.14 respectively for the hybrid mode of teaching and learning of Mathematics and its traditional manner of assessments. It could also be observed from the tables that the high percentage values of 65.1, and 75.2 of the respondents with their corresponding low mean values of responses of 2.32 and 1.98 respectively kicked against the statements "I prefer learning Mathematics online with my study groups and "I prefer the online Mathematics learning environment to the face- to-face". Interestingly, an average of about 12.0% of the respondents were undecided on each of the statements about their preferences on the preferred mode of teaching and learning of Mathematics.

4.0 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Discussions

This study was conducted with the purpose to examine trainee-teachers' perceptions on traditional, online and hybrid learning modes of Mathematics learning environment. The study specifically was intended to answer research questions on how student-teachers perceive the various Mathematics learning modes and the most preferred learning mode in Mathematics instructional environment.

The results of the five Likert-type questionnaires based on four constructed sections including: Mathematics learning environment, Face-to-face Mathematics learning mode, Online Mathematics learning mode and Preferences of learning modes in Mathematics learning environments were analysed and represented using percentages of frequencies and statistical means of responses in descriptive tables.

The results with over 80% frequencies of students and above 4.0 mean of choice of responses per variables, it is empirically evident that students are mostly comfortable interacting and communicating with their tutors and colleagues in face-to-face Mathematics learning environment. Again, over 90% frequencies of the respondents and with more than 4.7 mean

values of responses for each variable alluded to the fact that the face-to-face learning of Mathematics enables them learn better, understand Mathematics concepts better, improves Mathematics learning ability and is most preferred. The hybrid, with about 60.9% frequencies and a mean of about 4.0, was evidently shown as the most preferred choice of learning mode in Mathematics learning environment by the students. However, with 76.2% frequencies and 4.14 variable mean, students' most preferred assessments in Mathematics learning should be in the face-to-face teaching-learning mode.

The findings of this study are in line with that of Krishnan (2016) which indicates students' mostly preferred choice of Mathematics learning mode is the face-to-face. On the contrary, the findings of Ary and Brune, (2011) showed that students preferred online learning mostly depending on the topic and the technology. On the other hand, the study by Fortune, Spielman and Pangelinan (2011) found no statistically significant differences in learning preference between those who enrolled in the online and face-to-face learning modes. The study of Mamattah (2016) also revealed that students preferred mode of study is the hybrid though they showed some interest in the online learning. In a study of Fidalgo, Thormann, Kulyk, & Lencastre (2020), the findings revealed that students were generally optimistic about blended learning and they also acknowledged the interdependencies between face-to-face learning and online learning.

Interestingly, it was observed that a significant percentage representation of the respondents were undecided on the variables. Particularly, on the preference of Mathematics learning mode, averagely about 12% of the respondents were undecided. This could be due to the fact that the online learning is ultimately a new learning mode introduced to students due to the unprecedented shift from face-to-face to online learning as a result of the inception of the COVID-19 pandemic. With this, the students might not be able to make any meaningful justification in comparison. In the same vain, the face-to-face as the most preferred mode of learning Mathematics by students could be justified for being the only mode they were used to over the years before the introduction of the online learning mode which came into existence recently due to the COVID-19 pandemic. This could also be related to the challenges faced in the online learning in the COVID-19 as most students' complaints are about poor internet connectivity and unavailability of the common Learning Management System (LMS) in the individual Colleges as well as not being abreast with technology use (Tsitsia et al, 2020).

Conclusion

This study focused on the Colleges of Education students' perception on various learning modes of Mathematics learning environment. The results revealed that the students' preferred modes of learning Mathematics are the face-to-face and the blended/hybrid.

Recommendations

We recommend resorting to the use of blended teaching and learning of Mathematics in the Colleges of Education in Ghana as this would meet the desire of students and would whip up their interest in Mathematics. The Colleges are advised to strengthen their Information Communication Technology facilities and resources to facilitate the integration of face-to-face and online teaching and learning.

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