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Effectiveness of Two Modes of Distance Learning on Nigerian College Teachers' Meaningful Understanding of Chemistry Concepts

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The author appreciates Early Years Exposure to Science (EYES) in Nigeria that allowed its workshop trainees to participate in the two modes of distance learning described in this study.

Abstract
This study has assessed meaningful understanding of chemistry concepts by College teachers using Live and Video Modes of distance Learning. It has examined if gender could influence college teachers understanding of chemistry concepts meaningfully. It was a quasi-experimental study with a sample size of Ninety-Four (94) college teachers drawn from Forty-Seven (47) State Colleges of Education in Nigeria. The instrument used for data collection was a Multiple-choice Objective Chemistry Test (MOCT). Data was analyzed using t-test based on the standard alpha level of $p<0.05$ and simple percentages. The findings showed that the live mode was more effective than the video mode such that, teachers in the interactive television that used personal cell phones (GSM technology) on the live mode of distance learning performed better on MOCT than those in the video mode. A significant gender influence was observed such that males in the live mode out-performed the females on the live mode and video mode in the MOCT respectively. The study therefore has recommended that college teachers who are not biased in chemistry and females in particular should strive for excellence in attending live mode distance learning programmes with adequate commitment. This would promote meaningful understanding of some perceived difficult Chemistry concepts and thus enhance quality lesson delivery for performance improvement in chemistry. It concludes that adequate incentives and flexibility on the use of live-mode distance learning could help in building up a desired collaborative professional network especially for those college teachers who are not chemistry specialists and ultimately could improve the teaching of chemistry meaningfully in Nigeria Colleges of education.

Keywords: College Teachers, Chemistry Concepts, Live and Video Modes of Distance Learning.

1. Introduction

In Nigeria and most developing countries around the world, it is an established fact that students are generally not performing well in Science (Chemistry) and mathematics when compared with their performance in other subjects (Adedayo, 2001). Some researchers have identified a lot of woes in the teaching and learning of Sciences (Chemistry) in Nigeria, to include poor background in Chemistry (Science); biological disposition of women; ineffective teaching methods; inadequate knowledge of the subject matter; negative attitude and lack of interest in Science and Chemistry in particular; poor study habits; overloaded and poor implementation of curriculum; low self-concept and poor remuneration of science teachers; inadequate instructional and infrastructural facilities among others (Animalu, 2000; Bajah & Bozimo, 1989; 1998;Longe, 2010 and Okafor, 2003). Jegede (2002), Nsofor (2001) and Okeke (2007) opined that all is not well with the teaching of science in Nigeria by emphasizing that the teaching of science is often characterized by textbook domination, rote memorization, inadequate science practical, poor understanding of scientific principles and methods, inadequate professional development of science teachers, obsolete teaching techniques and gender gaps. Every country today craves for meaningful training of their 'would be' science teachers through compliance with Information and Communication Technology (ICT) (Okafor, 2003). Some of these College teachers or pre-service science teachers are biased in their respective science subjects (like Biology; Physics; Technology; Home Economics and Agricultural Science) but not in Chemistry and thus, after graduation, may be compelled to teach Chemistry in their schools of primary assignment. Due to the observed woes in the teaching pedagogy and shallow knowledge of some Chemistry concepts by some of these College teachers, this study attempts to ascertain if the Live mode and Video mode of distance learning could contribute to the effective and efficient teaching and meaningful comprehension of some chemistry concepts by the College teachers especially those, who are not biased in Chemistry.

Early distance learning started with tribal (village) elders, gathering in meetings, festivals, funerals and other ceremonies outside their residence to share information (Okafor, 2003). Presently, ICT is used to deliver information without traveling to a far distance (Cornell, 1990). The most significant premise of distant learning is the teaching of target audience in specific fields of education (Slavin 2002). It is obvious that distance learning would enhance quality teaching delivery and improve students' achievements and meaningful understanding of concepts (Okafor, 2006). Students are also ready to learn when teachers are prepared to teach effectively and efficiently (Bruner 1960). What teachers understand and practice influence what students learn (Ivowi, 1996). Consequently, achieving high level of students understanding of chemistry concepts requires skillful teachers that are organized and ready to undergo teacher preparation programmes and in-service training. Some teachers who have gone through rigorous teacher preparation programmes in higher institutions for either three (3), four (4) or even five (5) years are often times deficient on content knowledge but focus mostly on methodologies (Okafor 2006). Poor background of female science teachers combined with inadequate instructional and infrastructural facilities in the Colleges make teaching uninteresting and difficult especially for the novice chemistry teachers (Mulholand, 2003). Gender differences and the problem of teachers' unpreparedness ultimately have cascading and compounding effect on the students learning outcomes (Bajah & Bozimo, 1989; Bajah & Okafor, 1998; Nsofor, 2001 and Slavin, 2002). It is against this background that this study has focused on interactive television (Live Mode) and Re- Played Video-Tape (Video Mode) as two forms of distance learning and to investigate if they could enhance meaningful understanding of chemistry concepts by the College teachers.

2. Statement of Problem

It is vital that college teachers keep pace with the challenges of modern teaching strategies that are used in delivering chemistry concepts meaningfully to the learners. This study therefore has assessed the effectiveness of Live and Video modes of distance learning on college teachers' meaningful understanding of chemistry concepts. It has further examined if gender could influence College teachers' understanding of chemistry concepts when exposed to the two modes of distance learning differently.

2.1. Hypotheses

Based on the stated problem, this study tested the following hypotheses.

HOI: There is no significance difference between the Live and Video Modes of distance learning for meaningful understanding of chemistry concepts by the College Teachers'

HO2: There is no significance difference between male and female College Teachers exposed differently on Live and Video Modes of distance learning for meaningful understanding of chemistry concepts.

2.2. Operational Definitions

In this study, some terms were used with some contextual meanings. Their definitions are listed below.

Distance Learning: This is a non-formal in-service training (workshop) given to the College Teachers Some of them are Science generalists but would be compelled to teach Chemistry after graduation.

The two modes of distance Learning includes:

- Live Mode. This was an interactive television whereby the Facilitator, made live presentation. It was also a two -way communication that allowed the Facilitator and the Participants to be at a distance yet able to interact with each other using Personal Cell Phones (GSM technology).
- Video Mode. This was also a live presentation that was video- tape recorded, to be re-played. It was also a video-taped delayed session of the same Facilitator which can be broadcasted over the same channel.

3. Methodology

The research was a quasi-experimental study where an intact class was used to garner reactions on the effectiveness of the two modes of distance learning on college teachers' meaningful understanding of chemistry concepts.

This study strictly focused on College Teachers drawn from Forty-Seven (47) State Colleges of Education in Nigeria.

The chemistry concepts taught were limited to three (3).

- Periodicity
- Bonding (Covalent, Metallic, Ionic)
- Energy and Chemical Reactions

These concepts were chosen because they fall within the first semester scheme of work for the College Teacher Education Programme. The result of the study was limited to the defined target population that was sampled.

3.1. Sample and Sampling Technique

Two science teachers were randomly drawn from each of the 47 State Colleges of Education in Nigeria. The sample consisted of 94 College of Education Teachers (50 males and 44 females) who were science generalists and not biased in chemistry but would be compelled to teach chemistry after graduation from the College. They all participated in a two-day workshop organized by the Early Years Exposure to Science (EYES) in Nigeria. Their ages ranged between 35 and 52, with over 15 years teaching experience.

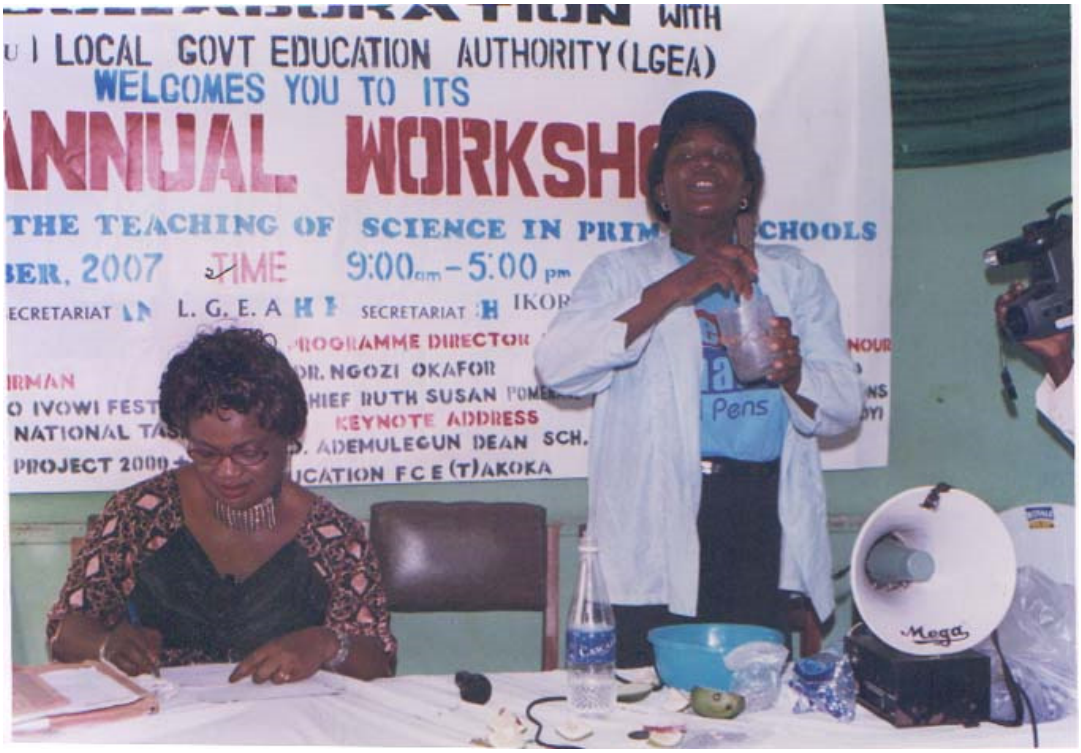
The instrument used for the study was Multiple-choice Objective Chemistry Test (MOCT). MOCT was a 20-item test with four options drawn by the researcher from the three Chemistry concepts as stated above. The weighting was five marks for each correct answer. The reliability index of r=0.77 was obtained using Kuder Richardson Formula 20 for internal consistency of the items.

T-test and simple percentages were used in data analysis. This was based on standard alpha level of $P<0.05$.

3.2. Procedure

94 College of Education Teachers who participated in the workshop were put into two equal groups of 47 each. A group was taught in a Live mode session (see figure 1 below). The Live- Mode group members were seated in a Centre for Educational Technology (CET) room of Federal College of Education (Technical),Akoka that contained television on which they could interact with the Guest Speaker (facilitator) with their personal cell phones, and who is also biased in chemistry. The facilitator's voice and image could be heard and seen on the screen by the college teachers (participants). The participants interacted with the facilitator through their personal cell phones (GSM). After presentation of the concepts by the facilitator for 30 minutes, participants were given two (2) minutes each to ask questions among themselves and also to the facilitator. The facilitator responded to all their questions. An hour later, Multiple-choice Objective Chemistry Test (MOCT) was administered on them by the researcher.

Figure 1: Live Mode presentation by the facilitator at the 2007 workshop of the Early Years Exposure to Science (EYES) in Nigeria



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The video-tape recorded mode group (see figure 2 below) listened to the tape-recorded presentation of the same facilitator on the chemistry concepts under the guidance of the researcher for 30 minutes. They had no opportunity to discuss with the facilitator, but they discussed among themselves. MOCT was also administered to them as in the Live Mode session.

Figure 2: A group of participants listening to Video-Tape- Recorded presentation of the Facilitator

3.3. Results and Discussions

The presentation of results and discussion are shown below as reflected on the hypotheses.

Table 1: This Table 1 shows the **e**ffectiveness of Live and Video Modes on College teachers' meaningful understanding of chemistry concepts.

Mode Contrast	Mean Contrast	Df	T	Significance
Live	0.84	103	2.77	0.01
Video	0.72	81.1	-1	0.31

The Multiple-choice Objective Chemistry Test (MOCT) option chosen by the participants allowed for explanations of their meaningful understanding of chemistry concepts in the two modes of distance learning. Although there was a strong concepts effects, but they did not alter the effects of the two modes. The T-test between the means for the two modes showed that the live mode was more effective than the video mode as shown in Table 1. This study indicated also that the participants understood chemistry concepts better in the live mode than the video mode. This is in agreement with Woodruff and Mosby (1996) findings that meaningful learning can hardly take place when teachers and students are physically separated during the teaching-learning process. Another explanation for the live Mode group superiority was that, the participants were able to interact and share their views with the facilitator using their individual cell phones.

Indeed, live mode distance learning that involved the use of GSM technology has impacted and will continue to impact on methods of teaching and meaningful understanding of Chemistry concepts in modern times. Perhaps, the combination of live mode, GSM technology, personal interaction and immediate feedback may have better potentials to revolutionize how the Science generalist can meaningfully teach Chemistry in schools after graduation.

On the other hand, the Video-Taped group did not have the same opportunity for immediate feedback with the facilitator. Though the video- tape could be played synchronously or asynchronously at the discretion of the subjects in the Video group, but the group did not have the opportunity to interact with the facilitator on the chemistry concepts presented with their Personal cell- phones (GSM). The challenge in this regard was associated with lack of interaction with the Facilitator, inability to use the GSM technology for questions and answers, overwhelming and unbearable distractions among the group members that needed the Facilitator to simplify the Chemistry concepts that were taught. Consequently, they expressed frustrations due to lack of immediate feed-back, questions and answers from the Facilitator as to simplify some ambiguity perceived during her presentation of the Chemistry concepts. Therefore, hypothesis 1 (HOI) was rejected.

Table 2: This Table 2 ascertains the influence of gender on College Teachers meaningful understanding of chemistry concepts.

Mode Contrast	Gender	MOCT score/ %
Live	Males Females	Highest 80 & least 20 Highest 70 & least 30
Video	Males Females	Highest 50 & least 40 Highest 35 & least 15

From **Table 2**, there was a significant effect of gender on college teachers understanding of chemistry concepts. Out of 25 males on the Live mode group that attempted MOCT, 15 scored 80%, Seven scored between 55% and 72% and Three scored below 50%. However, out of 22 females on the same Live mode group, Nine scored between 59% and 70%, Eight scored 53% and Five scored below 50%. This result showed that the males out-performed the females on the live mode.

In the same vein, out of 25 males that attempted MOCT on the video-taped mode, 19 scored 50% and Six scored 40% while out of 22 females in the same mode, 21 scored 35% and One (1) participant scored 15%. Therefore hypothesis 2 (HO2) was rejected. The findings have also shown the outstanding performance of the males in the Video mode. This entails gender difference in the MOCT achievement on both Live and Video modes of distance learning in favour of males. This also entails that female intellectual superiority is lower than that of the males. This supports the report findings of Nsofor, (2001) which explained that female students feel inferior than males especially when exposed to similar achievement tests in science and mathematics subjects due to cultural biases and socialization impediments. The poor performance of female College teachers on MOCT suggests the need to checkmate the pedagogical strategies being used in the teaching of sciences at both primary and secondary school levels because they form the bedrock upon which female and male students' performance at the tertiary institution is based. At these levels, boys and girls should be armed with appropriate tools, skills and abilities needed to excel equitably in sciences. The result further implied that differences in the group means were sufficiently large and could not have occurred due to sampling errors.

4. Recommendation

Essentially, the need to alleviate the problem of poor teaching and shallow understanding of chemistry concepts by the college teachers necessitated a study of this nature. In this vein however, the following suggestions are recommended:

- The College teachers who are not biased in chemistry and females in particular should strive for excellence in attending live mode distance learning programme with adequate commitment. This would promote meaningful understanding of some perceived difficult Chemistry concepts and thus enhance quality lesson delivery for performance improvement in chemistry.

- Experienced Female Chemistry teachers should intervene urgently as Role Models and Mentors to monitor the perception, negative attitude, socialization pattern and cultural disposition of would-be female Chemistry teachers' through counseling, incentives and motivation.

- State Ministry of Education and other Stake holders in Education should enforce the teaching of Science and Chemistry with Live and Video modes of distance learning in all the Schools by providing the necessary resources for its effective implementation.

- Chemistry Students have varying capacities and capabilities for understanding difficult chemistry concepts. Consequently, there is need for the Heads of Schools to monitor their Chemistry teachers when teaching with these two modes of distance learning which permit interactive and individualistic teaching and learning. There should be room for interactions, questions and answers, positive-reinforcement and immediate feedback.
- Practicing Chemistry teachers and those concerned with Science, Technology and Mathematics Education (STME) should organize a competitive scientific literacy programme for girls/women and boys/men preparing to teach Chemistry in Nigerian schools. This would enhance girls/women logical and intellectual development in the teaching of Chemistry meaningfully.
- Federal and State Governments should provide Science (Chemistry) education opportunity for girls/females and boys/males as a sure way of achieving and sustaining meaningful development in Science, Technology and Mathematics.

- The Federal and State Ministries of education in Nigeria as well as private sector should provide facilities for 'Would-be' female and male Chemistry teachers in both State and Federal Colleges of Education for mastering the Live mode of distance learning. This would enhance their skills acquisition in the teaching of chemistry concepts as well as breaking gender barrier for effective classroom teaching.

5. Conclusion

This paper has justified the relevance of Live and Video Modes of distance learning on the performance of male and female college teachers' in meaningful understanding of chemistry concepts. Going by evidences available, it appears that the Nigerian educational system is poised to embrace these two modes of teaching and learning. Indeed, in the last few years, National Open University of Nigeria (NOUN) adopted Video mode to enhance the quality of teaching Science, Technology and Education Programmes in schools. This is a welcome development and the impact would be the major driving force for sustainable development of Science and Technology. However, the Live and Video Modes of Distance learning would gradually be explored at all levels of Nigerian educational system for children, youths and adults in meaningful teaching and learning of Sciences and Chemistry in particular. Their functionality would obviously be useful for knowledge sharing, group discussions, teacher-teacher and student-teacher interactions as well as handling large classes. When teachers' conventional teaching method is supplemented with Live and Video Modes of distance learning, teachers and students reasoning abilities and science process skills acquisition are enhanced. For full integration into teaching and as a science professional, every teacher, irrespective of gender should be involved in relevant academic dialogue and efficient use of Live Mode distance learning. Adequate incentives and flexibility on the use of live-mode distance learning could help in building up a desired collaborative professional network especially for those college teachers who are not chemistry specialists and ultimately could improve the teaching of chemistry meaningfully in Nigerian Colleges of Education.

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