TEACHERS' PERCEPTION TOWARD SYNCHRONOUS AND ASYNCHRONOUS APPROACHES IN TEACHING CHEMISTRY IN ENUGU AND ANAMBRA STATES, NIGERIA

By

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Abstract

This study examined teachers' perception of the use of synchronous and asynchronous electronic learning media in teaching chemistry. Four research questions guided the study. Descriptive survey design was adopted. The population of the study comprised of all chemistry teachers in both Anambra and Enugu sTATES. The sample was made up of 140 chemistry teachers who were selected using convenience sampling technique, because of the limited physical reach of teachers. A validated 24-item questionnaire, with a reliability coefficient of 0.87 was used to collect data. Data were analysed using frequency, percentages and bar charts. Results of the study showed that chemistry teachers had a greater positive perception towards the use of synchronous and asynchronous approaches in teaching chemistry. Also, chemistry teachers of 6-10years of experience had greater positive perception and rural teachers had more positive responses, when compared to urban teachers. It was concluded that chemistry teachers have positive perception towards the use of synchronous and asynchronous approaches in teaching chemistry. Therefore, it was recommended that both synchronous and asynchronous approaches should be used to teach chemistry, especially in this Post-COVID-19 era and workshop should be organized to train older teachers on how to effectively use these approaches.

Keywords: COVID-19, Synchronous Media, Asynchronous Media, Chemistry

Introduction

The world was on a halt, during the disruption of the COVID-19 pandemic, which had changed the procedures of things in each sector of the world, especially the education sector. COVID-19 was a deadly disease that widely spread throughout the world; it was an airborne disease that can be transferred through the touch and sneezing of an infected person to another. According to

the World Health Organization (2020), it was stated that COVID-19 stood for CO-Corona, VI-Virus and D-Disease, whose symptoms were fever, pneumonia, cough, the difficulty in breathing, and can be transmitted by touching the face of an infected person, touching contaminated surfaces, and through the touch of respiratory droplets of an infected person through sneezing and coughing. The Corona Virus Disease can only be prevented by washing hands always, covering of nose and face with mask, and staying at a distance from people, at least 6meters wide. The nature of the spread of COVID-19 and the preventive measure led to the lockdown of schools: primary, secondary and tertiary institutions. As indicated by Gostin and Wiley (2020) who stated that several preventive measures were taken by the governments to counter the spread of the disease. These measures were social distancing, closure of schools and universities, self-isolation and lessened travelling.The school lockdown really lasted for a long time and had changed a lot of things. Students were confined in to their homes doing nothing, even teachers in private schools were jobless for a while and that brought so many changes to the education system of Nigeria.

One of the changes that occured is the change of learning pattern from traditional method to online method. Online learning is generally known as electronic learning, which is defined as learning with the aid of technology (Ogbonna, Ibezim & Obi, 2019). Therefore, electronic learning involves the use of electronic gadgets to either acquire knowledge, skills and attitude either from the teacher separated by distance and time or from recorded videos and audios. There are two major forms of electronic learning, they are synchronous and asynchronous e-learning media (Aboderin & Kumuyi, 2013). Synchronous and asynchronous e-learning media all have different approaches to learning.

Synchronous e-learning media is a medium of electronic learning that involved the tutor and tutee in teaching and learning process at the same time live online. It is an immediate two-phase communication that happens at the same time between the teacher and students. According to Agah, Ocheni, Nwani, Asanga, Ezeanya and Ukwueze (2021) all students and instructors are obliged to be online at the same time when synchronous online media is used in teaching. When synchronous e-learning media is used in teaching, it enhances fruitful discussions between students and teacher, clear misunderstanding of students and allows immediate feedback from both teacher and students. Examples of synchronous e-learning media are the use of chats (like WhatsApp), video conferencing, free conferencing, web conferencing, among others. Other advantages of synchronous e-learning are that it is a similitude of a traditional classroom setting with the added advantage of time; it also improves interaction amongst students `and between students and teacher; it also improves the digital skills, communication skills and individualized learning. Apart from synchronous e-learning media, there is also asynchronous e-learning media.

Asynchronous e-learning media is also an electronic medium through which teacher and students connect for teaching-learning process at different time, that is to say it is a two-phase communication that does not happen at the same time. Asynchronous e-learning is a process that is centred on the learner and is not constrained by time and place (Shahabadi & Uplane, 2015). This means that the nature of asynchronous e-learning is organised in a way that allows learners to respond at their convenient time, and this can help them to be more focus and take more responsibility of their learning. According to Merisotis (2010), lessons, learning materials, assignments and test sent by the teacher can be accessed at any agreed range of time by the learners.Example of asynchronous e-learning media are; discussion boards, e-mail, narrated

slideshow, streaming audio and video, web books, document libraries, among others (Samuel & Tina, 2016). Asynchronous e-learning media has its advantages which are: it enable students to learn and respond at their own free time; it also provides more time for students to read further about the topic; it increases interaction among students and between students and teacher. It also allows learners to prepare their questions ahead of the next class for better understanding, but it slows down interaction between teachers and learners (Samuel & Tina, 2016). Both synchronous and asynchronous e-learning media can be advantageous to chemistry teaching and learning due to the present happenings of the world such as COVID-19 pandemic, hence may lead to a paradigm shift.

Chemistry also explains how food transforms from raw to cooked food, the preservation, utilization of food by the body and how ingredients interact to become food. All these processes are harnessed in the chemistry laboratory

Chemistryis a science subject that has to do with the study of chemical components of matter and its compounds. It explains the processes of reactions that occur in matter, which give rise to technological growth in terms of production of finished products (Beneth and Nwani, 2020). Therefore, there is a need to foster the teaching of Chemistry because from it, technological breakthrough is achieved. That is Chemistry is an essential subject that can advance the technology of a nation. Dave-Ugwu, Priscilla, and Nwosu (2018) stated that Chemistry is needed to acquire basic knowledge of the environment and develop self and the nation. The agents through which the agenda of technological advancement is going to burst despite the lockdown, are the chemistry teachers. Some factors such as experience and school location may influence teachers' perception of the use of synchronous and asynchronous approaches. Hadullo, Oboko and Omwenga (2018) stated that course design, social support, instructor characteristics, course assessment and institutional factors, among others are all factors that influence the quality of e-learning. Therefore, this study examined the influence of school location and teachers' experience on their perception of the use of synchronous and asynchronous e-learning media. To advance in the nation at all odds, there is a need to seek the perception of the teachers on the use of synchronous and asynchronous e-learning media in teaching Chemistry, to bring back the glory of the nation Nigeria.

Various studies have shown the impact of online learning. The study by Samuel and Tina (2016) indicated that synchronous and asynchronous media tools can be used for effective delivery in distance learning in a cloud computing system or environment. That is to say, the global nature of cloud allows learners to do their tests, assignments, exams, and have access to virtual interaction with fellow students and with their facilitator thereby creating a reliable distance learning. Similarly, Francis Pol (2017) affirmed that both synchronous and asynchronous communication tools have their respective usability and limitations in e-learning. Thus, it is important for facilitators and schools to know which one to apply at the right time, so as to promote effective learning. Equally, Ahmad and Bokhari (2013), looked at the combined effect of both synchronous and asynchronous e-learning in distance education. They asserted that both type of e-learning has its importance in different situation and they cannot fulfil the requirements individually. Therefore, both synchronous and asynchronous e-learning work effectively and completely when used together in distance education. Likewise, Obasa, Eludire, and Ajao (2013) researched on comparative study of synchronous and asynchronous e-learning

resources in the light of 'Elluminate' and 'Modular Object-Oriented Dynamic Learning Environment (MOODLE)'. They established that synchronous and asynchronous advanced high learning experiences and diverse instructional techniques, so technical skills are to be developed by the teachers and students to improve their use of ICT in learning and teaching.

Theoretical Framework

The study is anchored on "the Online Collaborative Learning" (OCL) theory by Linda Harasim (2012) and Community of Inquiry (COI) model by Garrison, Anderson and Archer (2000). The Online Collaborative Learning is a new learning theory that involved the use of internet facilities to provide a collaborative learning environment where knowledge is built to reshape formal, non-formal, and informal education for the knowledge age.The education system can be reshaped by the use of internet facilities like chat for discussion, video conferencing for synchronous classes etc. For a successful reshape of education, there are three phases through which knowledge can be constructed through dialogue. These phases in OCL are; idea generating, idea organizing and intellectual convergence.

i. Idea generating is the first phase of knowledge construction. This is the phase where different thoughts are gathered from each student on a topic of discussion.
ii. Idea organizing is the second phase of knowledge construction. This is the phase where ideas and opinions are compared, analyzed, and categorized during a discussion.
iii. Intellectual convergence is the third and the last phase where there are agreement and disagreement over ideas and opinions that have been raised between students and teacher.The ideas are synthesized and consensus are reached for the final conclusion.

The three stages or phases are the major ways through which knowledge can be constructed, since the teacher acts as the facilitator and students take up an active role in their learning through dialogue between them and their teacher. In this theory, the students are encouraged to collaboratively solve problems through discussion and brainstorming.

The Community of Inquiry (COI) model is based on the concept of three distinct "presences", namely; 'cognitive, social, and teaching'. The model supports online learning as an active learning environment or community that is dependent on the students and instructor sharing ideas and opinions on a topic. The model also states that "presence" is a social phenomenon that shows when students and instructors interact among themselves using video conferencing, blogs, wikis, discussion boards etc. The three presences (i.e. cognitive, social, and teaching) mustbe intertwined to create a favorable "learning experience" for the students, that is to say, there must be a content to be learned (cognitive presence), an interaction between teacher and students (social presence), and a process of transferring knowledge, skills and attitude through teaching (teaching presence) to create a learning experience, which means without the three distinct presence, there will not be a learning experience.

Statement of the Reseach Problem

Since the outburst of the COVID-19 pandemic all over the world, great changes have occurred in almost all sectors of the world, especially the education sector. Schools were on lockdown for a long time and this has influenced the education system, has been gradually shifting from face-to-face learning to electronic learning. These changes have posed new challenges for teachers, who are known as the agents of change in every country. They are the vehicle through which

new technology is introduced.For this reason, the study seeks the perception of Chemistry teachers on the use of synchronous and asynchronous approaches in teaching Chemistry.

Purpose of the Study

The following specific objectives guided the study, which are to determine:

i. the perception of Chemistry teachers in the use of synchronous approach in teaching Chemistry
ii. the perception of chemistry teachers in the use of the asynchronous approach in teaching Chemistry
iii. the perception of chemistry teachers in the use of synchronous approachwith respect to their years of teaching experience
iv. the perception of chemistry teachers in the use of asynchronous approach with respect to their years of teaching experience

Research Questions

The following research questions guided the study:

i. What are the perceptions of Chemistry teachers in the use of synchronous approach in teaching chemistry?
ii. What are the perceptions of Chemistry teachers in the use of asynchronous approach in teaching Chemistry?
iii. What are the perceptions of Chemistry teachers in the use of synchronous approach with respect to their years of teaching experience?
iv. What are the perceptions of Chemistry teachers in the use of asynchronous approach with respect to their years of teaching experience?

Methodology

The study adopted a descriptive survey design. The design was chosen because, the study seeks to collect data from Chemistry teachers, their views on the use of synchronous and asynchronous approaches in teaching Chemistry. The population of the study comprised of all chemistry teachers in both Enugu and Anambra State, Nigeria. A sample of one hundred and forty (140) Chemistry teachers was used. The sample was selected using Convenience sampling technique; this was because of the limited physical accessibility of chemistry teachers during the COVID-19 period. The instrument used to collect data was a googgle form questionnaire. The questionnaire was titled "Chemistry Teacher Perception of Synchronous and Asynchronous Questionnaire (CTPSAQ)". The questionnaire has two (2) sections, with two clusters. Section A collected information on Chemistry teachers' nature of school location and years of experience. Section B elicites Chemistry teachers' agreement or disagreement; there were two clusters in this section. The first cluster was on the use of synchronous e-learning while cluster two was on asynchronous e-learning. The questionnaire was a positive 4-response scale which is: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

The instrument was duly validated by three experts, one from Chemistry Education, two from Measurement and Evaluation, all from University of Nigeria, Nsukka.Their comments were used to enhance the validity of the instrument. The reliability coefficientof 0.87 was obtained using Cronbach's Alpha technique, after distributing the sample questionnaire to 30 respondents who have similar characteristics in a different area. The reliability estimate indicated that the

instrument is reliable. Frequency, percentages and bar charts were used to analyse the data collected. Frequency, percentage and bar charts were used because the nature of the data is ordinal.

Results

Research Question One: What are the perceptions of Chemistry teachers in the use of synchronous approach in teaching Chemistry?

Table 1: Perceptions of Chemistry teachers in the use of synchronous approach in teaching Chemistry

SN	ITEM STATEMENT	N	SA		A		D		SD	
			Freq	%	Freq	%	Freq	%	Freq	%
1	Teaching chemistry through video conferencing saves time	140	44	31.4	71	50.7	25	17.9	-	-
2	Teaching chemistry throughvideo conferencing improves interaction between teachers and students	140	50	35.7	53	37.9	29	20.7	8	5.7
3	Chemistry teachers can easily ask students questions and clarify misunderstanding of students via video conferencing platform	140	23	16.4	103	73.6	6	4.3	8	5.7
4	Chemistry can be effectively taught when both teacher and students are present online via video conferencing platform at the same time	140	28	20.0	96	68.6	16	11.4	-	-
5	Chemistry teachers can use WhatsApp for further discussion and deliberation of topics in chemistry	140	22	15.7	108	77.1	10	7.1	-	-
6	The use of WhatsApp for discussion slows down the rate of communication	140	35	25.0	47	33.6	58	41.4	-	-
7	The quality of bandwidth determines the quality of video conferencing for teaching chemistry	140	46	32.9	80	57.1	14	10.0	-	-
8	The use of video conferencing in teaching chemistry enhances instant feedback during teaching but can be expensive	140	55	39.3	73	52.1	12	8.6	-	-
9	The use of web conferencing improves the digital skills of chemistry teachers	140	65	46.4	59	42.1	16	11.4	-	-
10	Teaching chemistry through video conferencing enhance interaction between students and their colleagues	140	57	40.7	63	45.0	20	14.3	-	-
11	The use of video conferencing greatly improves the learning of chemistry through co-operate learning among students.	140	17	12.1	79	56.4	44	31.4	-	-
12	Lesson notes can easily be distributed to students during teaching of chemistry via zoom	140	31	22.1	83	59.3	26	18.6	-	-

The result in table 1 showed the perception of Chemistry teachers in the use of synchronous approach in teaching Chemistry. The result revealed that 115 (82.10%) of the teachers agree that teaching Chemistry through video conferencing saves time, 103 (73.60%) of teachers agrees that teaching Chemistry through video conferencing improves interaction between

teachers and students, 126 (90%) of teachers agree that chemistry teachers can easily ask students questions and clarify misunderstanding of students via video conferencing platform, 124 (88.60%) of teachers agree that chemistry can be effectively taught when both teacher and students are present online via video conferencing platform at the same time, 130 (92.80%) of teachers agree that Chemistry teachers can use WhatsApp for further discussion and deliberation of topics in Chemistry, 82 (58.60%) of the teachers agree that the use of WhatsApp for discussion slows down the rate of communication, 126 (90%) of teachers agree that the quality of bandwidth determines the quality of video conferencing for teaching Chemistry, 128 (91.40%) of teachers agree that the use of video conferencing in teaching chemistry enhances instant feedback during teaching but can be expensive, 124 (88.50%) of teachers agree that the use of web conferencing improves the digital skills of Chemistry teachers, 120 (85.70%) of teachers agree that teaching Chemistry through video conferencing enhance interaction between students and their colleagues, 96 (68.50%) of teachers agree that the use of video conferencing greatly improves the learning of chemistry through co-operate learning among students, 114 (81.40%) of teachers agree that lesson notes can easily be distributed to students during teaching of Chemistry via zoom. From the ongoing, the inference drawn is that teachers have a positive perception of synchronous approach in teaching Chemistry.

Research Question 2: What are the perceptions of Chemistry teachers in the use of asynchronous approach in teaching Chemistry?

Table 2: Perceptions of Chemistry teachers in the use of asynchronous approach in teaching Chemistry

S/N	ITEM STATEMENT	N	SA		A		D		SD	
			Freq	%	Freq	%	Freq	%	Freq	%
1	Chemistry can be best understood when web links are sent to students to access additional learning resources.	140	24	17.1	65	46.4	51	36.4	-	-
2	Chemistry is best understood when streaming videos (i.e. recorded videos) of lessons are sent to students to listen, watch and study	140	32	22.9	78	55.7	30	21.4	-	-
3	Students carry out individual projects efficiently when instructions and direction are provided via recorded video	140	32	22.9	69	49.3	39	27.9	-	-
4	Students understand chemistry better when e-books are sent to them via email to study	140	24	17.1	50	35.7	66	47.1	-	-
5	Chemistry teacher feedback/response to students via email can enhance individualized learning for better understanding of chemistry	140	23	16.4	111	79.3	6	4.3	-	-
6	Sending lesson videos and lesson notes to students makes them active participants of their learning	140	-	-	101	72.1	39	27.9	-	-
7	The use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research	140	29	20.7	88	62.9	23	16.4	-	-
8	Chemistry students reflective thinking is greatly improved when streaming audio and video (i.e. recorded audio and video) of lessons are sent to them	140	40	28.6	76	54.3	24	17.1	-	-
9	The use of messaging via email before chemistry teaching improves interaction between chemistry teachers and students	140	39	27.9	82	58.6	19	13.6	-	-
10	There may be misinterpretation of instructions given by chemistry teachers to students via email	140	36	25.7	79	56.4	25	17.9	-	-
11	Sending learning materials to students through postal services enhance self-study which is appropriate for studying chemistry	140	9	6.4	42	30.0	64	45.7	25	17.9
12	Sending learning materials to students enables them to be adequately prepared for chemistry instructions	140	46	32.9	80	57.1	14	10.0	-	-

The result in table 2 showed the perception of chemistry teachers in the use of asynchronous approach in teaching chemistry. The result revealed that 89 (63.50%) of teachers agree that Chemistry can be best understood when web links are sent to students to access additional learning resources, 110 (78.60%) of teachers agree that Chemistry is best understood when streaming videos (i.e. recorded videos) of lessons are sent to students to listen, watch and study, 74 (52.80%) of teachers agree that students carry out individual projects efficiently when instructions and direction are provided via recorded video, 134 (95.70%) teachers agree that students understand Chemistry better when e-books are sent to them via email to study, 101 (72.10%) teachers agree that Chemistry teacher feedback/response to students via email can enhance individualized learning for better understanding of chemistry, 117 (83.60%) of teachers agree that the use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 116 (82.90%) of teachers agree that the use of

streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 121 (86.50%) of teachers agree that Chemistry students reflective thinking is greatly improved when streaming audio and video (i.e. recorded audio and video) of lessons are sent to them, 115 (82.10%) of teachers agree that the use of messaging via email before Chemistry teaching improves interaction between chemistry teachers and students, 51 (36.40%) of teachers agree that there may be misinterpretation of instructions given by Chemistry teachers to students via email, 126 (90%) of teachers agree that sending learning materials to students through postal services enhance self-study which is appropriate for studying Chemistry. From the ongoing, the inference drawn is that teachers have a positive perception of asynchronous approach in teaching Chemistry.

Research Question Three: What are the perceptions of Chemistry teachers in the use of synchronous approach with respect to their years of teaching experience?

Table 3: Perceptions of Chemistry teachers in the use of synchronous approach with respect to their years of teaching experience

S/N	ITEM STATEMENT	Years of Teaching Experience	Synchronous Approach							
			SA		A		D		SD	
			F	%	F	%	F	%	F	%
1	Teaching Chemistry through video conferencing saves time	0-5 years	25	17.9	33	23.6	25	17.9	-	-
		6-10 years	19	13.6	32	22.9	00	-	-	-
		26-30 years	00	-	06	4.3	00	-	-	-
2	Teaching Chemistry through video conferencing improves interaction between teachers and students	0-5 years	31	22.1	21	15.0	23	16.4	08	5.7
		6-10 years	19	13.6	32	22.9	00	00	00	00
		26-30 years	00	-	00	-	06	00	00	-
3	Chemistry teachers can easily ask students questions and clarify misunderstanding of students via video conferencing platform	0-5 years	23	16.4	52	37.1	00	00	08	5.7
		6-10 years	00	-	51	36.4	00	00	00	00
		26-30 years	00	-	00	-	06	11.4	00	00
4	Chemistry can be effectively taught when both teacher and students are present online via video conferencing platform at the same time	0-5 years	19	13.6	64	45.7	00	-	-	-
		6-10 years	09	6.4	32	22.8	10	7.1	-	-
		26-30 years	00	-	00	-	06	4.2	-	-
5	Chemistry teachers can use WhatsApp for further discussion and deliberation of topics in chemistry	0-5 years	16	11.4	67	47.9	00	-	-	-
		6-10 years	06	4.3	35	25.0	10	7.1	-	-
		26-30 years	00	-	06	4.2	00	0.0	-	-
6	The use of WhatsApp for discussion slows down the rate of communication	0-5 years	16	11.4	35	25.0	32	22.9	-	-
		6-10 years	19	13.6	06	4.2	26	18.6	-	-
		26-30 years	00	-	06	4.2	00	0.0	-	-
7	The quality of bandwidth determines the quality of video conferencing for teaching chemistry	0-5 years	37	26.4	38	27.1	08	5.7	-	-
		6-10 years	09	6.4	42	30.0	00	0.0	-	-
		26-30 years	00	00	00	00	06	4.2	-	
8	The use of video conferencing in teaching Chemistry enhances instant feedback during teaching but can be expensive	0-5 years	37	26.4	40	28.6	06	4.2	-	-
		6-10 years	18	12.9	33	23.6	00	00	-	-
		26-30 years	00	00	00	00	06	4.2	-	-
9	The use of web conferencing improves the digital skills of Chemistry teachers	0-5 years	30	21.4	53	37.9	00	00	-	-
		6-10 years	35	25.0	06	4.2	10	7.1	-	-
		26-30 years	00	00	00	00	06	4.2	-	-
10	Teaching Chemistry through video conferencing enhance interaction between students and their colleagues	0-5 years	23	16.4	46	32.9	14	10.0	-	-
		6-10 years	34	24.3	17	12.1	00	00	-	-
		26-30 years	00	00	00	00	06	4.2	-	-
11	The use of video conferencing greatly improves the learning of Chemistry through co-operate learning among students.	0-5 years	08	5.7	52	37.1	23	16.4	-	-
		6-10 years	09	6.4	27	19.3	15	10.7	-	-
		26-30 years	00	00	00	00	06	4.2	-	-
12	Lesson notes can easily be distributed to students during teaching of Chemistry via zoom	0-5 years	25	17.9	41	29.3	09	6.4	-	-
		6-10 years	09	6.4	36	25.7	06	4.2	-	-
		26-30 years	00	00	06	4.2	00	00	-	-

The result in Table 3 showed the perception of chemistry teachers in the use of synchronous approach with respect to their years of teaching experience. The result revealed that teachers with teaching experience between 0 – 5 years, 48 (41.50%) agree that teaching Chemistry through video conferencing saves time, 52 (37.10%) agrees that teaching Chemistry through video conferencing improves interaction between teachers and students, 75 (53.50%) agree that

chemistry teachers can easily ask students questions and clarify misunderstanding of students via video conferencing platform, 83 (59.30%) agree that Chemistry can be effectively taught when both teacher and students are present online via video conferencing platform at the same time, 83 (59.30%) agree that Chemistry teachers can use WhatsApp for further discussion and deliberation of topics in Chemistry, 82 (58.60%) agree that the use of WhatsApp for discussion slows down the rate of communication, 51 (36.40%) agree that the quality of bandwidth determines the quality of video conferencing for teaching Chemistry, 75 (53.50%) agree that the use of video conferencing in teaching Chemistry enhances instant feedback during teaching but can be expensive, 77 (55.00%) agree that the use of web conferencing improves the digital skills of chemistry teachers, 83 (59.30%) agree that teaching chemistry through video conferencing enhance interaction between students and their colleagues, 69 (49.30%) agree that the use of video conferencing greatly improves the learning of Chemistry through co-operate learning among students, 60 (42.80%) agree that lesson notes can easily be distributed to students during teaching of Chemistry via zoom. From the ongoing, the inference drawn is that teachers with 0 – 5 years teaching experience have a positive perception of synchronous approach in teaching Chemistry.

The result revealed that teachers with teaching experience between 6 – 10 years, 51 (36.50%) agree that teaching Chemistry through video conferencing saves time, 51 (36.50%) agrees that teaching chemistry through video conferencing improves interaction between teachers and students, 51 (36.40%) agree that Chemistry teachers can easily ask students questions and clarify misunderstanding of students via video conferencing platform, 41 (29.20%) agree that chemistry can be effectively taught when both teacher and students are present online via video conferencing platform at the same time, 41 (29.30%) agree that chemistry teachers can use WhatsApp for further discussion and deliberation of topics in Chemistry, 25 (17.80%) agree that the use of WhatsApp for discussion slows down the rate of communication, 51 (36.40%) agree that the quality of bandwidth determines the quality of video conferencing for teaching Chemistry, 51 (36.50%) agree that the use of video conferencing in teaching Chemistry enhances instant feedback during teaching but can be expensive, 41 (29.20%) agree that the use of web conferencing improves the digital skills of Chemistry teachers, 51 (36.40%) agree that teaching chemistry through video conferencing enhance interaction between students and their colleagues, 36 (25.70%) agree that the use of video conferencing greatly improves the learning of chemistry through co-operate learning among students, 45 (32.10%) agree that lesson notes can easily be distributed to students during teaching of Chemistry via zoom. From the ongoing, the inference drawn is that teachers with 6 -10 years teaching experience have a positive perception of synchronous approach in teaching Chemistry.

The result revealed that teachers with teaching experience between 26 – 30 years, 6 (4.30%) agree that teaching Chemistry through video conferencing saves time, 6 (4.20%) agree that Chemistry teachers can use WhatsApp for further discussion and deliberation of topics in chemistry, 6 (4.20%) agree that the use of WhatsApp for discussion slows down the rate of communication, 6 (4.2%) agree that lesson notes can easily be distributed to students during teaching of Chemistry via zoom. From the ongoing, the inference drawn is that teachers with

26-30 years teaching experience have a low perception of synchronous approach in teaching Chemistry.

Research Question 4: What are the perceptions of Chemistry teachers in the use of asynchronous approach with respect to their years of teaching experience?

Table 4: Perceptions of Chemistry teachers in the use of asynchronous approach with respect to their years of teaching experience

S/N	ITEM STATEMENT	Years of Teaching Experience	Asynchronous Approach							
			SA		A		D		SD	
			F	%	F	%	F	%	F	%
1	Chemistry can be best understood when web links are sent to students to access additional learning resources.	0-5 years	15	10.7	23	16.4	45	32.1	-	-
		6-10 years	09	6.4	42	30.0	00	00	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
2	Chemistry is best understood when streaming videos (i.e. recorded videos) of lessons are sent to students to listen, watch and study	0-5 years	23	16.4	36	25.7	24	17.1	-	-
		6-10 years	09	6.4	42	30.0	00	00	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
3	Students carry out individual projects efficiently when instructions and direction are provided via recorded video	0-5 years	17	12.1	52	37.1	14	10.0	-	-
		6-10 years	15	10.7	17	12.1	19	13.6	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
4	Students understand chemistry better when e-books are sent to them via email to study	0-5 years	15	10.7	24	17.1	44	31.4	-	-
		6-10 years	09	6.4	26	18.6	16	11.4	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
5	Chemistry teacher feedback/response to students via email can enhance individualized learning for better understanding of chemistry	0-5 years	14	10.0	69	49.3	00	00	-	-
		6-10 years	09	6.4	42	30.0	00	00	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
6	Sending lesson videos and lesson notes to students makes them active participants of their learning	0-5 years	-	-	75	53.6	08	5.7	-	-
		6-10 years	-	-	26	18.6	25	17.9	-	-
		26-30 years	-	-	00	00	06	4.3	-	-
7	The use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research	0-5 years	14	10.0	61	43.6	08	5.7	-	-
		6-10 years	15	10.7	27	19.3	09	6.4	-	-
		26-30 years	00	00	00	00	06	4.3	-	-
8	Chemistry students reflective thinking is greatly improved when	0-5 years	31	22.4	44	31.4	08	5.7	-	-
		6-10 years	09	6.4	32	22.9	10	7.1	-	-

	streaming audio and video (i.e. recorded audio and video) of lessons are sent to them	26-30 years	00	00	00	00	06	4.3	-	-
9	The use of messaging via email before chemistry teaching improves interaction between chemistry teachers and students	0-5 years	15	10.7	59	42.1	09	6.4	-	-
		6-10 years	24	17.1	17	12.1	10	7.1	-	-
		26-30 years	00	00	06	4.3	00	00	-	-
10	There may be misinterpretation of instructions given by chemistry teachers to students via email	0-5 years	08	5.7	50	35.7	25	17.9	-	-
		6-10 years	28	20.0	23	16.4	00	00	-	-
		26-30 years	00	00	06	4.3	00	00	-	-
11	Sending learning materials to students through postal services enhance self-study which is appropriate for studying chemistry	0-5 years	09	6.4	16	11.4	42	30.0	16	-
		6-10 years	00	00	26	18.6	16	11.4	09	-
		26-30 years	00	00	00	00	06	4.3	00	-
12	Sending learning materials to students enables them to be adequately prepared for chemistry instructions	0-5 years	22	15.7	53	37.9	08	5.7	-	-
		6-10 years	24	17.1	27	19.3	00	00	-	-
		26-30 years	00	00	00	00	06	4.3	-	-

The result in table 4 showed the perception of Chemistry teachers in the use of asynchronous approach in teaching Chemistry with respect to their years of teaching experience. The result revealed that teachers with 0 – 5 years teaching experience, 38 (27.10%) agree that Chemistry can be best understood when web links are sent to students to access additional learning resources, 59 (42.10%) agree that Chemistry is best understood when streaming videos (i.e. recorded videos) of lessons are sent to students to listen, watch and study, 69 (49.20%) agree that students carry out individual projects efficiently when instructions and direction are provided via recorded video, 39 (72.80%) agree that students understand Chemistry better when e-books are sent to them via email to study, 83 (59.30%) agree that Chemistry teacher feedback/response to students via email can enhance individualized learning for better understanding of Chemistry, 75 (53.60%) agree that the use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 75 (53.60%) agree that the use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 74 (52.80%) agree that Chemistry students reflective thinking is greatly improved when streaming audio and video (i.e. recorded audio and video) of lessons are sent to them, 58 (41.40%) agree that the use of messaging via email before Chemistry teaching improves interaction between Chemistry teachers and students, 25 (17.80%) agree that there may be misinterpretation of instructions given by chemistry teachers to students via email, 75 (53.60%) agree that sending learning materials to students through postal services enhance self-study which is appropriate for studying Chemistry. From

the ongoing, the inference drawn is that teachers have a positive perception of asynchronous approach in teaching Chemistry.
The result revealed that teachers with 6 – 10 years teaching experience, 51 (36.40%) agree that Chemistry can be best understood when web links are sent to students to access additional learning resources, 51 (36.40%) agree that Chemistry is best understood when streaming videos (i.e. recorded videos) of lessons are sent to students to listen, watch and study, 32 (22.80%) agree that students carry out individual projects efficiently when instructions and direction are provided via recorded video, 35 (25.00%) agree that students understand Chemistry better when e-books are sent to them via email to study, 51 (36.40%) agree that Chemistry teacher feedback/response to students via email can enhance individualized learning for better understanding of Chemistry, 26 (18.60%) agree that the use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 42 (30.00%) agree that the use of streaming video (i.e. recorded videos) of lessons creates more time for students to study and carry out further research, 41 (29.30%) agree that Chemistry students reflective thinking is greatly improved when streaming audio and video (i.e. recorded audio and video) of lessons are sent to them, 41 (29.20%) agree that the use of messaging via email before chemistry teaching improves interaction between chemistry teachers and students, 51 (36.40%) agree that there may be misinterpretation of instructions given by Chemistry teachers to students via email, 26 (17.80%) agree that sending learning materials to students through postal services enhance self-study which is appropriate for studying Chemistry. From the ongoing, the inference drawn is that teachers with 6 – 10 years teaching experience have a positive perception of asynchronous approach in teaching Chemistry.
The result revealed that teachers with 26 – 30 years teaching experience, 6 (4.30%) agree that the use of messaging via email before Chemistry teaching improves interaction between Chemistry teachers and students, 6 (4.30%) agree that there may be misinterpretation of instructions given by chemistry teachers to students via email, From the ongoing, the inference drawn is that teachers with 26-30 years teaching experience have a low perception of asynchronous approach in teaching Chemistry.

Discussion of the Findings

The result of research question one as presented in Table 1 showed that Chemistry teachers had more positive responses than negative responses. This finding is in line with the finding of Ahmad and Bokhari (2013), who stated that synchronous and asynchronous e-learning is very effective when used together. The similarity in findings may be as result of uniformity of network around the world.

The result of research question two as presented in Table 2 showed that Chemistry teachers had more positive perception towards the use of asynchronous approach than negative responses. This finding agrees with the findings of Obasa, Eludire, and Ajao (2013), who stated that the use of both asynchronous and synchronous advances high learning and instructional techniques.

The result of research question three and four as presented in Table 3 and Table 4 showed that chemistry teachers with 6-10years of teaching experience had greater positive perception of both the use of synchronous and asynchronous, followed by teachers with 0-5years and 26-30 years of teaching experience, while teachers with 26-30years had more negative response towards the use of both synchronous and asynchronous approaches. The finding conforms to the

finding of Francis Pol (2017), who affirmed that facilitators and schools ought to know the right time to either use synchronous or asynchronous tools, so as to promote learning. This result can be attributed to different levels of teacher's exposure to ICT gadgets and usage.

Conclusion

Teachers have positive perception towards the use of synchronous and asynchronous approaches; therefore should be used in teaching chemistry, especially in this Post-COVID-19 period, so as to enable learners from various places and time zones to easily connect to classes online.

Recommendations

Based on the findings, the following recommendations were made:

1. Synchronous electronic learning media, such as video conferencing should be used to teach Chemistry
2. Asynchronous electronic learning media, such as email should be used in conjunction with synchronous electronic learning media, so as to make distance learning more interesting and reliable.
3. Workshop should be organized for older Chemistry teachers, so as to train them to be digitally outstanding, in order to make teaching and assessment easier.

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