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A COMPARATIVE STUDY OF LECTURE AND DEMONSTRATION METHODS IN THE EDUCATION OF QUALITATIVE AND QUALITATIVE ANALYSIS FOR CHEMISTRY STUDENTS IN UMAR SULEIMAN COLLEGE OF EDUCATION GASHUA, YOBE STATE.

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Abstract

A Comparative Study of Lecture and Demonstration Methods in the Education of Qualitative and Qualitative Analysis for Chemistry Students in Umar Suleiman College of Education Gashu'a, Yobe State. Two semesters period, 100 NCE III students in the chemistry department were given educational sessions on qualitative and qualitative chemical analysis. These sessions were given by a single instructor in a traditional lecture method, in a demonstration method, or in a combination of these two methods. Prior to the instructional sessions, students anonymously completed a 20-question multiple-choice examination on the covered topics. At the completion of sessions, students repeated the same multiple-choice examination. They also completed an evaluation form on the instructional format, using a 5-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree).

Results: There was a significantly higher level of enjoyment in the combination group (lecture + discussion), although there were no differences in the test scores immediately after the instructional sessions. Conclusions Chemistry students learning about Qualitative (QlCA) and Quantitative Chemical Analysis (QnCA) preferred a combination of lecture and demonstration methods over traditional lectures or demonstration methods. However, this preference did not lead to improved test scores on these subjects.

Keywords: Demonstration; Lecture; Teaching; Method.

Introduction

One important step in educational design is choosing a teaching method. Traditional lectures often focus on memorization rather than the comprehension and use of information. Lecturing is one of the primitive and maybe the oldest method of teaching, and it is currently the most conventional educational technique. In this approach, students silently and passively receive information.[1] However, active participation and cooperation of students often leads to better, more effective and permanent learning. Because of this, educational experts emphasize the use of modern comprehensive methods,[2] which help students better understand and remember information.[3]

In various studies, the conventional lecturing method (Fig. 01) has failed to transfer concepts to students as effectively as active learning approaches such as small group tasks and discussions. Therefore, it has been suggested that it is better to use the conventional lectures only for transferring data to students.[4-7] In contrast to these studies, others have reported that both teaching methods have equal impact on learning. Lectures continue to be the most used education method since they save time and resources that are used in more active learning techniques.[8-10]



Figure 01: Lecture Delivered by an Instructor

Botelho and O'Donnell's research has shown that teaching via demonstration technique (Fig. 02) creates an active learning environment for all students. They suggested that teaching in a demonstration format with the instructor demonstrating with real objects is most efficacious for students. They have also emphasized that students prefer learning in active lectures with an expert faculty who predominates the educational discussion. [11] Hiill's comparison between lecturing and demonstration method showed that students' practical abilities and skills are higher in demonstration method and that this approach is useful for remembering information. [12] Roche has also reported that by combining lectures with group tasks, the students' attitudes towards the subject would become better more quickly.[13]



Figure 02: Demonstration Method Delivered by an Instructor

These two techniques have been compared in various science educational groups. For example, chemistry students showed that the combined methods led to increased student satisfaction and inner motivation, which led to higher educational quality. [14] In physics students, the combined teaching method improved their communication skills in the laboratory environment.[15]

Science students need to learn the skills of problem solving and decision making in addition to receiving data and knowledge. Since chemistry programme is a practical oriented subject,

therefore demonstration method is of high importance for chemistry instructor. Therefore, we studied the effects of different teaching methods for QlCA and QnCA in chemistry students.

Materials and Methods

This study was performed with 100 NCE III chemistry students. Due to the practical importance of being familiar with basic and advanced chemical analysis based on National Commission for College of Education (NCCE), 2012 latest guidelines, we chose this topic for teaching.

Students were randomly divided into three groups:

- ✓ Lecture Method,
- ✓ Demonstration, and
- ✓ Lecture plus Demonstration Methods.

For all three groups, we performed 3 educational sessions of 50 minutes each. Based on their teaching type, we gave the students the performance protocol for each group, which included the list of lessons to be learned, a step by step manual of teaching performance, and goals of the class.

The traditional lecture session was carried out in a large classroom with plentiful light and audiovisual equipment including a white-board, video projector, and teaching slides. In the beginning, the aim of the class was explained, and during the session we tried to increase the students' attention by asking questions, giving examples, and making conclusions and outlines. There were 3 topics to discuss, which took a total time of 3 hours (50 minutes for each topic and 10 minutes of questions and answers).

In the demonstration method session, students were divided into 5 groups of 10, and they were guided by an instructor (a total of 5 mutual instructors) through scenarios covering the assigned subjects. All of the needed material was given to the students in advance. This session was performed in a 3 hour period as a whole. In the third group, first, a 30 minute lecture was given for each topic followed by a 20 minute group discussion guided by instructors in groups of 10. The content was similar in all 3 groups and we used uniform slides.

In all three sessions, we completed forms containing the students' demographic data and characteristics, and then gave them a pre-test questionnaire with a 20 minute time limit. At the end of the program they completed a similar post-test as well as an evaluation form. The pre and post-test each contained 20 questions in multiple-choice format with the same value. The validity of the tests' contents was confirmed by 5 respectful school of science academic members of Umar Suleiman College of Education, Gashu'a, Yobe State. The quality of teaching was evaluated with a form added at the end of the post-test questionnaire, which contained five sentences with answers adjusted using a 5-point Likert scale (including: strongly agree, agree, no opinion, disagree, strongly disagree). These statements evaluated the way the class was handled (how, who, when, where).

Sample Size

Based on the number of students present in Federal University Gashu'a during this research time, after coordination with college authorities, and after a 20 percent drop in participants, a total of 100 students (in their final year) were enrolled in the study and were randomly divided into three groups.

Data Analysis Method

Comparison of the difference between the score of pre and post-tests was analyzed by a Paired t-test. For all three groups, we used variance analysis for quantitative variables and Chi squared tests for qualitative variables. A p value of less than 0.05 was accepted as significant. All statistical calculations were performed using the SPSS software program (version release 13.0, SPSS, Inc., Chicago, IL).

Results

In this study, three groups with a total number of 100 students were enrolled in the study. Thirty (30) students were in the lecture method group, twenty five (25) were in the demonstration group, and Forty five (45) were in the combined lecture and demonstration methods class. The participants were aged between 18 and 25 years (mean 22.7±2.3 years) and all of them were in their 8th to 10th term of their medical education. Twenty six (20.6%) of them were female students and seventy (70.4%) were male students.

The pre-test mean score in the lecture group was 53.3±16.3 and after the lecture it was 89.5±5.8. In the group discussion session, the pre-test had a mean score of 45.0±13.1 and the

post-test mean score of this group was 85.6±9.6. In the lecture and discussion group, the mean score of the pre and post-test were 47.8±14.6 and 89.8±5.9, respectively. Using a t-paired test, the differences between the pre and post-test scores for each group were significant (Table 1).

For comparing the effectiveness of three mentioned methods, a variable showing the difference between pre-test and post-test score was calculated. The mean increase of scores was 36.2±15.9 in the lecture group, was 40.6±13.0 for those in group discussion, and was 43.0±13.8 in the lecture plus group discussion group. According to an ANOVA test, these differences were not statistically significant (Table 2).

Based on a 5-point Likert scale, participants evaluated the overall session, the session moderator, and the timing and place of that session. Using a Kruskal Wallis test, there was no significant difference between the groups. At the end of each session and right before the post-test, students were asked about how satisfied they were with their sessions. According to their comments, the mean satisfaction in the lecture group was 87.9%, was 89% in the group discussion group, and was 94% in the lecture plus group discussion group. A one-way ANOVA test showed that differences between the groups were not statistically significant (Sig=0.04) (Table 3).

Table 01: Mean Score of Pre-test and Post-test of Three Groups

Group	Mean	N0.	Std. Deviation	Sig. (2-tailed)*
Lecture Method				
Pretest	53.27	16.30	16.30	0.00
Posttest	89.52	05.80	05.80	
Demonstration Method				
Pretest	45.00	13.10	13.10	0.00
Posttest	85.60	09.56	09.57	
Lecture + Demonstration Methods				
Pretest	47.75	14.60	14.59	0.00
Posttest	90.75	05.92	05.10	

Paired Samples Test **Source:** Usman A. A.

Table 02: Difference Between Pre-Test and Post-Test in Each Group

Group	N0.	Min.	Max.	Mean	Std. Deviation	Sig. *
Lecture Method	30	03.20	75.00	36.25	15.96	
Demonstration Method	25	05.00	70.00	40.60	13.04	
Lecture + Demonstration Methods	45	12.00	70.00	43.00	13.79	

*OneWay ANOVA Source: Usman A. A.

Table 03: Comparison of Participants Satisfaction According to Kruskal Wallis

	Group	N0.	Mean Rank	Sig.
Satisfaction from performance method	Lecture Method	30	76.07	.562
	Demonstration Method	25	82.50	
	Lecture + Demons. Method	45	75.65	
Satisfaction from presenter	Lecture Method	30	73.65	.272
	Demonstration Method	25	84.42	
	Lecture + Demons. Method	45	76.21	
Satisfaction from time of the class	Lecture Method	30	81.13	.665
	Demonstration Method	25	74.26	
	Lecture + Demons. Method	45	78.45	
Satisfaction from place of class	Lecture Method	30	84.82	.267
	Demonstration Method	25	77.31	
	Lecture + Demons. Method	45	71.96	

Source: Usman A. A.

Discussion

The results of this research have shown that all three educational methods were able to effectively increase the students' knowledge on the topics. A comparison of pre-test and post-test scores of all three groups showed elevation in scores, but the differences in the average scores were not statistically significant. All three methods increased the students' post-test scores, but there was not a significant difference between the three sessions. There might not have been a difference because there were limited sessions, there was a high load of academic content in proportion to the time and number of sessions, and because of the type of the educational content.

The outcome of our study confirmed the published study of Fischer and colleagues in 2004. In that study, the methods of lecture and small group discussion were compared, and it was reported that although the students significantly preferred the group discussion to the lecture, there was no significant difference in the post-test scores of the two groups.[16] In another study done by Hanze and Berger in 2007, there was no difference between cooperative and traditional teaching groups in reaching goals, but the cooperative group had a higher motivation,[17] which matches our present results.

The current study shows that in comparison with the lecture method, teaching with a demonstration method significantly elevates student satisfaction with the teaching methods. This could be due to the students' obligation to actively cooperate in the discussion, the enforcement of communication skills, and because of the facilitation of the learning process.

Limitations

Problems we faced in performing this research work included difficulty in planning student groups, having concurrent sessions, and determining the pre-guidance of demonstration method before the session. Another limitation was the inability to measure the students' practical skills after each program. Another limitation was a lack of proper space for having demonstration method sessions.

Conclusion

In conclusion, the lecture plus demonstration teaching methods was as effective and capable as the traditional lecture or demonstration methods in increasing the knowledge of students about qualitative and quantitative chemical analysis in the department of chemistry of Umar Suleiman College of Education, Gashu'a, Yobe State, Nigeria.

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