Effects of Self-Regulated Learning Model on Students Attainment of Physics Concepts and Retention in Nigeria

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Executive Summary

Before the pandemic (COVID-19), Nigeria's education sector was already faced with many problems. One of the problems is how to make learning in schools more authentic, more useful, more contextualized and more meaningful for students so that they are equipped to solve problems that confront them in and beyond schooling. We should ask ourselves, how our children /students can compete on the world stage with this quality of teaching (through rote memorization). Consequently, the effects of Self-regulated learning model on physics students' academic achievement and retention would be explored. In order to address these issues, four (4) research questions and four (4) hypotheses will be raised and tested in the study at 0.05 level of significant. The study will adopt the quasi-experimental research design (Non-Equivalent Control group research design). All SSII physics students' in all the public senior secondary schools in Ethiop West Local Government Area of Delta State form the population of the study. From the total population of the study, a sample will be drawn from two co-education public senior secondary schools that are far apart; these two schools will be selected using the multistage sampling techniques. The instrument that will be used for data collection will be the Physics Students' Achievement Test (PSAT). Reliability and Validity of the instruments will be carried out and analysed using the t-test and analysis of covariance statistics (ANCOVA). It is hope that workable recommendations that will improve students' academic achievement will begiven due attention by the concerned educational bodies and the Government, based on the findings of this study.

Introduction

It is apparent that the COVID-19 pandemic has a sweeping effect across different sectors of the Nigerian economy. The effect has been drastic, from the financial sector to entertainment and to education. Stakeholders in every affected sectors have been forced to restructured and have a rethink on their operations. Recently, the Government of Nigeria allowed students in exit classes to resume school in preparation for West African Senior School Certificate Examination (WASSCE). Even before the pandemic, Nigeria's educational sector was already basset with many problems. Issues like gender discrimination, poor academic performance to low retention etc. We can only hope that these students do well after months of learning hiatus.

However, trend analysis studies on achievement patterns in physics among Nigerian senior secondary school students clearly shows that from 2001to 2015 shows that there was a steady average of l.9% annual decline in students' achievement in physics at the West African Senior School Certificate Examination (WASSCE). Similarly, 2016 NOV/DEC. NECO results shows that out of 22,201 number of students who sat for physics examination, only 818 representing 3.68% of the students pass at credit level (Omoifo, 2012). Also the Chief Examiners' Annual report in Senior Examination for 2001/2002, 2002/2003, 2009/2010, attributed students' poor performance to poor teaching methods which results in weak preparation of candidates for the examination. This downward trend in students' performance in external examinations in physics has become a source of worry for all especially physics educators. Could teaching method be responsible for this poor academic performance?

The essence of teaching is to bring about positive change in the thinking of the students. The teaching method the teachers adopt in order to bring about this positive change is very important. But in Nigeria, the predominant method of teaching physics is the traditional method which is mostly talk and chalk method that emphasizes transfer of knowledge, skills and rewards memorization. In this method the teachers talk while the students listen and jot down notes mainly for the purpose of passing examination(s). According to Piaget and Vygotsky deposited that an important goal of teaching should be to lead the students to achieve participation so that they can actively explore, think and construct their own knowledge (lhensekhien, & Salami, 2012).

But the different ways in which students learn is a reflection of the type of teaching/learning method that they are expose to. Therefore, teaching and learning through rote memorization could lead to poor performance of students towards physics. Studies have suggested that students generally regard the study of physics as difficult, abstract, uninteresting and elite disciples' only suitable for exceptionally talented and gifted students. This might not be true as observed by the researchers.

Despites the different instructional methods proposed by different researchers, there is still persistence poor academic achievement toward physics. Could it be that teachers only focus on teaching methods (that is teachers leaving the learning to the faith of the students)? How can we

help students to learn and understand physics better and more importantly, encourage their future involvement in the study of physics? In answering this questions raised by the researcher, is important to look at a teaching and learning strategy proposed by Bandura knows as "Self-regulated learning strategy (SRLS)".

Saks and Leigen (2014) defined self-regulated learning strategy as an active process whereby students set goals for learning, monitor and control their cognitive processes, get motivated and get to achieve the targeted goals set by the students. Self-regulated learning strategy is a learning process whereby learners can control their own motivation, cognition and behavior. Students can manage their own learning in a proactive way which includes the process of goal setting, planning, use of strategies, monitoring and evaluating. Therefore,to promote physics learning in Senior Secondary level in Nigeria, there is need for physics teachers to encourage students to develop and employ self-regulated learning strategy that will enable them view scientific knowledge as that which is not separated from their environment and background. Self-regulated learning strategy includes two sub-processes, motivational beliefs and strategy use. It can also be seen as the integration of "will" and "skills". "Will" refers to learners' goals, values and expectation or motivational orientation. "Skills"refers to the learners' use of different strategies of cognition, Meta-cognition and resources management (Garica, l996). Therefore this study will make an attempt to investigate the effects of self-regulated learning strategy (SRLS) model on students' academic achievement and retention on the concepts of heat and temperature. However, the choice of heat and temperature for this study was born out of the fact that studies have shown that students have difficulty about the concepts of heat and temperature which may hinder their adequate understanding of the concepts and also heat and temperature are important topics as they are applicable to many fields of science and technology. Researchers have also observed that students frequently confused the concepts of heat and temperature.

Objective of Study/ Project Goals/ Impacts

This study has the following specific goals

1. To determine whether self-regulated learning model is more effective than the method used by physics teachers with respect to academic achievement of students in physics.
2. To examine the effect of self-regulated model on the academic achievement of high-achiever.
3. To examine the effects of self-regulated model on the academic achievement of low-achiever.
4. To examine the effects of self-regulated learning model on the retention of the students.
5. To recommend for the improvement and promotion of suitable method of teaching physics.

At the end of this empirical study, it is hoped that the results will have high impact on education in the following Ways;

1. Apart from considering the study novel approach in teaching physics, the findings will be made available to physics teachers in the school system through Workshops, and seminars that will be utilized effectively in the classroom.
2. The findings of this study will enable researchers, science educators, and curriculum planners, ministries of education, education research institutions and organizations of interest to have empirical evidence on self-regulated learning model on academic achievement of physics students.
3. The findings will also be beneficial to students, as it provides a learning strategy that will enhance their understanding which will lead to academic achievement, and increase their interest towards physics by making them life-long learners.
4. Finally, if self-regulated learning model is implemented in the classroom,it would be beneficial to Nigerians because it would increase students' performance; this will lead to increase in students enrolment in physics which in turn translates to growth in the figure of students' in science courses in tertiary institutions. Also the 60% to 40% ratio of science to art admission policy into tertiary institutions as specified by the National Policy on Education (PGN, 2008) can be achievable, thereby providing enough manpower in science and technological industries

In view of the above stated objectives, the following research questions were raised to guide this study by the researchers.

1. Will there be any significant difference between mean achievement scores of the students taught by self-regulated learning model and students taught with the traditional method of teaching physics?
2. Will there be any significant difference between mean scores of high achiever and low achiever of the control and experimental groups at post-test?

3. Will there be any significant difference between the mean scores of high achievers and low achievers of the experimental and the control groups on retention test?
4. What is the interaction effect of teaching methods of students' achievement in physics?

Based on the research questions, the following hypotheses will guide this study:

1. There is no significant difference between mean achievement scores of the students taught by self-regulated learning model and students taught with the traditional method of teaching physics.
2. There is no significant difference between mean scores of high achiever and low achiever of the control and experimental groups at post-test.
3. There is no significant difference between the mean scores of high achievers and low achievers of the experimental and the control groups on retention test.
4. There is no significant interaction effect of teaching methods on student's achievement on Heat and Temperature.

Review of Related Literature

Self-regulated learning strategy has a reputable history in cognitive psychology with roots in Bandera's Social cognitive learning theory (SCLT) which suggests that learning occur as a result of a dynamic interaction of three factors constantly influencing each other, thus, Person, Behaviour and Environment (Bandura, 1991; Melellan. & Martin, 2008; McAlister, Perry, & Parcel, 2002). For instance an individual's belief goals and self-perception can influence their behavior, in turn influence their thought and emotion. Additionally an individual's behaviour can determine element of their environment and their behaviour can also change as a result of their environment. Finally physical and social factors of an individual's environment can influence their beliefs and cognitive functioning and vice-versa (Bandura, 2001). Bandura included self-regulation in his social-cognitive learning theory of human behaviour as a process through which individuals control their external environment by conducting self-observation and judgments as well as self-reactions (Bandura, 2001; Schunk, 2008). More specifically, self-regulation focuses on the result of behaviour that can be seen as the product of the individual environment interaction.

Therefore, self-regulated learning strategy can be used to described learning that is guided by Meta-Cognition (thinking about one's thinking), Strategic action (planning, monitoring and evaluation, personal progress against standards), and Motivation to learn (Zimmerman, 2001; Winne & Perry, 2000; Perry, Phillips & Hutchinson, 2006). In particular, self-regulated learners are cognizant of their academic strengths and weakness and they have a repertoire of strategies they appropriately apply to tackle the day-to-day challenges of their academic tasks. These learners hold incremental beliefs about intelligence (as against fixed views of intelligence) and attribute their successes or failure to factors (e.g. effort expended on task, effective use of strategies) within their control. They believe that ability is incremental; they also value personal progress and deep understanding and view errors as opportunity to learn.

Understanding the nature of self-regulated learning strategy and how it is been nurtured opens up a world of possible roles and their relationship between teachers and students. That is why the metaphors of teaching as coaching and mentoring are popular today. It emphasizes how teachers deign and scaffold experiences that make students to emulate the wisdom of the teachers.

It is important to outline what does not constitute self-regulated learning strategy as documented in the literature. Researchers in the field have operated with the view that self-regulated learning is not a mental ability or an academic performance skill, but is a self-directed process through which students transform their mental abilities into academic skills (Zimmerman, 2008). Rather viewing themselves as victims of the learning process, with their learning simply being an event in reaction to teaching, self-regulated learners perform learning activities consciously in a proactive way for their own benefit (Zimmerman, 2008). Self-regulated learning strategy is also not a single personality trait that an individual possesses but involves selective use of specific processes/strategies that are personally adapted to each learning task and educational context.

There are different taxonomies of self-regulated learning strategy model available in literature but this study will adopt Zimmerman's cyclical Model of self-regulated learning strategy. Mclieachic, Pintrich, Lin, and Smith (1987) deposited that, Zimmerman's cyclical Model of self-regulated learning strategy is comprehensive and fit for Science (Physics) teaching and learning. However, self-regulated learning (SRL) strategy theories try to model how each of these, "Cognition, Meta-Cognition, Motivation, and Contextual factors" which influences the learning process. Even though the four assumptions serveas the basis for most SRL strategy theories but reviews of literature indicates that some approaches have shown major dominance when it comes to studies involving students' academic performance and Zimmerman's Cyclical Model is one of them.

Zimmerman's Cyclical Model takes into consideration how an individual perceptions; environment and behavior interact to influence the learning process. He believed that self-regulated learning is distinct from other theoretical model of learning because it describe learning activities form the students perspectives, also draws heavily from an individuals' self-image as a learner. Hence, his cyclical model of SRL strategy provides a useful way of exploring issues such as how self-efficacy shapes learning strategy used and how learners' self-evaluations influence their sub-sequent motivation and goal-setting. Zimmerman's cyclical model involves three sequential phases namely the fore thought (Pre-action) phase, the performance (actions) phase, and the self-reflection (Post-action) phase. To promote or integrate SRL strategy in science classroom, teachers must teach students' the self-regulated learning processes that facilitate learning. These processes often includes: goal setting planning, attention, control, flexible use of learning strategies, self-monitoring, appropriate help-seeking and self-evaluation.

Self-regulated learning strategy as apply to achievement is not necessarily universal in its application; rather, it can be situation or contextual. The skills and approaches needed for one subject do not necessarily apply to all subjects. As applied to the study of science (although it has been argued by researchers that SRL strategy can be applied to all subjects), Winne and Perry (2001) view SRLS which is similar to that of Zimmerman, has three Components: Cognition,Meta-Cognition and Motivation. The Cognitive aspects comprises of theknowledge and skills a students' needs to engage in the processes of science; problem-solving, inquiring and critical thinking. The Meta-Cognitive aspect comprised of the knowledge and skills the students need to understand and exert control over there cognitions While the motivational aspect comprised the attitudes and belief the students has in relation to the use and development of one's cognition and meta - cognition" (Sinatra & Taasobshirazi, 2011). Over the past decades, educational research has emerged on the use of SRL strategy as a dominant paradigm. This new paradigm emphasis learning as an active process best facilitated by the learner himself and the interaction with peers, teachers, and other learning resources.

Chika, Abigail and Okafor (20l5) carried out a study of the effect of SRL approach on junior Secondary School students' academic achievement in basic science. The study attempted to provide education with various strategies to increase basic science students' learning. The purpose of the study according to them is to explore the effect of SRL approach on students' achievement also on male and female students' achievement as well. However the findings of the study reveal that SRL approach enhance students' academic achievement in basic science than the conventional method.

Anane (2014) perform a study investigating pre-service teachers' motivation and self-regulated learning and its impact on their academic achievement. The multi-stage sampling technique was used in selecting 500 teachers' trainers from residential colleges of education in Ghana. The findings from the study indicate that SRLS intervened significantly in the influence of performance. Baris (2015) investigated whether academic motivation and academic self-regulated learning predicted students' academic achievement. The results of the study showed that there was no correlation between grade point average of students and academic motivation and academic self-regulated learning. Kim and Seo (20l3) in their study showed that self-regulated learning explained academic achievement. Komacraju, Karau and Schmeck (2009) determined that self-regulated learning best predictors of academic achievement and intrinsic motivation to accomplish task. Kosin (2007) study showed that self-regulated learning strategy is the best predictor of academic achievement in college students'.

Methodology

i. Design

The research design adopted in this study was the quasi-experimental design. It is a quasi-experimental study because it can be used to establish a causal effect connection between the dependent and independent variables, The design is represented and illustrated in **table 1**: Pre-test/Post-test non-equivalent control group design

Group	Pre-test	Treatment	Post-test
Experimental group	O_1	X_1	O_2
Control group	O_l	-	O_2

Where 0_1 and 0_2 represent the pretest and Post-test respectively. X is the treatment (self-regulated learning strategy model and - is the traditional method of instruction.

i. Population

The population for this study will consist of all senior secondary school two (SSII) students that offer physics as a subject in all public senior secondary schools in Ethiop West Local Government Area of Delta State. From this population, only two schools were randomly selected through multistage sampling techniques for the study based on the criteria set by the researcher. One intact class was selected randomly through balloting to determine which school served as the experimental and control groups respectively.

ii. Instrumentation

The instrument that will be used for this study would be the Physics Students' Achievement Test (PSAT) to measure the students acquired knowledge and retention that enhanced their performance, even during and after schooling.

iii. Validity/ Reliability of Instrument

The validity of the PSAT will be carried out by experienced science lecturers in the fields of physics, measurement and evaluation departments respectively. They will ensure the items in the PSAT measure accurately what it is designed to measure so as to provide information that will be relevant to the study and also ensure both content and face validity. Furthermore, test blue print (table of specification) will be constructed.

To establish the reliability of the instrument, a pilot study was carried out on 20 SSII physics students, these students and their school were not involved in the main study. However, this pilot study were done in order to see the feasibility of the new teaching method; thus making the necessary adjustment to the procedures in using the new teaching method before the final study was carried out. The reliability coefficient was calculated using the Kuder-Richarson 2l (KR-21) techniques.

Procedure for the study

Before the beginning of instruction, students' will be pre-tested on their level of understanding and achievement in physics as a core science subject. Pre-test would be administered to the students' prior to the actual teaching using the physics students' achievement test (PSAT).

Pre and Post-achievement test would be the same in content except that colored papers will be used and there will be changes in the numbering of items (pre-test-white papers and post-test- yellow papers respectively) and also the retention test. The researchers will developed lesson plans for self-regulated learning strategy and the Traditional Method of instruction. The lesson plans would be developed on the selected topics from the physics curriculum for SSII. The topics are Heat, Temperature, Conversion of Temperature Scales, and Change of State of Object. Both the sell'-regulated learning strategy and traditional method of instruction would be varied in organization as well as in pedagogy. The researchers will trained the class teachers that will teach the student'. In the control group, the students' will be taught the same selected topics using the lesson plan prepared for the traditional method of instruction by their teachers who will be trained by the researchers. By the closed of the teaching (both at the experimental and control groups) that will last for 6 weeks, a post-test will be administered to the students. Thereafter, a gap of two weeks will be given to re-administer PSAT to the students as a surprise test to ascertain their retention level.

Data analysis

The data collected from the PSAT will be analyzed using mean and standard deviation for the research questions. The t-test and ANCOVA will be used to analysis the hypotheses. Also graphs will be drawn to give the pictorial view of the results of the study. The statistical analysis will be tested at 0.05 level of significance.

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