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Effect of Self Regulated Learning Approach on Junior Secondary School Students' Achievement in Basic Science

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Abstract
This study explored the effect of self-regulated learning approach on junior secondary school students' achievement in basic science. Quasi-experimental design was used for the study.Two co-educational schools were drawn for the study through simple random sampling technique. One school was assigned to the treatment group while the other was assigned to the control group through a simple toss of the coin. Basic Science Achievement Test (BSAT) was the instruments used to collect data. Three research questions and three null hypotheses guided the study. The data for the research questions were answered descriptively using mean and standard deviation, while the hypotheses were tested using the analysis of Covariance (ANCOVA) at an alpha level of 0.05. The findings of the study reveal that self regulated learning strategy enhanced higher students' achievement in basic science than the conventional method.
Keywords: Self-regulated learning, Basic Science, Quasi-experiment, Stimulus response learning.

Introduction

The term self-regulated learning can be used to describe learning that is guided by Metacognition (thinking about one's thinking), strategic action (planning, monitoring and evaluating personal progress against a standard), and motivation to learn (Butler and Winne, 1995; Winne and Perry, 2000; Perry, Phillips, and Hutchinson, 2006; Zimmerman, 1990; Boekaerts and Corno, 2005). In particular, self-regulated learners are cognizant of their academic strengths and weaknesses, and they have a repertoire of strategies they appropriately apply to tackle the day-to-day challenges of academic tasks. These learners hold incremental beliefs about intelligence (as opposed to fixed views of intelligence) and attribute their successes or failures to factors (e.g., effort expended on a task, effective use of strategies) within their control (Dweck and Leggett, 1988; Dweck, 2002). Students who are self-regulated learners believe that opportunities to take on challenging tasks, practice their learning, develop a deep understanding of subject matter, and exert effort will give rise to academic success (Perry, 2006).

In part, these characteristics may help to explain why self-regulated learners usually exhibit a high sense of self-efficacy (Pintrich and Schunk, 2002). In educational psychology literature, researchers have linked these characteristics to success in and beyond school (Corno, 20002; Pintrich, 2000; Winne and Perry, 2000). Understanding the notion of self regulated learning enhances a teachers' ability to be reflective because SRL provides additional insights into the issues of teaching and learning, particularly those that arise when teachers are faced with the challenge of connecting their teaching and the students' learning to the real world. Knowing more about their own thinking, developing effective strategies, and sustaining their own motivation will be crucial for teachers interested in making schooling more relevant to outside world. In addition, by combining the notions of contextual teaching and SRL, teachers gain a deeper understanding of the learning experiences that face their students. Teachers have a better sense of what is entailed in those experiences, what obstacles need to be overcome, and what teaching or learning strategies that will be called into play. The more teachers understand about their own thinking, the better they can model for students. Understanding self-regulation can help teachers make thinking public and visible. Thinking-strategic, independent, and inquisitive- then become a topic of classroom discussion and an explicit goal of education.

Understanding the nature of self-regulation and how it is nurtured opens up a world of possible roles and relationships between teachers and students. That is why metaphors of teaching as (coaching and mentoring) are popular today. They emphasize how teachers design and scaffold experiences that lead students to emulate the wisdom of teachers. The aim of focusing on SRL in preparing teachers to contextual teaching is to help new teachers better understand themselves as thinkers so they can impart a metacognitive curriculum to students that is thought-provoking and stimulating.

Self-appraisal leads to a deeper understanding of learning. One general aspect of Metacognition is the periodic appraisal of one's thinking. It is useful for teachers and students alike because it is a reflection on the dynamics of teaching and learning, the core of education, and a first step to changing or revising one's approach. There are a number of ways that self-appraisal enhances learning.

These may include analyzing personal styles and strategies for learning, and comparing them with others. This increases awareness of different ways of learning. Teachers can Asses their own learning strategies by examining the processes they use to write papers, the tactics they use to search for information in the library

or on the Internet, or their methods of studying for tests. Each of these activities are similar to the tasks they will present to children sot they need to become aware of their own learning strategies and then compare them to other options. For example, teachers may discover that some people use notes or outlines before writing but others do not; some may revise several times while others revise once; some may ask for friends to read early drafts but others are reluctant to share their writing. Teachers need to know why adults choose particular methods for writing papers so that they can create situations in which their students discover the same range of styles. Teachers also need to become aware that learning strategies are often unexamined, often superficial or easy, and often difficult to change. Unless they go through the process of explaining, discussing and justifying their own strategies, they may not understand how children can create or adopt poor learning strategies. Moreover, until one discusses why strategies are chosen and if someone would give up their strategy, they may not realize how entrenched people can be with their prior habits.

Evaluating what you know and what you do not know, as well as discerning your personal depth of understanding about key points, promotes efficient effort allocation. Perhaps, the most surprising finding from early metacognitive research was that children are often aware of what they do not know (Markman, 2001) and unable to distinguish important information (Brown and Baker, 2003). Either they fail to reflect on what they do not understand or mistakenly assume that things make sense when they do not. This is exactly why periodic self-appraisal is useful. Teachers may fail to discern their own understanding also. Sometimes, they follow a teachers' manual or prescribed lesson plan so carefully that they fail to ask if it makes sense to them, if all the information is necessary to teach, or if it could be presented in a more sensible sequence.

Teachers learn to judge their own knowledge by evaluating a lesson that they are preparing to teach to identify the important and secondary information. This can be done through highlighting or summarizing in a way that can be used directly with students also. Another method is to identify aspects of the lesson that may be confusing to them so that they do not provide superficial or erroneous information to students. Another method is to ask questions of other teachers about their lesson plans to prompt them assess their own level of understanding and to provide warrants for their teaching.

Periodic self-assessment of learning processes and outcomes is a useful habit to develop because it promotes monitoring of progress, stimulates repair strategies, and promotes feelings of self-efficacy. Research on children's reading has shown that they rarely stop as they read a passage to determine if it makes sense, if their rate is appropriate, or if they need to reread (Winograd and Paris, 2008). Instead, they read short to finish and then are perplexed if they cannot answer the teachers' questions. When children fail to monitor their comprehension, they may erroneously attribute poor performance to their low ability rather than lack of strategic reading and they may feel ashamed of their reading instead of proud. Adults can exhibit similar behaviour also.

The teacher is the key actor in the provision of quality science education. Therefore, for the effective implementation of the Basic Science curriculum much are desired of the science teacher. For science, and particularly Basic Science, to adequately play these desired roles, the factors necessary for the teaching and learning of science and in particular Basic Science must be suitable and be such that can create and sustain students' interest in the subject. Although some teachers tend to use expository method which entails a teacher standing before the students and reading a paper, arguing a point, or writing on the chalk board with minimal chance for students' participation

Although the attributes if self regulated learning tend to suggest that its learner centeredness will facilitate achievement and boost interest especially at the basic science level, its practical gains in terms of achievement and interest in science among beginners still remains in doubt. It therefore becomes very necessary that the practical implications of the self regulated learning as an instructional technique on students' achievement and interest in basic science be verified.

Objectives of the Study

The purpose of this study is to explore the effect of self-regulated learning approach on Junior Secondary school students' achievements in Basic Science. Specifically, the study explored:

1. Effect of self-regulated learning on students' achievement in Basic Science.
2. Effect of self-regulated learning on achievement of male and female students' in basic science.
3. Interaction effect of method and gender on students' achievement in Basic Science.

Scope of the Study

The study is restricted to the effect of self-regulatory learning on Junior Secondary school II (JSS II) students' achievement in Basic Science. The Basic Science unit focused on during the 8 weeks of the experiment is saving your Energy, as contained in the current syllabus from the national curricular as approved by the National Council on Education (2007). The sub-topics include: energy and appliances in the home, forms of energy, Force, Simple Machines, Maintenance of machines.

Research Questions

The following research questions guided the study:

1. What is the effect of self- regulated learning approach on students' mean achievement score in Basic Science?
2. What is the effect of self-regulated learning approach on the mean achievement scores of male and female students' in Basic Science?
3. What is the interaction effect of the gender and method on students' achievement in Basic Science?

Hypotheses

The following null hypotheses were tested at an alpha level of 0.05

$H0_1$: There is no significant difference in the mean achievement scores of students' taught Basic Science using self-regulated learning approach and those taught with the conventional approach.

$H0_2$: There is no significant difference in the mean achievement scores of male and female students' taught Basic Science using the self regulated learning approach.

$H0_3$: There is no significant interaction between gender and method on students' achievement in Basic Science.

Method

This study employed a Quasi-experimental research design. The specific design the researcher employed is a pretest posttest non-equivalent control group design. In this design there were both experimental and control groups. In this design also there is no random assignment of subjects. Intact classes were used. The design is represented thus:

$$\frac{Y^b \; x \; Y^a}{Y^b \; \sim x \; Y^a}$$

where Y^b = Pre-test

Y^a = Post-test

X = Treatment

~X = Conventional Method

The study was conducted in secondary schools in Udi Education Zone of Enugu State of Nigeria. Most of the schools in the zone are coeducational; the researcher used only coeducational schools. Two secondary schools were drawn from the twenty three coeducational secondary schools in the zone through simple random sampling. Out of the two secondary schools that were used for the study, one was assigned to the treatment group while the other was assigned to the control group through a simple toss of coin. Due to the large population at the junior secondary level data for the study were collected from only two intact classes in JSS II from each of the two schools that were used for the study. These intact classes were drawn through simple random sampling technique. In all therefore a total of four intact JSS II classes were used for this study (2 intact classes for treatment group and 2 intact classes for the control group).

The instruments that were used for data collection is Basic Science Achievement Test (BSAT). The BSAT is a 50-item multiple-choice test. The items were drawn from the module – Saving your Energy. The five units in the module (Energy and appliances in the home-forms of energy, Energy, Force, Simple machines, Maintenance of machines were taken into consideration in item generation. The distribution of the items across the contents was guided by a test blueprint.

The BSAT was subjected to both face and content validation. The Basic Science Achievement Test was face validated by specialists in Science Education and Measurement and Evaluation. During the face validation the test was scrutinized in terms of relevance, general test format, suitability and clarity. For the content validation a test blueprint was developed which guided the generation of the test items. In addition the researcher subjected the BSAT to item analysis to verify the difficulty and discrimination indices of the items.

The reliability of the Basic Science Achievement Test was assessed using a measure of stability and internal consistency. To assess the stability of the instrument, the researcher employed the test-retest procedure. Using the Pearson's Product Moment correlation approach the BSAT yielded a stability index of 0.93. The test of internal consistency for the BSAT was conducted using the Kudar Richardson's (K-R 20) approach. The BSAT yielded internal consistency index of 0.91.

Experimental Procedure

The researcher developed two instructional packages for this study. The first instructional package is based on the Self Regulated Learning Approach while the second package is based on the conventional method. The two packages were drawn from the same curriculum content. The Self Regulated Learning Approach was used for treatment group while the conventional package was used for the control group. At the onset of the experiment, the subjects in both the treatment and control groups were given the pre-test. After the pre-test the regular Basic Science teachers began the experiment in their respective schools adhering strictly to the lesson procedure that

was developed from the instructional package during the pre-experimental training. The experiment was conducted during the normal school periods in accordance with the school timetable. At the end of the experiment that lasted eight weeks the posttest was administered to the subjects in the two groups. Data were collected during the pre and posttest for the two groups on achievement in Basic Science. Research questions were answered descriptively using mean and standard deviation, while the hypotheses were tested using the Analysis of Co-variance (ANCOVA) at an alpha level of 0.05.

Control of Extraneous Variable

The following procedures were adopted by the researcher to ensure that extraneous variables, which may influence the internal validity of the findings, are controlled:

(i). Instructional Situation Variables

The researcher prepared and issued out instructional guides for teachers in each of the two groups in order to ensure compliance to the specifications of the instructional packages in each of the groups. In order to minimize errors, which may arise as a result of teacher difference, the researcher organized a pre-experimental training for the teachers that were used for the study. Separate trainings were organized for teachers in the two groups. The purpose of the training is to establish uniform instructional standard among the teachers. In addition the researcher monitored the experiment very closely and ensured that they comply with the stipulated procedure.

(ii). Inter-group Variables

Intact classes were used for this study. This implied that initial equivalence cannot be achieved for the research subjects in the two groups and even within a group. In order to control the errors that may arise as a result of the non-equivalence, the researcher employed Analysis of Co-variance for data analysis.

(iii). ***Subject Interaction***

The researcher did not select treatment and control groups from the same school to ensure that the students in the treatment and control groups do not exchange ideas and information. This is to reduce errors arising from interaction among the research subjects in the two groups which may lead to either harthawn or John Henry effect.

(iv). ***Testing effect***

The same test was used for pretest and posttest. In order to reduce errors of memorization of previous test items the researcher reshuffled the items of the posttest. In addition papers of different colours were used for the pretest and posttest.

Results

Research Questions

Research Question 1

What is the effect of self- regulated learning approach on students' mean achievement score in Basic Science?

For this research question data obtained with the Basic Science Achievement Test for the treatment and control groups were used to answer the research question. Mean for pre and post test were adjusted statistical in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 1.

Table 1: *Mean Basic Science achievement scores of students taught Basic Science using the self-regulated approach and those taught with the conventional method.*

Groups	Adjusted Me	Std
Treatment Group (Group Taught with Regulated Approach)	55.07	10.21
Control Group (Group taught with conven method).	40.24	8.51

Result on table 1 above show mean achievement score of 55.07 and standard deviation of 10.21 for the experimental group. That is the class taught using self-regulated learning while a mean achievement score of 40.24 and standard deviation of 80.51 is for the control group. The mean score for the experimental group is higher than that of control group. The treatment group therefore achieved better than the control group in achievement score in Basic Science.

Research Question 2

What is the effect of self-regulated learning approach on the mean achievement scores of male and female students' in Basic Science?

In answering this research question the researcher used the subjects from the treatment group only. The

pre and posttest scores of males and females who were taught Basic Science using the Self-regulated approach were adjusted in the analysis. The summary of result is shown in table 2.

Table 2: *Mean Basic Science scores of males and females taught Basic Science using the Self-regulated Approach*

Gender Categories	N	Adjusted Mean	SD
Male Students	47	56.11	9.70
Female Students	22	52.86	11.14

Result on table 2 above show a mean achievement score of 56.11 and standard deviation of 9.70 for the males and mean achievement score of 52.86 and standard deviation of 11.14 for the females for treatment group. The results for male and female groups of students had marginal effect in achievement score in basic sciences. The male performed better than the female.

Research Question 3

What is the interaction effect of gender and method on students' achievement in Basic Science?

The adjusted mean for the two levels of gender that were subjected to the Self-regulated approach and those subjected to the Conventional approach were used to assess the interaction. Summary of result is presented in table 3.

Table 3: ***Summary of interaction of gender and teaching method on students' mean achievement scores in Basic Science***

Gender Groups	Adjusted Mean for Treati Group	Adjusted Mean for Conventional Method
Males	56.11	40.82
Females	52.86	39.70

The result in table 3 shows that there is interaction between method and gender on students understanding and achievement in self-regulated learning. The results in the table also indicate that the average mean score in treatment group is greater than the control group at both male and female students' levels. Also the treatment (mean score) at both male and female levels shows no significant difference when compared with the control group (mean score).

Hypotheses

$H0_1$: *There is no significant difference in the mean achievement scores of students' taught Basic Science using self-regulated learning approach and those taught with the conventional approach.*

$H0_3$: *There is no significant interaction between gender and method on students' achievement in Basic Science.*

These two hypotheses were tested using Analysis of Co-Variance. Summary of the analysis for these two null hypotheses is shown in table 4.

Table 4**: *Analysis of Co Variance for Students Overall Basic Science Achievement scores by teaching methods and by gender with interaction effect***

Sources of variation	Sum of squares	Df	Mean Squares	F	F_{cv}
Covariates	**10576.662**	**1**	**10576.662**	**390.149**	
Main Effects	**6274.174**	**2**	**3137.087**	**115.720**	
Teaching Methods	**5894.303**	**1**	**5894.303**	**217.427**	**3.89**
Gender	**22.517**	**1**	**22.517**	**.831**	**3.89**
2 – Way Interaction Teaching Methods & Gender	**11.519**	**1**	**11.519**	**.425**	**3.89**
Explained	**16862.356**	**4**	**4215.589**	**155.503**	
Residual	**3849.522**	**142**	**27.109**		
Total	**20711.878**	**146**	**141.862**		

For hypothesis 1, the ANCOVA result in Table 4 shows that the calculated F-ratio (F-cal) due to teaching method is 217.427 while the critical value (F-critical) at alpha level of 0.05 is 3.89. The decision rule is to reject the null hypothesis if the calculated value is greater than the critical value at a given probability level. The null hypothesis was therefore rejected. The researcher therefore concludes that there is significant difference in the mean achievement scores of students' taught Basic Science using self-regulated learning approach and

those taught with the conventional approach.

For hypothesis 3, the same ANCOVA table reveals that for the two-way interaction, the F-calculated is .425 which is less than the critical value of 3.89 at alpha value of 0.05. Based on the decision rule, the researcher upholds the null hypothesis and concludes that there is no significant interaction between gender and method on students' achievement in Basic Science.

$H0_2$: *There is no significant difference in the mean achievement scores of male and female students' taught Basic Science using the self regulated learning approach.*

This hypothesis was also tested using the Analysis of Co-variance. Summary of result is shown in Table 5

Table 5: ***Analysis of Co Variance for Students Overall Basic Science Achievement scores for treatment group only by gender***

Sources of variation	Sum of squares	df	Mean Squares	F	F_{cv}
Covariates	**3915.955**	**1**	**3915.955**	**82.318**	
Main Effects	**35.011**	**1**	**35.011**	**.736**	**3.98**
GENDER	**35.011**	**1**	**35.011**	**.736**	3.98
Explained	**3950.966**	**2**	**1975.483**	**41.527**	
Residual	**3139.672**	**66**	**47.571**		
Total	**7090.638**	**68**	**104.274**		

For hypothesis 2, table 5 indicates that F-calculated is .736 which is less than critical value (F-crit) of 3.98 at an alpha level of 0.05. Since the calculated value is less than the critical value at a given probability level, the null hypothesis is not rejected. The researcher therefore concludes that there is no significant difference in the mean achievement scores of male and female students' taught Basic Science using the self regulated learning approach.

Summary of Result

Results presented in this chapter reveal that:

(a).Self regulated teaching strategy enhanced higher students' achievement in Basic Science than the conventional method. Male students achieved higher than the female students in Basic Science when self regulated method was used but the difference is however not significant.

(b).There is no interaction effect of teaching methods and gender on students' means achievement scores in Basic Science.

(c). There is a significant difference in the mean interest scores of students taught Basic Science using self regulated approach and those taught Basic Science using conventional method. The difference in the mean achievement scores of male and female students taught Basic Science using self regulated approach is not significant.

(d). There is no significant interaction between gender and teaching methods on students' mean interest scores in Basic Science

Conclusion and Recommendations

From the results obtained in the study, the researcher concludes that self-regulated learning method of instruction is superior to the conventional chalk-talk approach in fostering mastery of basic science concepts among junior secondary school students. When students are exposed to learning through exploration, asking question, answering questions and writing down questions and answers on what they have explored, concepts are more appropriately internalized with the learner taking responsibility of their own learning. Based on the findings of this study, the researchers recommend that self-regulated learning instructional strategy should be included in the curriculum of pre-service teachers. In addition conferences, seminars and workshops should be organized regularly by government and relevant professional bodies to educate basic science teachers on the use of self regulated learning instructional strategies. Government agencies and professional associations, whose responsibilities it is to design and revise the curriculum for secondary schools, should incorporate and emphasize the use of self-regulated learning instruction strategies in basic science curriculum.

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