

EFFECT OF ENGLISH LANGUAGE PROFICIENCY ON STUDENTS' ACADEMIC ACHIEVEMENT IN AND ATTITUDE TOWARDS CHEMISTRY

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Abstract

Instructions in Schools are characterized by exchange in communication through English Language. This communication is sometimes distorted leading to learners' inability to comprehend. They experience difficulty in reading and understanding texts. Against this background, this study investigated effects of English Language Proficiency on achievement and attitude towards Chemistry. Pre-test, post-test control group quasi-experimental design was adopted. Two hypotheses were tested. Treatment was by Branching Programmed Instruction. 291 SS II Students from six Schools participated. Instruments included Chemistry Achievement Test, Chemistry Attitude Scale, Reading Comprehension Proficiency Test, Chemistry Branching Programmed Text was stimulus instrument. Result showed that English Language Proficiency had significant effect on achievement and attitude. High English Language Proficient subjects achieved higher than low English Language Proficient subjects and developed more positive attitude. Recommendation was that level of semantics in English Language and its understanding be considered in designing texts. Writers should consider the difficulty encountered in using texts.

Background

Science and Technology have made a tremendous impact on all facets of man's existence and as a result, a lot of focus is being directed to the study of science as well as its application in Technology in Nigeria and other countries of the world. In the study of science, Chemistry is a major feature of the science curricula. It is so inclusive that it serves as a pre-requisite to the study of all science-based professional courses in our higher institutions. It is actually difficult to draw strict line between Chemistry and other physical and natural sciences (Slabaugh, Wedell and Parsons, 1966). As a result of the importance attached to this subject, it should be expected that the study of Chemistry in Nigerian secondary schools and the performance of students in the subject should have improved, but, what is observed in the field is a relatively poor performance of students in the subject (Adeyegbe 1993, Yoloye 1994, WAEC 1998, 1999 and 2000). This under achievement in chemistry prompted investigations to be conducted to find out the causes of the underachievement. Different empirical studies have identified several causes of this problem. Prominent among them was the English language proficiency levels of

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students (Eniayeju and Eniayeju, 1991, Ogbonnia, 1999, Papanastasiou and Papanastasiou, 2002, Von, 2002).

English Language Proficiency (ELP) is an individual characteristic that may influence the performance of second language students in science examinations. The choice of ELP as a variable in this study is important because English is the language of learning, language of instruction, of conceptualization and of communication in our schools. In considering the effect of English Language on achievement, there are two issues of importance: first, students are hindered if they are unable to articulate their thoughts clearly in the second language and secondly, language problems may interfere with students' understanding of examination questions (Bird and Wellford, 1995). In Nigeria, English is a Foreign Language (EFL) and studied in our schools as a second language (ESL) and at the same time, used as a medium of instruction. It will not be surprising therefore to discoverer that English Language affects science examination scores of students. For example, the West African Examinations Council Chief Examiners' report (2000), pointed out that candidates exhibited ignorance of the rudiments of English Language. They committed errors in their comprehensions and summary questions and this was attributed to the ignorance of the meaning of words. As a result, they assigned any imaginable meaning to any word and therefore, misunderstood the information in the passage. This report by the chief examiners explains the reason why earlier in 1999 there was a noticeable decline in performance in Chemistry which was attributed to students writing obscure answers that bore little relationship to questions (WAEC 1999).

The dynamics of science classroom are dominated by language and not surprisingly, over the past twenty five years, educationists have become more interested in the language used in science classroom interactions (Lemke, 1990). This has led to the growing awareness of the process of linguistic functions in classrooms. The way language is constructed and used influences the use made of a particular learning situation (Barnes and Todd, 1977, Love 1994, Rodriguez and Bell 1995). Language is an effective medium of instruction which cannot be dispensed with in the teaching-learning process. Umeoduagu (1991) noted that learning experiences are expected to be communicated to the child by way of language which is articulate and meaningful to him. It is identified as an important medium for thinking and learning that goes on in the classroom (Bennett, 1990). As language especially English, contributes significantly to the understanding of concepts in science clearly, it warrants investigation in the context of science education.

There have been some experimental studies on the effects of English language proficiency on students' achievement in science. O'Donnell (1968) reviewed the role of English Language in Physics examination questions, Cassels and Johnstone (1978), Cassels (1980) focused on the language used in multiple choice chemistry questions, Adeyegbe (1993) analyzed Senior School Certificate Examination results in science and found that candidates did not understand the questions which was as a result of deficiency in English Language. Ejide (2001) investigated the effect of dominant use of English language at home on students' academic performance and found that pupils from homes where only English language was spoken performed better than pupils from

homes where both mother tongue and English language were spoken. However, these researchers did not investigate the effect of English language proficiency on the attitude of students towards Chemistry which is a justification for the inclusion of attitude as a variable in this study. Also, the construct of attitude as it relates to Science is vague, inconsistent and ambiguous, (German, 1988). This could account for the reason why students' attitudes towards Science have been studied for decades, but little progress has been made in terms of developing more positive attitudes among students (Morell and Lederman 1998). Consensus has therefore not been reached by various researchers on the relationship between attitude and achievement in science. Research in this area has therefore led educators to study affective differences in connection with students' achievement (Fennena, 1980; Leder, 1990) and their results have either agreed or disagreed with each other which suggest conflicting findings.

Statement of Problem

Classroom activities in Nigerian schools involve an exchange in communication between the teacher and the learners through a medium of language. This communication which is usually in English Language is sometimes distorted leading to a breakdown in communication due to the learners' inability to comprehend this language of instruction. It has also been found that a great number of our secondary school students find it difficult to read and understand textual materials. It is therefore on the basis of this that this study was set out to investigate the effects of English Language Proficiency levels of students on their achievement in and attitude towards Chemistry.

Research Hypotheses

Two null hypotheses (H_0) were tested at .05 alpha level of significance in this study.

- H_{01} There will be no significant effect of English Language Proficiency on students' achievement in Chemistry.
- H_{02} There will be no significant effect of English Language Proficiency on students' attitude towards Chemistry.

Methodology

Design: The study adopted a randomized pre-test, post-test quasi-experimental design.

Population: The target population for this study was Senior Secondary two (SSII) Chemistry students in all the **twenty three** Senior Secondary Schools in Ibadan South West Local Government Area of Oyo state.

Sample and sampling procedure: Purposive sampling technique was adopted in selecting schools from the population based on certain criteria. (Such as should be co-educational, must have been presenting candidates for SSCE chemistry for at least five years, must have professionally qualified graduate Chemistry teachers, must not have treated the concepts to be used for the study). Thirteen of these schools met the criteria from which six schools were randomly selected. From the selected schools, two hundred and ninety-one Chemistry students participated in the study.

Instruments

The instruments used for the study were the Chemistry Achievement Test (CAT), Chemistry Attitude Scale (CAS) and the Reading Comprehension Proficiency Test (RCPT). The CAT was a 45-item multiple choice objective tests with four options that covered the learning units treated during the period of study. The reliability of the CAT was .85 and the difficulty index was .43. The CAS was adapted from the instrument developed by Simpson and Troost (1982) to measure the attitude of adolescents toward science and used by Talton and Simpson (1986). It had 46 items based on Rensis Likert scale which was pruned down to 40 after validation and the reliability estimate was .95 (Crombach alpha). The Reading Comprehension Proficiency test was taken from Grant, Nnamonu and Jowitt (1998). The RCPT consisted of 24 items with four options lettered A-D which after validation was reduced to 16 items. The reliability using KR 20 was .83 and the difficulty index was .53. The RCPT was used to categorize the subjects into high and low English language proficient groups. Those who scored above the mean were assigned to high while those who scored below the mean were assigned to low. A Branching Programmed Text in Chemistry (BPTC) developed by the researcher was used as a stimulus instrument. The instrument had a correlation coefficient of .65 using Pearson Product Moment Correlation.

Procedure

Before the commencement of treatment, the RCPT and pretest were administered, the result of the RCPT was used to classify the students into high and low English Language Proficient groups. A Self-learning teaching strategy using Branching Programmed instruction in Chemistry was adopted for the study. The teacher and students were briefed on how to use the programmed material. The treatment lasted five weeks after which a post-test was done.

Data Analysis: The data collected were analyzed using Analysis Covariance (ANCOVA) and Multiple Classification Analysis.

Result:

The result of this study was based on the stated two null hypotheses.

H₀₁: There will be no significant effect of English Language Proficiency on students' achievement in Chemistry.

To test this hypothesis, Analysis of Covariance (ANCOVA) was carried out and the result is presented in Table I.

Table I: Summary of ANCOVA of post-test achievement scores by English Language Proficiency

Source of Variation	Sum of squares	DF	Mean squares	F	Significance of F
Covariates	213.873	1	213.873	8.052	.005
Main Effects	4560.989	4	1140.247	42.928	.000*
ELP	353.311	1	353.311	13.301	.000*
Model	4952.462	12	412.705	15.537	.000
Residual	7384.266	278	26.562		
Total	12336.73	290	42.540		

The data on Table I shows that there was a significant effect of English language proficiency on students achievement in Chemistry ($F_{(1, 290)} = 13.301, P < .05$). Based on this finding, the hypothesis was rejected. This shows that English language proficiency has effect on the performance of students in Chemistry. To determine how the two groups of English Language proficiency performed, Multiple Classification Analysis was done and the data are shown on table 2 below with a grand mean of 22.

Table 2: MCA of post-test achievement scores according to ELP

Variables + category	N	Unadjusted mean Deviation	ETA	Adjusted for factors + covariate deviation	BETA
English lang. prof. 1. High	135	55	.079	1.23	.176
2. Low Multiple R = .622 Multiple R ² = .387	156	-48		-1.06	

The High English Language Proficient (HELP) group had an adjusted mean of 23.74 while the low English Language Proficient group had an adjusted mean score of 21.45. This shows that the HELP group performed better than the LELP group.

H₀₂: There will be no significant effect of English language proficiency on students' attitude towards Chemistry.

This hypothesis was tested with ANCOVA and the result is presented in table 3

Table 3: Summary of ANCOVA of post-test attitude scores by English Language Proficiency

Source of Variation	Sum of squares	DF	Mean squares	F	Significance of F
Covariates	2564.456	1	2564.456	9.997	.002
Main Effects	45292.72	4	11323.18	44.140	.000*
ELP	3287.917	1	3287.917	12.817	.000*
Model	48954.32	12	4079.527	15.903	.000
Residual	71315.07	278	257.529		
Total	120269.4	290	414.722		

The ANCOVA summary shows that ELP had a significant main effect on the attitude of students towards Chemistry ($F_{(1,290)} = 12.817$ $P < .05$). This hypothesis was as a result rejected. To determine the magnitude and direction of difference between the groups of ELP, Multiple Classification Analysis was carried out. The data are shown on Table 4 with a grand mean of 80.70.

Table 2: Multiple Classification Analysis of post-test Attitude scores according to ELP

Variables + category	N	Unadjusted mean Deviation	ETA	Adjusted for factors + covariate deviation	BETA
English lang. prof.					
1. High	135	204		3.75	
2. Low			.093		.172
Multiple R = .631	159	-1.76		-3.25	
Multiple R ² = .398					

Data in the table revealed that the HELP group had a higher adjusted post mean score of 84.45 than the LELP subjects with an adjusted mean of 77.45. This means that the attitude of students of high English language proficiency was more positively affected than those of low English language proficiency.

Discussion

The result of this study showed that ELP had a significant main effect on achievement in Chemistry. This result corroborates the findings of O’Donnell (1968), Eniayeju and Eniayeju (1991), Rollinick and Rutherford (1993) and West African Examination Council Chief Examiners’ report (2000). The finding does not however, agree with Iroegbu (2002) which might be due to the differences in the length of time of the two studies, target population and type of schools used. Result showed that the HELP subjects performed better than the LELP subjects in the CAT. This could be explained on the basis of their ability to read, comprehend and interpret the materials used for the self-learning/Programmed Instruction strategy. This led to better understanding of the concepts. As the materials used for the study were in prints and

therefore, called for the ability to read and understand, subjects who are proficient in the use of English Language had higher achievement scores than the LELP counterparts. The thought processes of the higher proficient subjects were clarified by their understanding of the language of instruction which facilitated contemplation, improved ideas and stimulated thinking that gave them edge over the low proficient subjects. The poor performance of the LELP subjects could be as a result of their ignorance of the rudiments of English Language which could have led even to misconceptions (WAEC, 2000).

The result of the study also showed that the ELP had a significant main effect on attitude. The HELP subjects who achieved higher than the LELP subjects in the Chemistry Achievement Test developed a more positive attitude. This should be so as attitude of students toward any school subject has been found to be directly related to the students' level of achievement (Beaton, Mullis, Gonzalez, Smith and Kelly 1996, Freedman, 1997). These findings agreed with Olawojaiye (1999) and Akinbote (1999) who found that level of academic achievement affects the attitudes of a learner to any discipline. It follows therefore that higher achievers are more positive in their attitude towards a school subject than the low achievers. This accounts for the more positive attitude developed by the HELP subjects than the LELP subjects towards Chemistry.

Implications and Recommendation

The findings of this study showed that English Language Proficiency of students influenced achievement in and attitude towards Chemistry in favour of the HELP subjects. The implication of this is that programme designers and classroom teachers have to be more careful when designing programmes and workbooks to be used by students. The level of semantics in English language and its understanding by students should be considered in designing programmed materials and workbooks. Also, writers and publishers of students' textbooks should put into consideration the issue of difficulty encountered by students in the course of using textual materials. English language teachers should go back to the rudiments of the subjects which the WAEC Chief Examiners' report (2000) implicated as a major militating factor against proficiency of students in the subject which consequently, affect their performance in Chemistry and other subjects.

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