

Comparative Effectiveness of Video Media Instruction and Laboratory Teaching Technique in Learning Practical Chemistry in Nigeria Senior Secondary Schools

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Abstract: This study examined the relative effectiveness of Video Media Instruction (VMI) and Conventional Laboratory Technique (CLT) on the teaching of Volumetric Analysis an aspect of practical Chemistry. A pre-test, post-test control group design was used for the study. A sample of ninety students was randomly selected out of one thousand two hundred SSS II Chemistry students in Osun State and divided into three groups. The 1st group was taught with Video Media Instruction (VMI), the 2nd group was taught with the Conventional Laboratory Technique (CLT), while the 3rd group combined the two methods. A pre-test was administered before treatment and after six weeks of instruction, a post-test was similarly administered. The data obtained were analyzed using t-test and F-statistic. The results showed that there was a significant difference in the performance of students taught with CLT and those taught and those taught with VMI. Also a significant difference existed in the mean achievement scores of students that were exposed to VMI coupled with CLT and those exposed to CLT alone. There was also a significant difference in the performance of students when CLT, VMI and VMI/CLT groups were compared. It was therefore concluded that VMI/CLT was more effective in teaching Volumetric Analysis and that augmenting CLT with VMI allow students learn better.

Key words: Video Media Instruction, Conventional Laboratory Technique, Laboratory Instruction, Instructional Technology.

1. Introduction

It has been observed that chemistry teachers in most of our public secondary schools do not have enough time and laboratory resources to teach practical chemistry. This has made them to resort to gathering the students together for practicals when it is just about a week or two to their School Certificate Examination. Teachers would not be crucified for this "Window-dressing" approach, because funds for practical are habitually released when the examination is very close or when the examination bodies released their instructions to supervisors. This is a major problem in practical chemistry teaching. The problems associated with the role of laboratory in science teaching were acknowledged by Hofstein and Lunetta (1982) when they concluded that researchers have not comprehensively examined the effects of laboratory instruction on student's learning. Specifically they recommended that further studies be conducted concerning the conceptual understanding students gained from laboratory instruction. Oladipupo (2002) observed that part of the factors that affects poor academic performance of students in chemistry is lack of instructional materials and improper utilization of instructional aids by the teachers. Chemistry teachers have attributed their using alternative to practical teaching approach to lack of equipments, facilities and chemicals in schools. This has made chemistry students to regard the subject as very difficult and abstract and this has led to poor performance of the students in the subject year in year out.

The above statement is attested to in the result of students in the West African Secondary School Certificate Examination (WASSCE) May/June, 2003 to 2008 as shown in Table 1.

Table 1: Trends of performance in chemistry in the west african senior school Certificate examination May/June 2003-2008

YEAR	TOTAL ENTRY	TOTAL EXAMINED	TOTAL ABSENT	NUMBER AND PERCENTAGE WITH GRADES		
				CREDIT 1-6	PASS 7 & 8	FAIL 9
2003	412480	405447 (98.29%)	7033 (1.70%)	165513 (40.82%)	92909 (22.91%)	84875 (20.93%)
2004	340367	333272 (97.91%)	7095 (2.08%)	124250 (37.28%)	84384 (25.31%)	111188 (33.36%)
2005	361575	353656 (97.80%)	7919 (2.19%)	179156 (50.65%)	65804 (18.63%)	96537 (27.28%)
2006	393207	383694 (97.58%)	9513 (2.41%)	173103 (45.11%)	87645 (22.84%)	116230 (30.29%)
2007	434460	424741 (97.76%)	9719 (2.23%)	196081 (46.16%)	105602 (24.86%)	112637 (26.51%)
2008	468291	456993 (97.58%)	11298 (2.41%)	198621 (43.46%)	121139 (26.50%)	116892 (25.57%)

Source: West African Examination Council, Nigeria

It could be seen from the table that except in 2005, students with grade A1 to C6 were below 50%. It then implies that very few numbers of students had the opportunity of securing admission into science related courses like medicine, agriculture, pharmacy, geology, physical sciences, science education and engineering in the higher institutions.

It was this kind of observation that made Burbules and Linn (1991) to affirmed that the traditional method of teaching of science in the secondary schools seems to convince students that science is a collection of facts to be subjected to memorization rather than a set of derivable principles that can be subjected to confirmation through experiments. The method of teaching practical chemistry should be one that gives opportunity for students to act responsibly with a view to achieving approved set of educational objectives.

Allen (2000) sees instructional aids as devices which present a complete body of information and largely self supporting rather than supplementary in the teaching-learning process. He further submits that instructional technology like video media, would do two things, one, they stimulate the learners and two, they communicate with them. The use of instructional technology especially in the classroom has been increasing in the world over the past few years but the challenges have not been adequately utilized especially in developing countries like Nigeria. Developed countries like United States of America recognized the challenges of the appropriate use of instructional media and they created separate department of Instructional Media Service (IMS) out of Instructional Technology Service (ITS). IMS was to focus on the classroom activities mainly. Cox (1997), an experienced educational technologist, was charged by the American government with the responsibility of instructing on an encouraging the effective use of technology in American classrooms. The use of technologies such as presentation-software, video, compact Disc-Read only Memory (CD-ROM) and Internet Media for classroom instruction is in its infancy in the Nigeria classrooms and has great potential for improving the quality of instruction.

Teachers of secondary schools are used to the demonstration method and sometimes used manuals to teach Chemistry practical due to lack of chemical and apparatus. Therefore, practical demonstration is done by alternative to practical method. Some teachers, in this alternative approach, only draw the apparatus on the chalkboard and explain the practical process by drawing. Even where the students are not many and teachers are encouraged to demonstrate the practical in the laboratories, it is done not more than once in a term and this is usually inadequate to give adequate knowledge of chemistry practical to the students. The effective use of Video Media Instruction (VMI) could be a remedy for this problem. This is because students

could watch the demonstration on videotape repeatedly until the students could carry out the practical themselves without the teacher.

It has however been observed that teachers seem not to develop positive attitude toward integrating technology into their classroom teaching. Numerous surveys conducted even in developed countries like United State of America (USA) showed the negative attitude of teachers despite the vast advantages of instructional media. Becker (1991) found that only a small proportion of instructional activities actually incorporate technology. Hardy and Sheingold (1993) stated that, technologies are peripheral to learning and teaching for most teachers and students, they generally provided either add-on-activity or simply technological versions of the workbook. Furst Bowe (1992) surveyed 22 technology education graduates after their first year of teaching to assess their use of instructional technology. She found that more than 75 percent of the respondents stated that they had never used CD-ROM or laser Video Disc in the classroom. Similar findings were reported by Dessey (1992) who surveyed 35 elementary education graduates after their first year of teaching. One hundred percent (100%) of these respondents had never used a laser video disc during their first year of teaching and 94 percent never used CD-ROM. The results of the study do support earlier research that found little overall use of instructional media in the elementary classrooms. Zammit (1992) found that many schools had provided substantial funds to invest in hardware but fewer funds were provided for the professional development of teachers. It has been reported that it is easier for many school districts to approve expenditure to purchase equipments than to pay for time to enable teachers develop their knowledge and expertise.

However, teachers should not be seduced by technical virtuosity or cutting-edge visual and aural effects, there is still a need for human interaction and emotional support. As Clark and Mayer (2003) remind us "What we have learned from all the media comparison research is that it is not the medium, but rather the instructional methods that cause learning". Such learning outcome where human interactions are used to augment video media may be improved.

2. Purpose of Study

The study aimed at finding out the effect of using recorded video practical instruction as a supportive instructional means on the performance of students in practical chemistry in the secondary school. This is with a view to provide solution to the development of observation, measurement and problem-solving of students in practical chemistry amidst inadequate chemicals and apparatus. The Video Media introduced may be a remedy to forgetfulness in students as a result of abstract nature of alternative to practical approach.

The specific objectives of this study are to:

- a. compare the relative effectiveness of Conventional Laboratory Technique (CLT) and Video Media Instruction (VMI) in the learning of Volumetric Analysis,
- b. investigate the effectiveness of VMI when used together with CLT in the learning of Volumetric analysis; and
- c. examine the relative effectiveness of CLT, VMI and a combination of CLT and VMI in the learning of Volumetric Analysis.

3. Hypotheses

The following hypotheses were generated:

1. There is no significant difference in the performance of students in practical chemistry taught Volumetric analysis with CLT and those taught with VMI.
2. There is no significant difference in the mean achievement scores of students who were exposed to VMI coupled with CLT and those exposed to CLT only.

3. There is no significant difference among the performance of students when CLT, VMI and VMI/CLT are used in the learning of Volumetric Analysis.

4. Methodology

The population of study was all chemistry students in public Senior Secondary School class two (SSS II) in Osun State, while the sample consisted of ninety chemistry students randomly selected from three randomly selected public secondary schools from two Local Government Areas (Oshogbo and Olorunda Local Governments). The schools from Osogbo Local Government were St. Charles Grammar School and Baptist Girls' High School while Ansar-ud-Deen Grammar School was selected from Olorunda L.G. The average age of the students involved in the experiment was seventeen years.

The research instruments used in this study were:

- i. Video Media Instruction (VMI) – a software technology on Volumetric Analysis.
- ii. A fifteen-item supply-response questions tagged Achievement Test on Volumetric Analysis (ATVA).

VMI contained instructions and demonstrations on how to carry out Volumetric Analysis in the laboratory as done in the normal laboratory practical work, delivered by the researcher and recorded on video tape and run on a video machine (VCR) and television monitor. The fifteen items practical tests were questions on relevant apparatus, indicators, titration experimental procedures and calculations of concentration, relative molecular mass, number of moles of substance, number of moles of water of crystallization, solubility and so on. The questions were standardized and validated. The reliability of the test instrument was also determined and the reliability coefficient was 0.61 using test-retest method.

All the participating students in both experimental and control groups were first given a test (pre-test) on the first day of the study in each school. The actual teaching started in the second lesson. The experimental group I students were taught the practical Volumetric analysis by playing the video clip which lasted for eight periods running at 40 minutes in each period. The students in experimental group II, were taught Volumetric Analysis using Conventional Laboratory method and then the Video Media Instruction. The student watched the video and the teacher explained using the usual laboratory demonstrations. This also lasted for eight lesson periods of 40 minutes each. The teacher paused at intervals when discussion was to come in. The control group students were taught using CLT only. The experimental and control groups were examined after the teaching session with a post-test using the same test items used in pre-test but restructured.

The scripts of the students were marked and scored and the scores obtained during served as the data for analysis as the dependent variables. The data collected was analyzed by using t-test and F-test statistics.

5. Results

The Achievement Test on Volumetric Analysis (ATVA) which was administered as pre-test to the three groups was to determine the background knowledge of the students in practical chemistry. The data obtained was subjected to a One Way Analysis of Variance (ANOVA) and F value calculated.

Table 2: Analysis of Variance of Scores of the VMI, CLT, and VMI/CLT Groups on the pre-test Scores.

Sources of variation	Sum of squares	Degree of freedom	Mean Square	F _c
Between Groups	0.26	2	0.13	0.049
Within Groups	232.14	87	2.67	
Total	232.4	89	2.80	

$F_c = 0.049$ while F_t (F-table value) $F_c = 3.07$ i.e. $F_c < F_t$. This implies that there was no significant difference in the mean score of the three groups in the Achievement Test on Volumetric Analysis in the pretest, indicating similar background knowledge.

Hypothesis One

There is no significant difference in the performance of students taught Volumetric Analysis with CLT and those taught with VMI. In testing this hypothesis, the post-test scores of students who were exposed to VMI were compared to the post-test scores of students exposed to CLT using t-test statistics as presented in table 3.

Table 3: t-test Analysis of the Performance of VMI and CLT groups

Group	N	\bar{X}	S.D.	t_c
VMI	30	19.27	9.83	4.96
CLT	30	13.83	7.68	

From the table, $t_c = 4.96$, $t_t = 2.39$ at $P=0.05$ and degree of freedom 58. That is $t_c > t_t$ indicated a significant difference existed in the performance of students that were taught volumetric analysis using VMI and those taught with CLT. The null hypothesis is hereby rejected. The VMI group performed better than the CLT group.

Hypothesis Two

The hypothesis state that there is no significant difference in the mean achievement scores of students who were exposed to VMI/CLT and those exposed to CLT only.

In testing this hypothesis the post-test scores of students taught with VMI coupled with CLT were compared with those of students taught with CLT only. The result is presented in table 4.

Table 4: t-test Analysis of the Performance of VMI/CLT group and the CLT group alone

Group	N	\bar{X}	S.D.	t_c
CLT	30	13.83	7.68	6.57
VMI/CLT	30	30.27	11.35	

The value of $t_t = 1.98$ indicating $t_c > t_t$ and the null hypothesis is rejected. This implies that a significant difference existed in the performance of students taught volumetric analysis using VMI coupled with CLT and those taught using CLT only. The VMI/CLT performed better than CLT group alone.

Hypothesis Three

The hypothesis states that there is no significant difference in the performance of students when CLT, VMI and VMI/CLT are used in teaching and learning Volumetric Analysis. In testing the hypothesis, the post-test scores of students in three groups were compared and the result subjected to an F-test. The result is presented in table 5 below.

Table 5: Analysis of variance of scores of the three groups; CLT, VMI and VMI/CLT on post-test scores

Source of Variation	Sum of Square	Degree of Freedom	Mean Square	F_c
Between groups	4205.75	2	2102.88	21.45
Within groups	8527.91	87	98.02	
Total	12733.66	89	2200.9	

At probability level of 0.05 and degree of freedom of 2,87, the calculated F value (F_c) is 21.45 while that of table; F_t is 3.07, i.e. $F_c > F_t$. This implies that a significant difference exists in the mean scores of the three groups. The VMI/CLT group had better performance than the VMI and CLT separately with group means equal to 30.27, 19.27 and 13.83 respectively.

6. Discussion

The findings of this study showed that the combination of the Conventional Laboratory Technique and Video Media Instruction (VMI/CLT) strategy was more effective in enhancing students' achievement in practical chemistry than the conventional laboratory technique (CLT) and the Video Media Instructional strategies(VMI) separately.

The combination of the VMI and CLT allow the student to utilize the demonstration shown by the teacher during the conventional laboratory teaching to practice many times with the video media. The video media provides a stimulating environment, which allows for practice and interaction among the students. They are interested in watching the video clip with consequent learning over a period of time of repeated watch. The performance of the students that were taught with the VMI was even better when Conventional Laboratory Technique (CLT) alone. The results of this study is however consistent with those of Jasper and John (1998) on the use of Video Media, where students performed better after watching 20-minute Video story of twelve multimedia videodiscs. The result is also in agreement with Slaughter (1990) who ascertained that human element is primary in all educational processes, while the technical elements is secondary in almost all cases. The presence of a teacher to augment the selected Video Media is important and influential.

7. Conclusion and Recommendation

The results and the findings of this study indicated that the use of Video Media Instruction coupled with Conventional Laboratory Teaching Technique or used alone is a very effective method of teaching. The effectiveness of the Video Media Instruction give the opportunity of using the strategy where there is chemistry teacher in the school to teach practical chemistry. That is it could be a good substitute for the actual teacher in the classroom. Aside from this, the method could be useful to teach students in such schools where there are no equipment and chemicals for use. It is far better than teaching the students with alternative to practicals where the students will not have the opportunity of sighting the apparatus and even the demonstration with the apparatus talk less of handling them. The method in addition gives the students the opportunity of watching the video clips as many times as they wanted hereby making them the master the principles involved in volumetric analysis. This study therefore calls on chemistry teachers to develop positive attitude at developing instructional media that can assist in the teaching of the subject which will provide novel learning environment to the students.

Government on their own part should see to the integration of electronic learning (E-Learning Instructional Technology) into the classroom. In-service training on the application of technology to classroom instruction should be organized for teachers from time to time. According to Greenberg (1996) professional development for teachers needs to connect technology to science teaching.

References

- Allen, D.S. (2000): The use of Instructional Materials. Yale-New Jersey Teachers Institute <http://www.jersey.edu/jsht/puhs>
- Becker, H.J. (1991): How computers are used in United States Schools; Basic data from the 1989 I.E.A. computers in education survey. *Journal of Educational Computing Research*, 7, 385-406.
- Burbules, N.C. and Linn, M.C. (1991): Science Education and Philosophy of Science; Congruence or contradiction. *International Journal of Science Education* 13, 227-241.
- Cox B. (1997): In Instructional Media Service. Mike Bauer < bauer @csd.uwo.ca> and <http://www.uwo.ca/its/services/ims>
- Clark and dMayer (2003): In the Newest Media and a Principal Approach for Integrating Technology into Instruction by Susan Ambrose and Joel Smith. Carnegie Mellon University, U.S.
- Desey, D.E. (1992): First year elementary school teachers' utilization of Instructional Media. *International Journal of Instructional Media*. 19, 15-21
- Furst-Bowe, J. (1992): The utilization of instructional technology by beginning technology education teachers. *International Journal of Instructional Media* 19, 229-233.
- Grant I.F. and Car. J.T. (2001): The teaching of Science. Georgia: Gorge Allen and Union Ltd.
- Greenberg, R. (1996): Image processing for Teaching. A research tool enters schools, colleges and the work place. *Technology Horizons in Education Journals*. 24, 82-86.
- Hadley, M. and Sheingold, K. (1993): Commonalities and distinctive patterns in Teachers' Integration of computers *American Journal of Education*, 101, 261-315.
- Hofstein, A and Lunetta, V.N. (1982): The role of laboratory in science teaching: Neglected aspect of research. *Reviews of Educational research* 52. 207-217.
- Jasper (1998) In Lincoln, A.C. (1998): Anchored Instruction. John Bransford and the cognition and Technology Group at Vanderbilt (CTGV). Online: <http://www.lincoln.ac.nz/educ/tip/13.htm>.
- Oladipupo, J.A. (2002): Factors affecting the poor performance of secondary school students in chemistry. An unpublished M.ED. Dissertation, University of Ibadan.
- Slaughter, T.M. (1990): Teaching with Media. Victoria: Australia The University of Melborne, Parkville.
- Zammit, S.A. (1992): Factors facilitating or hindering the use of Computers in schools. *Educational Research*, 34, 57-66

