Effectiveness of Jigsaw Instructional Strategy on Self-efficacy among High, Average and Low Ability Students of Polytechnics in North-west Zone, Nigeria

[1]Dr. Ali Muhammad SULEIMAN, [2]Dr. Aliyu Umar and Idris [3]Sani Ibrahim
[1]Department Physical Science Kano State Polytechnic
[2]Department of Science Laboratory Technology Kano State Polytechnic
3 Department of Pharmaceutical Science Technology
Kano state Polytechnic

Abstract
This study investigated the effects Jigsaw instructional strategy on self-efficacy towards chemistry among students of Average and Low Ability when compare with their counterparts of High and Average ability in control group taught using traditional talk and chalk method. The research design was the experimental/control match group design using pretest to ensure group equivalence and posttest to generate data for the study. The result obtained from the analyzed data showed that: (1) there was no significant difference in self-efficacy average ability subjects taught using jigsaw instructional strategy and the high ability subject taught using traditional lecture method. (2) low ability subjects taught using jigsaw instructional strategy developed high self-efficacy better than the average ability subjects taught using lecture method (3) low ability subjects taught using jigsaw instructional strategy developed high self-efficacy than the low abilities subjects in control group taught using lecture method. Based on these findings a number recommendations were made among which is the curriculum planners should examine the effectiveness of jigsaw instructional strategy in the teaching of sciences.

Key word: Jigsaw instruction strategy, High ability, Average ability and Low ability

Introduction

One of the social characteristics of a learner is the belief he holds in his capability to accomplish a task or activity that affects his learning (self-efficacy). In other words, leaner's self–efficacy belief is very essential in guiding learner towards accomplishments of task. Students with high self-efficacy participate enthusiastically in the learning process. Such students are more confident, active and have high self-efficacy towards learning. Students with high self-efficacy perform better in examination as compared to those students who have low self-efficacy (Abdullahi, 2010). Amini (2004) found that there is close relationship between self-efficacy and high rate of academic achievement. Students with low self-efficacy do not participate actively in the teaching and learning process. They remain silent, passive and have a withdrawal attitude towards learning activities. Similarly Pullmann and Allik, (2008) highlights that students with low self-efficacy do not expose their skills or willingness to take part in the learning process actively. They also try to hide their unfavorable characteristics which according to them are not liked by others. According to Slavin, Hurley and Chamberlain (2011) students with poor self-efficacy avoid anything that may put them in a risk of exposing their flaws to others for that they do not show much interest in the activities which may bring them fame and name in the class.

Students with low self-efficacy do not take part in computational activities that could also bring rewards, laurels to them such as furtherance of their education and bringing them good name in their social circles both in school and at home (Doymuş, 2007). In another study Murayama (2008) have examined the relationship between student's self-efficacy, their achievements and classroom participation. The rate of academic achievements of students with high self-efficacy was found to be highly significant. (Beckett, 2009) looked at the effects of self-efficacy of students in a post-high

school context in Indiana State through a longitudinal study. The students were placed in three categories for investigation. These three categories of students consisted of students who joined various services after completion of their high school education. Data collected from this study showed that the students who had high level of self-efficacy weremuch happy and were enjoying their services. Studies conducted by Beckett (2009) on prison inmates to see their level of self-efficacy. The study revealed that majority of them did not have positive self-efficacy about their own selves. They had less confidence to share their views with others during their school days. They shirked participating in activities with their classmates. After this study the same prisoners were provided training on developing positive self-efficacy. The post training interviews, and showed that this training had increased their self-awareness, self-confidence, and self-efficacy. Kurbanoğlu, and Akın (2012) found that individual with high self-efficacy did not drop out from school. The greatest number dropout occurred in schools where the students had low self-efficacy. Joseph (2004) had concluded that self-efficacy of gifted students (those with high degree of academic achievements) was much higher than those with low degree of academic achievements. Gifted students have thus more positive self-image and self-concept. According to Eilks (2005) there are other variables which contribute towards self-efficacy and increased rate of participation in learning activities by students such as, quality of family life, appreciation from teachers and parents, participation in co-curricular activities and positive peer relationships.

Statement of the Problem

Self-efficacy is positively co-relates with increased academic performance of students. Research studies showed a highly close relationship between academic achievements of students and their self-efficacy (Mari & Gumel 2015). Most studies had concluded that, students with high level of self-efficacy have high level of academic achievements (Doymus, 2007). The poor academic performance of students in chemistry in department of science laboratory of Kano state polytechnic is so alarming as can be seen from the reports of National Board for Technical Education (NBTE 2016-2018). Bashir (2016) relates this poor academic performance to the low level of students' self-efficacy towards chemistry. Mari and Gumel (2015) stated that, students difficulty in basic academic skills are often directly related to their beliefs that they cannot read write, or handle numbers, or think well- that they cannot learn- even when such things are not objectively true. This study investigated the effects jigsaw instructional strategy on self-efficacy among polytechnic students with varied learning abilities.

Objective of the Study:
The main objective of the study is:
The Effectiveness of Jigsaw Instructional Strategy (JIS) on Self-efficacy among High, Average and Low Ability Students of Polytechnics in North-west Zone, Nige**ria**

Research Questions:
1. Is there any difference in the self-efficacy believe between subject in the average ability learning group expose to Jigsaw Instructional Strategy (JIS) and subject in the high ability sub-group expose to lecture method?
2. Is there any difference self-efficacy believes between subject in low ability sub-group expose to JIS and subjects in average ability sub-group expose to lecture method?
3. What is the difference in self-efficacy believe low ability sub-group expose to JIS and their counterpart in control group expose to lecture method?

Null hypothesis:
1. There no significant difference in the self-efficacy believe between subject in the average ability learning group expose to JIS and subject in the high ability sub-group expose to lecture method.
2. There is no significant difference in self-efficacy believes between subject in low ability sub-group expose to JIS and subjects in average ability sub-group expose to lecture method.

3. There is no significant difference in self-efficacy believes low ability sub-group expose to JIS and their counterpart in control group expose to lecture method.

Methodology

This study was a matched experimental and control group. It employed pre-test post-test design. The population of the study comprised all the National Diploma two Students of Science Laboratory Technology (ND II SLT) in a State owned Polytechnics in the North-west geopolitical zone of Nigeria. The population consisted of 562 male and 530 female students of average age between 18 to 20 years. The six polytechnics in North-west geopolical zone were pre-tested to identify equivalent polytechnics in term of self-efficacy toward chemistry. Tow polytechnics were identified to be equivalent. The colleges selected were randomly assigned in experimental and control. The subjects selected were arranged according to their abilities level from highest to the lowest. The subjects ND 1 results were used to classify them. Top 25% were considered to be high ability, the middle 50% were the average ability while the last 25% were the low ability. This categorization of subjects according their ability level was based on the categorization of Lakpini (2006) and Adesoji (2011). In all one hundred and forty (140) subjects were selected. The subjects in experimental group were seventy (N = 70), in which average abilities 30, higher ability 20 and low ability 20. In the control there were seventy subjects as follows; higher ability 20, average ability 30 and low ability 20. Chemistry Self-efficacy Questionnaire was used for data collection in this study. CSQ was adopted from Mari and Gumel (2015). The instrument was used in two occasions, first in pre-test in order to determine the level of self-efficacy and equivalence of sample at the start of the study and secondly, in post-test to determine the effect of the treatment on the samples. The CSQ has reliability coefficient of 0.67 it consists of 20 items designed to assess individual self-efficacy level in chemistry. Items response was obtained using 5-point Likert scale ranging from SA (strongly Agreed), A (Agree), U (Undecided), D (Disagree) and SD (Strongly disagree). which carries 5,4,3,2 and 1 respectively for positive item while for negative item the scale is one to five (i.e. 1,2,3,4 & 5 respectively). Higher total scores reflect greater self-efficacy. T-test was used to test for the significant difference.

Data Collection Procedure

The experimental group was informed about how jigsaw group works and the need to have leader and the important of every member in the group. The following guidelines were followed in the formation of jigsaw groups and the expert groups:

1. The teacher divides the students into 4 or 5 people's Jigsaw groups which should be diverse of gender, ethnicity, race and ability.
2. The teacher appoints one student from each group as a leader who should be the most mature in the group.
3. The teacher divides the lesson into 4 or 5 segments.
4. The teacher gives each student in each group a segment of what is to be learned.
5. The teacher gives students time to write down their segment and become familiar with it.
6. Students from each Jigsaw group join other students assigned the same task to form "expert groups". The teacher gives the expert groups time to discuss their specific task.
7. The teacher brings the students back to their Jigsaw groups.
8. The teacher asks each student to present his or her task to the group
9. The teacher floats from group to group observing the process. If any group has any trouble, the teacher makes an intervention.
10. The teacher gives a quiz on what has been learnt and marks it himself.

The data collected were statistically analyzed using the Statistical Package for Social and Management Science version 17 (SPSS).

Null Hypothesis 1: There no significant difference in the self-efficacy believe between subject in the average ability learning group expose to JIS and subject in the high ability sub-group expose to lecture method.

Table 1: t-test on Self-efficacy of Experimental and Control groups

Group	Ability	N	$\bar{X}$	S.D	t-val	df	t-crit	Remark
Experimental	Average	30	3.55	0.54				
					1.76	48	2.00	NS
Control	High	20	3.67	0.72				

The results in Table 1 showed that the t-calculate (1.76) is lower than the t-critical (2.00) at 48 degree of freedom and 0.05 level confidence. This indicates that, there is no significant the means core of the subjects in the average ability sub-group taught using jigsaw instructional strategy and their counterpart in the high ability sub-group taught using traditional method. The null hypothesis is therefore retained.

Table 2: t-test on Self-efficacy of Experimental and Control groups

Group	Ability	N	$\bar{X}$	SD	t-value	df	t-crit	Rmk
Experimental	Low	20	3.15	0.54				
					2.75	48	1.67	Sig
Control	Average	30	2.86	0.63				

P≤0.05

In Table 2 the t-calculated is (2.75) which is greater than t-critical (1.67) at 48 degree of freedom and 0.05 level of significant. This showed that there is significant difference in means score between the low ability sub-group taught using jigsaw instructional strategy and their counterpart in the average ability sub-group taught using lecture method in the favor of excremental group. The null hypothesis is therefore, rejected, that is to say, the subjects taught using jigsaw instructional strategy developed more positive self-efficacy than those subjects taught using lecture method.

Table 3: T-test on Self-efficacy of Experimental and Control groups

Group	ability	N	$\bar{X}$	SD	t-value	df	t-crit	Rmk
Experimental	Low	20	3.15	0.54				
					2.76	38	1.97	Sig
Control	Low	20	.16	0.72				

P≤0.05

Also Table 3 showed t-value to be 2.76 which is greater than t-critical at 38 degree of freedom and 0.05 level of confidence. The null hypothesis is therefore rejected. Which means there is significant deference in the self-efficacy level of low ability subject taught using jigsaw instructional strategy and there counterpart taught using lecture method.

Discussion of Findings

The objective of this study is to investigate the effect jigsaw instructional strategy on self-efficacy among students with varied learning abilities. The result from the tested hypothesis one showed that the experimental group subjects of the average ability group developed positive self-efficacy as their counterparts of high ability in the control group after exposure to jigsaw instructional strategy. Jigsaw instructional strategy was able to bring the average ability subjects of the experimental group to be on a par with the high ability subjects of the control group taught using lecture method. The improvement of self-efficacy of subjects in the average ability sub-group to the level of high ability sub-group in the control group suggest a greater effectiveness of jigsaw instructional strategy over lecture method.

Result from the tested hypothesis tow revealed that subjects of low ability sub-group taught using jigsaw instructional strategy of the experimental group developed more positive self-efficacy than the average ability subjects taught using lecture method in the control. The results of tested hypothesis three revealed that subjects in the low ability sub-group in the experimental group developed more positive self-efficacy than their counterpart of low ability sub-group of the control group. This result suggested the effectiveness of jigsaw instructional strategy on low ability sub-group.

The finding of this study agrees to that of Bandura (2005), who reported that cooperative learning results in greater effort for performance, more positive interpersonal relationship and higher self-efficacy. Brady and Tsay (2010), opined that students who fully participated in groups' activities and exhibited collaborative behavior, provide constructive feedback and cooperate with their group mate, had a higher test scores and developed higher self-efficacy. The findings of this study were supported on the notion that Jigsaw instructional strategy is an active pedagogy that fosters higher academic performance which in turn improves students' self-efficacy (Hesson and Shad, 2007). However, the result of the present study contradicts the report of Mari and Gumel (2015) who investigated the effect of Jigsaw-learning model on self-efficacy belief among students of college of education. Their results reveal no significant difference in the self-efficacy belief of students involved in the study.

Implication of the Study

The results obtained from the present study shows that a strategy which is students' center, collaborative, where students are actively participating in knowledge construction has positive effects on students' self-efficacy belief. It help them to strengthen their ability and apply knowledge acquire to solve real life problems.

Conclusion

The results obtained from the study are important to chemistry teachers in particular and science teachers in general it urged them to improve on their teaching method. Active participation of student in knowledge construction raise their self-efficacy believes regardless of their ability group.

Recommendations

Based on the finding of this study, it is therefore recommended that:

1. Curriculum planners should examine the effectiveness of jigsaw instructional strategy in the teaching of sciences.
2. The federal and state ministry of education should organize seminars and work for teachers on the use of jigsaw instructional strategy.
3. The curriculum planers of teachers' training institute should include Jigsaw instructional strategy should be incorporated in science teachers training curriculum.

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