British Journal of Education
Vol. 9, Issue 5, pp.22-33, 2021
Online ISSN: 2054-636X (Online)
Print ISSN: 2054-6351(Print)

EFFECT OF INSTRUCTIONAL CONVERSATION STRATEGY ON SECONDARY SCHOOL STUDENT'S ACADEMIC PERFORMANCE IN CHEMISTRY

Oyakhirome, A. Helen Ph.D
Department of Curriculum and Instructional Technology
Faculty of Education, University of Benin,
Benin City, Edo State, Nigeria

Maltida Uvie Orheruata
Department of Educational Evaluation and Counseling Psychology
Faculty of Education, University of Benin
Benin City, Edo State, Nigeria

ABSTRACT: *This study was conducted to investigate the effect of instructional conversation strategy on student's academic performance in chemistry in Edo State, Nigeria. Three research questions and three corresponding hypothesis were raised and formulated to guide the study. The hypotheses were tested at 0.05 level of significance. The design used for this study is the pre-test post-test control group quasi-experimental design. The Chemistry Achievement Test was the instrument used for data collection The instruments' validity and reliability were properly determined before they were used. The reliability of the CAT instrument was found to be 0.88 using Kunder-Richardson 21 formula. The sample consist of 60 science students drawn from two public schools in Egor Local Government Area of Edo State. Data collected were analyzed using statistic of the mean, standard deviations, student's independent sample t-test and ANOVA. The major findings of the study included the following (i) instructional conversation strategy group students significantly performed better than the lecture method group students. (ii) the study showed a non-significant difference in the performance of male and female students taught with instructional conversation strategy. (iii) the study showed a non-significant interaction effect of method and sex on chemistry students' achievement. Based on the findings of the study, it was therefore recommended that instructional strategy which encourages social interaction should be used in the teaching and learning of chemistry in this 21st century.*

KEYWORDS: instructional conversation, gender, performance

INTRODUCTION

The importance of social interaction in the teaching and learning process has been emphasized by social constructivist theorists. According to these theorists, students are to construct their own knowledge and understanding through activities rather than receive knowledge given passively. In order to promote learning that will led to improvement of students performance in chemistry, there has being a paradigm shift in research and this has led to the determination of the efficacy of

activity based instructional strategies in the teaching and learning of chemistry. One of such methodology that will foster social intervention is the instructional conversation.

Instructional conversation is a form of a discussion-based lesson that develops students' conceptual and linguistic skills through guided discourse where all students are held accountable for participation (Goldsmith, 2013). Students engage in scaffolded exchange of ideas with their peers and the teacher to communicate their personal understandings and negotiate meaning of content on various levels (Johnson, 2016). It provides students' with multiple opportunities to discuss ideas with fellow students and promotes peer-supported strategic thinking. According to Aidinlou and Tabee (2002), teacher's talks significantly less and students significantly more when instructional conversation is used. In instructional conversation, the actual content of lesson is mutually shaped and defined by students and teachers' understanding in promoting learning through conversation is the aim. One of the major characteristics of instructional conversation is that, it assures that students' plays an important role in construction of novel knowledge in getting understanding about the environment. Teachers are facilitators of knowledge who give guidance to students in the process of knowledge acquisition by encouraging them to express their own ideas rather than designing instruction in such a way that students will produce right answers to correct performance.

The use of instructional conversation provides students with various opportunities to engage in thought-provoking discussions surrounding content to be studied and also increases their participation and willingness to present their ideas related to contents to be taught. To achieve this, teachers improve their capacity for using higher-order questions to guide student discursions. Also, they are able to readily perceive student misconceptions and redirect students with questions that allow them to revisit their thinking, dialogue with their peers, and choose a different approach. (Johnson, et al., 2013). The use of conversation to improve performance requires deliberate and self-controlled planned activities by the teacher, who has specific curricular, cognitive, and conceptual goals. The use of instructional conversation requires highly developed professional competencies, positive and efficient classroom and behavior management, provision of effective and varied activities, orderly monitoring and assessment of progress.

Instructional conversation is based on assumptions that are fundamentally different from those of traditional lessons. In traditional teaching, the assumption is that the student has nothing to say beyond the known answers but in instructional conversation, the assumption is that students have something to say beyond the known answers. The teacher listens carefully, makes guesses about the intended meaning, and adjusts responses to assist the student's efforts by engaging them in conversation. Such conversation reveals the knowledge, skills, and values of the learner and this enables the teacher to contextualize teaching to fit the learner's experience. This type of conversation plays a vital role in the modern cycle of instruction. In order for students to begin thinking like scholars, they must be placed in an environment that supports a community of practice that operates according to scholarly behaviors. Considering the fact that instructional conversation fosters active participation and social interaction among students themselves and

between students and teachers, this study seeks to examine its effect on students' performances and to also determine if there will be sex variation in their performances.

Statement of Problem

Meaningful learning can be achieved by creation of activity based atmosphere in classroom settings. This type of atmosphere gives the students the opportunity for co-participation and interactions among students themselves and between students and teachers. One characteristic of activity based atmosphere is that it allows for maximum assistance in performance of task at hand. These activities are design in such a way that allows teachers to assist students towards the achievement of higher order mental process. One of such instructional strategy that gives room for this is instructional conversation strategy. How well this strategy will impact chemistry students' performance is subject to empirical investigation.

Research Questions

1. Is there a difference in performance of students taught with instructional conversation strategy and those taught with lecture method?
2. Is there a difference in performance of male and female students taught with instructional conversation strategy and those taught with lecture method?
3. Is there any interaction effect of method and sex on chemistry students' achievement?

Hypotheses

1. There is no significant difference in performance of students taught with instructional conversation strategy and those taught with lecture method.
2. There is no significant difference in performance of male and female students taught with instructional conversation strategy and those taught with lecture method.
3. There is no significant effect of interaction of methods and sex on performance

Research Design

The design of the study was the pre-test post-test control group quasi-experimental design. The design consists of the following levels: two instructional groups (instructional conversation strategy and lecture groups), repeated testing (pre-test and post-test) and sex of two levels (male and female). The design was considered appropriate because it was not possible to achieve random assignment of students into treatment groups. Thus intact classes were used. Johnson and Christensen (2000) stated that any design in which a condition needed (randomization) for true experimental design is omitted is best described as quasi experimental design.

Sample and Sampling Techniques

The sample for the study consists of sixty senior secondary school II chemistry students in two mixed secondary schools randomly selected from Egor local government area of Edo State. In selecting the schools, all the single sex schools were eliminated from the list. With that done, the remaining names of schools were written on piece of papers for each of the senatorial districts. Schools in each senatorial district were in separate blind bags. Using withdrawal with replacement model of balloting, two mixed schools were selected from each senatorial district. Two chemistry

teachers were used for the study. Before they were selected, they were matched on sex, type of certificate possessed, professional training and years of experience. Based on these criteria, chemistry teachers were selected

Research Instruments

The Chemistry Achievement Test (CAT) was the instrument used for data collection for the study. It consists of two sections, Sections A and B. Section A asked questions on Bio-data like, sex, and name of school. Section B consists of Fifty (50) objective type questions drawn from Senior Secondary SSCE past question papers. The questions were selected in line with the contents taught during the study.

Validity of Instruments

Two kinds of validation were carried out on the instrument. These are content and construct validities. The content validity was determined with the table of specification and a three man panel made up of one expert in Science Education, one qualified and experienced Chemistry teacher and an expert in Measurement and Evaluation.

Each of the expert judges was provided with the file which contained the instrument, the research questions and hypotheses. They were asked to determine independently if the instrument would be able to generate the data for answering the research questions and test the hypotheses. On return of the files individually to the researcher, it was found out that they all recommended general edition of items in the instrument.

On construct validation of CAT, although the instrument was made up of items from standardized test which had been validated in the past, it was re-validated because the items were selected from questions of different years. To achieve this, a trial test of the instrument was carried out on 65 SS11 students in two schools in Egor Local Government Area who were not part of the study. However, the characteristics of the trial students are similar to the characteristics of the sample to be used for the study. Specific among the characteristics was that all the students were exposed to the same contents of the SS11 curriculum. The following are the findings generated from the process.

(1) **Factor Analysis:** The determination of construct validity of CAT involved the extraction method: Principle component Analysis and Rotation Method: Quatrimax with Kaiser Normalization. The analysis of the responses of the 65 respondents to the items resulted in the non-reduction of number by selecting only items with an initial Engen value of at least 1.

(2) **Item difficulty:** The difficulty of each item of CAT instrument was determined with Kuder Richardson 20 procedure for estimating internal consistency of a test. This was achieved by dividing the number of students who answered the item correctly by the number of students who made attempts. Wiseman (1999) stated the range of probabilities to be between 0.00-1.00. The higher the difficulty index value, the easier the questions. Wiseman (1999) stated that test items with difficulty indices of 0.00-0.20 are difficult. While those items with 0.8-1 too are easy. Based on these specifications, only items with difficulty indices of 0.3-0.7 were selected into the test instrument. All the test items selected from the past SSCE question papers met this specification.

Treatment Procedure

The treatment consist of two groups (a) experimental group (instructional conversation strategy) and control group (Lecture teaching group). The duration for study lasted for eight weeks and two chemistry teachers drawn from the local government area. The experimental group chemistry teachers used was trained on the skills peculiar with the instructional strategies they are to adopt in the classroom and separately too.

Step 1: Training of Chemistry Teacher

The two chemistry teachers (one per group) used for the study were trained separately on the skills of using instructional conversation strategy and lecture method for teaching for three days and lasting two hours per day. The training was done by the researcher. The first part of the training concentrated on discussing the theories, origin and characteristics of the two instructional strategies (instructional conversation strategy and lecture method). When that has been understood, the researcher together with the teacher went through the training manual developed by the researcher, one each for instructional conversation strategy and lecture. The teachers for each of the strategy were trained separately and at different times. The training manual specifically defines the steps and stages involved in using the instructional conversation strategy and lecture method for teaching and the specific roles teachers and students should play at each stage. The remaining part of the training was spent on practice and generation of ideas on how to apply instructional conversation strategy and lecture method in the teaching of the selected concepts in chemistry. The training came to a close when the researcher was convinced that the trained teachers can correctly apply the teaching strategies in their respective classes.

Step 11: Pre-testing of both group of Students

Three days before the start of teaching, the two groups (Instructional conversation strategy and lecture method) were pre-tested with the Chemistry Achievement Test (CAT). This was done for two reasons: to determine the equivalence of the groups and to be sure that the difference between the pre-test and post-test scores was later due to treatment. During treatment and in each of the instructional groups of study, the following activities were performed by both the teachers and students.

During the treatment, for each lesson, the experimental group students were taught using the instructional conversation strategy.

Step by step treatment procedure using instructional conversation strategy and lecture method

In applying the instructional conversation strategy, the following steps were followed:

Step 1. Thematic focus: The teacher selects a theme on which will be the focus discussion and has a general plan on how to move to the next permit optimal exploration of the theme.

Step 2. Activation and use of background knowledge and relevant schemata: Teacher either "hooks into" or provides students with pertinent background knowledge and schemata necessary for understanding a text, wearing the information into the discussion.

Step 3. Direct teaching: the teachers will provide direction to the teaching of a skill or concept were necessary.

Step 4. Promotion of more complex language and expression: Teacher elicits more extended student contributions by using a variety of elicitation technique: Invitations to expand, questions, and pauses.
Step 5. Promotion of bases for statements or positions: Teacher fosters students' use of text, pictures and reasoning to support an argument or ides, by gently probing.
Conversational:
Step 6. Fewer "known-answer" questions: in this step more of the discussion centers on questions for which there might be more than one correct answer.
Step 7. Responsiveness to student contribution: teacher is more responsive to students' statement and the opportunities they provide in this step. While maintaining the initial plan, focus and coherence of the discussion.
Step 8. Connected discourse: in step 8, the discussion is characterized by multiple, interactive, connected turns: succeeding utterances build upon and extended previous ones.
Step 9. Challenging, but non-threatening, atmosphere: a challenging atmosphere balanced by a positive affective climate is created by the teacher in this step. The teacher is more of collaborator than an evaluator.
Step 10. General participation, including self-selected turns: in this step, the teacher does not hold exclusive light to determine who talks; students are encouraged to volunteer or otherwise influence the selection of speaking turns.
(b). Step-by-step procedure for using Lecture classroom
The group taught with lecture method were taught the same concepts in the six weeks instructional unit. The teaching in the group was textbook-centered: students read assigned materials for the study, complete assignments independently and at their seat. They were engaged in discussion with their teachers and classmates in response to teachers' questions. The teacher who taught the lecture group were presented the content materials to the students in their final forms.
In teaching the concepts using lecture method, the following steps were taken for each of the concepts taught by the control group teacher.

Step 1: Teacher ask questions to elicit students' knowledge about the concept to be taught
Step II: Teacher explains the concepts to be taught
Step III: Teacher ask students questions to find out their level of understanding
Step IV: Teacher answers students' questions
Step V: Teacher summarizes the lesson.

Step 111: Post testing
At the end of six weeks of instruction, the groups (i.e instructional conversation strategy and lecture method) were given a post- achievement test. A. The response of the students to the items in the chemistry Achievement scores were scored.

Method of Data Analysis
The research questions were answered using the mean scores and standard deviation statistics. The hypotheses were tested with t-test independent group t-test.

Results and Findings

This section presents the results of research questions and hypothesis gotten from the data analyzed.

Research Questions 1**:** Is there a difference in performance of students taught with instructional conversation strategy and those taught with lecture method?

Table 1: Descriptive statistics showing the mean scores of both students taught with instructional conversation strategy (ICS) and lecture method (LM) at post- test.

Groups	N	Mean	Mean Diff.	SD
L M	26	26.12	3.2	4.48
ICS	34	29.32		2.65

In Table 1, the lecture method group students had a mean score of 26.12 and a standard deviation of 4.48. The instructional conversation strategy group students had a mean score of 29.32 and a standard deviation of 2.65. The mean difference between the two sets of scores was 3.2, with the instructional conversation strategy having the higher value. This shows that a difference exists between the lecture method and instructional conversation strategy group students' scores.

$H0_1$: There is no significant difference in performance of students taught with instructional conversation strategy and those taught with lecture method.

Table 2: Independent sample t-test statistics comparing the mean scores of both the lecture method (LM) and instructional conversation strategy (ICS) group students on pretest

Groups	N	Mean	SD	df	t_{cal}	Sig. (2-tailed)
LM	26	14.42	3.24	58	0.58	0.56
ICS	34	14.82	2.08			

Table 2 shows that the difference between the pre-test scores of the lecture method (LM) and instructional conversation strategy (ICS) group students is not significant. This is because the calculated sig. value of 0.56 is greater than the critical sig. value of 0.05. Therefore the null hypothesis is retained

Since the observed difference was not significant as seen in Table 2 at their pre-test score. The post test scores were examined as shown in table 3

Table 3: Independent sample t-t statistics comparing the mean scores of both students taught with instructional conversation strategy (ICS) and those taught with lecture method (LM) at post test

Groups	N	Mean	SD	df	t_{cal}	Sig. (2-tailed)
LM	26	26.12	4.48	58	3.47	0.00
ICS	34	29.32	2.65			

Table 3 shows that the difference between post test scores of the lecture method and instructional conversation strategy group students is significant since the calculated sig. value of 0.00 is less than the critical sig. value of 0.05. This shows that there is an effect of instructional conversation strategy on students' performance scores in Chemistry. Therefore the null hypothesis is rejected.

Research question 2: Is there a difference in performance of male and female students taught with instructional conversation strategy and those taught with lecture method?

Table 4: Descriptive statistics showing difference in students' performance by sex

Groups	N	Mean	Mean Diff.	SD
Male	14	29.71	0.66	3.52
Female	20	29.05		1.88

From Table 4, it is seen the male students had a mean achievement score of 29.71 with a standard deviation of 3.52 and the female students had mean achievement score of 29.05 with a standard deviation of 1.88. The mean difference between the two sets of scores was 0.66, with the males having the higher value. This shows that a difference exists between the male and female students' achievement scores.

$H0_2$: There is no significant difference in performance of male and female students taught with lecture method and instructional conversation strategy.

Table 5: Independent sample t-test statistics comparing the mean scores of both the male and female students taught with instructional conversation strategy (ICS) at pretest

Groups	N	Mean	SD	df	t_{cal}	Sig. (2-tailed)
Male	14	14.57	2.28	32	0.59	0.56
Female	20	15.00	1.97			

Table 5 shows that the difference between the pre-test scores of the instructional conversation strategy and lecture method group students is not significant. This is because the calculated sig. value of 0.56 is greater than the critical sig. value of 0.05. With this the null hypothesis is retained. **$H0_2$:** There is no significant difference in performance of male and female students taught with lecture method and instructional conversation strategy. Since the observed difference was not significant as observed in Table 5. The post test scores were examined as shown in table 6.

Table 6: Independent sample t-test statistics showing the mean achievement scores of male and female students of the Instructional Conversation Strategy (ICS) at post-test

Groups	N	Mean	SD	df	tcal	Sig. (2-tailed)
Male	14	29.71	3.52	32	0.71	0.48
Female	20	29.05	1.88			

From Table 6 it is seen that the difference between post-test scores of the male and female students is not significant since the calculated sig, value of 0.48 is higher than the critical sig value of 0.05 This shows that there was an equal effect of inquiry teaching using instructional conversation strategy on male and female students' performance scores in chemistry. Therefore the null hypothesis is retained.

Research question 3: Is there any interaction effect of method and sex on chemistry students' achievement?

Table 7: Descriptive statistics showing the interaction of method and sex on achievement in chemistry

	Sex	N	Mean	Mean Diff.	SD
Experimental	Male	14	29.71	0.66	3.52
	Females	20	29.05		1.88
Method Control	**Males**	90	26.14	2.91	4.37
	Females	115	29.05		4.80

Table 7 shows that the mean interaction achievement scores of male and female students in the experimental group is 29.71 and 29.05 respectively with a mean difference of 0.66, in favour of the male while that of the control group is 26.14 and 29.05 for males and females respectively with a mean difference of 2.92, in favour of the females. To determine if the differences in interaction scores are significant, $H0_3$ was tested using Analysis of Covariance (ANCOVA) as shown in Table 8.

$H0_3$: There is no significant interaction of sex and method on chemistry students' achievement.

Table 8: ANCOVA statistics showing the interaction effect of method and sex on chemistry students' achievement

Source	Type111 Sum Of Square	df	Mean Square	F-cal	Sig
Corrected Model	155.295	3	51.765	3.980	0.01
Intercept	44602.862	1	44602.862	3428.926	0.00
Groups	154.772	1	154.772	11.898	0.00
Sex	1.897	1	1.897	.146	0.70
Method*Sex	1.324	1	1.324	.102	0.75
Error	728.438	56	13.008		
Total	47700.000	60			
Corrected Total	883.733	59			

Table 8 indicates that there is no significant interaction of method and sex on chemistry students' achievement since the calculated sig value of 0.75 is greater than the critical sig value of 0.05. With this, the null hypothesis is retained.

DISCUSSION OF RESULTS

The finding of the study showed that the instructional conversation strategy group students significantly performed better than the lecture method group students. The high performance noticed in the instructional conversation strategy group students is as a result of the form of conversation and activities involved in the various phrases in the teaching and learning process using the strategy. The out-scoring of the instructional conversation strategy students has further buttressed the evidences from research in cognitive learning, science learning, educational psychology and other disciplines that the importance of social interaction in meaningful learning cannot be over emphasized. The use of inquiry based instructional strategies which have roots from constructivist theory are essential for meaningful learning to take place when properly implemented (Edmund, 2008), as noticed in the instructional conversation strategy group students' performance. This finding is in agreement with that of Aidinlou and Taeei (2012); Meskill and Anthony (2007); Ruston and Schwanefluged (2010) that found positive effect of instructional conversation strategy on students' comprehension.

Also the study finding showed a non-significant difference in the performance of male and female students taught with instructional conversation strategy. This shows that both the male and female students gain equally from its usage, which buttress that the methodology is not sex biased and this is very significant in the teaching and learning process, since science courses to be read are not gender based. This finding is as a result of the fact that the use of instructional conversation strategy focuses on constructivist principles and emphasizes explanation and investigation of phenomena making students to participate equally in the teaching and learning process. This is in agreement with finding of Ajaja (2013) whose study showed that male and females students who studied biology with concept mapping, learning cycle and cooperative learning strategies did not differ in achievement significantly.

Furthermore the finding of the study showed a non-significant interaction effect of method and sex on chemistry students' achievement. This shows that the performance of the students is solely base on the strategy used and not because of their sex. This finding is in agreement with that of Theresann and Lydia (2015); Ajaja and Eravwoke (2012) that found no significant interaction effect between 5E learning cycle and sex on students achievement.

CONCLUSION

Based on the findings of this study, it was therefore concluded that social interaction is important for meaningful learning to take place in the teaching and learning process of chemistry.

Recommendation

It is therefore recommended that instructional strategy which encourages social interaction should be used in the teaching and learning of chemistry in this 21st century.

Reference

Aidinlou, N.A & Tabeei, S. (2012). Effect of using instructional conversation methods on reading comprehension of Iranian EFL learners. *I.J. Modern Education and Computer Science*, 9,45-51

Ajaja, O. P. & Eravwoke. O.U. (2012) Effects of 5E learning cycle on students' achievement in biology and chemistry. *Cypriot Journal of Educational Sciences* 7, (3), 244-262

Ajaja, O. P. (2013).Which way do we go in the teaching of biology? Concept mapping, cooperative learning or learning cycle***?*** *International Journal of Science and Technology Education Research* 4(2), 18 – 29.

Goldsmith, W. (2013). Enhancing classroom conversation for all students. *Phi Delta Kappan* 94(7),48-52

Johnson, B. & Christensen, L. (2000). *Educational research*. Boston: Allyn and Bacon

Johnson, P., Betancourt, V., Villarreal, A., & Rodriguez, R., (2013). Synthesis of effective teaching strategies and practices-a handbook of secondary mathematics and science teachers. San Antonio, Texas: Inter-Cultural Development Research Association.

Johnson, P.M.A. (2016). The role of conversation in the classroom-promoting students voice through instructional dialogue. IDRA Newsletter.

Meskill, C. & Anthony, N. (2007). Learning to orchestrate online instructional conversation. *Computer assisted language learning* in: N.A., Aidinlou, & S. Taeei, (2012). Effect of using instructional conversation methods on reading comprehension of Iranian EFL learners. *I.J. Modern Education and Computer Science*, 9,45-51

Ruston, H. and Schwanefluged, P. (2010). Effect of conversation intervention on the expressive vocabulary development of pre-kinder garden children. Retrieved from http\\www.google.com

Theresam T. H, & Lydia S. R.(2015). The effectiveness of using 7E learning cycle model in the learning achievement of grade 8 students. Retrieved from www.google.com on 8 March, 2018.

Wiseman, D.C. (1999). *Research strategies for education*. New York: Wadsworth publishing.