International Journal of Operational Research in Management, Social Sciences & Education | IJORMSSE
p-ISSN: 2536-6521 | e-ISSN: 2536-653X
Volume 10 Number 1 May, 2024

Effect of Self- Regulated Learning Instructional Strategy on Students' Achievement in Physics Concepts Among Senior Secondary Schools

[1]Azowenunebi, L. O., [2]Adeyemo S. A. & [3]Babajide, V. F. T.
[1,2&3]Department of Science Education,
Faculty of Education, University of Lagos

Article DOI: 10.48028/iiprds/ijormsse.v10.i1.13

Abstract

A successful learner plans, monitors, and evaluates his/her learning. Therefore, this study determined the effect of self-regulated learning instructional strategy on students' achievement in Physics concepts among senior secondary schools in Education District II Lagos State. Four research questions and four hypotheses guided this research. The hypotheses were tested at a 0.05 level of significance. The design of this study was a pretest-posttest control group quasi-experimental research design. The study population consists of the SS2 Physics students in the 2022/ 2023 school year in Lagos State. Through a multi-stage sampling technique, four schools from Education District II, Lagos State were selected. The sample consists of 109 students from intact classes of the four schools. Physics achievement test adapted from the West African Senior School Certificate Examination (WASSCE) past questions was used to collect data. The data was analyzed using descriptive and inferential statistics. Results revealed: first, the Self-regulated learning instructional strategy (SLIS) is an effective learning instructional strategy that can potentially enhance students' achievement in Physics more than the talk-and-marker instructional strategy (TIS). Second, this study established no significant gender difference in learners' achievement in Physics. The researchers recommend that Physics teachers adopt SLIS in teaching and learning Physics since it has proven to be an active learning strategy. Seminars and workshops should be organized for Physics teachers on how to use SLIS to teach Physics. Inspectors of Physics should monitor and supervise Physics teachers on using SLIS in teaching and learning of Physics.

Keywords*: Self-regulated learning, Achievement, and Physics.*

Corresponding Author: **Azowenunebi, L. O.**

Background to the Study

Physics is a physical science subject that deals with matter in relation to energy. It is a crucial science subject as no student can be offered admission to study courses such as Engineering, Medicine, Pharmacy, Chemistry, Agriculture, Environmental, and Biological Sciences in any tertiary institution in Nigeria without a credit pass in Physics in the West African Senior School Certificate Examination. (WASSCE) or National Examinations Council (NECO) Senior School Certificate Examination. Physics is the most fundamental of all the sciences, playing critical roles in medicine and surgical research (NERDC, 2011 & Babajide, 2013 cited by Azowenunebi, Adeyemo, & Babajide, 2019) and has to date remained a fundamental part of the educational system.

Developing countries including Nigeria and other African countries acknowledge Physics as a basic requirement for economic, scientific, and technological developments, (Adegoke, 2009; Babajide, 2013 cited by Azowenunebi, Adeyemo, & Babajide, 2019). Physics forms the backbone of science and technology. (Ogunleye & Owolabi, 2008; Okeke, 2019). As critical as Physics is as highlighted above, countries cannot develop or sustain any form of technology unless a good foundation for effective and efficient Physics education is laid right from secondary school (Adegoke, 2009 cited by Azowenunebi, Adeyemo, & Babajide, 2019). Teaching of Physics at the secondary school level lays the foundation for the application of science and technology for the benefit of society. In the development of any nation technologically, knowledge of basic concepts and principles in Physics is central (Jegede & Adebayo, 2013 in Achor & Gdadamosi 2020). Laying a solid foundation in Physics education involves employing appropriate teaching and learning techniques which will translate into good academic achievement in Physics (Adegoke, 2009).

Previous researchers have observed several teaching methods as improved strategies for teaching. Such strategies include the effect of conceptual change pedagogy Achor & Yakubu (2021). They determined the effect of conceptual change pedagogy on students' academic performance in thermal concepts of secondary school Physics. The result revealed that students who were taught Physics using conceptual change pedagogy performed significantly better than their counterparts who were taught Physics with traditional teaching methods. Amosa, Ogunlade, & Atobatele, (2016), determined the effect of field-trip teaching on students' academic performance using a quasi-experimental research design on 120 students in Kaduna State, Nigeria. They observed that the students who were exposed to field trips outperformed those who were not exposed to teaching strategy. Problem-solving, team teaching (Archor, Imoko & Jimin, 2011), and so on. With all these improved teaching strategies, the achievement of students in Physics has not yet gotten to an excellent level and is fluctuating. The performance of students in Physics in WASSCE 20012 – 2017 Table 1.

Table 1: Students Performance in May/June SSCE (WAEC) Physics 2012– 2017.

Year	Total Number of Candidates	Total Pass $A_1 - C_6$	%	Total Pass $D_7 - D_8$	%	Total Fail F_9	Failed %
2012	624658	429415	68.74	120369	19.27	74874	11.99
2013	636857	296910	46.62	175877	27.62	164070	25.76
2014	635739	386270	60.75	157414	24.76	92055	14.48
2015	657266	390447	59.40	160664	24.44	88598	16.15
2016	640491	497713	77.70	96694	15.09	31233	7.21
2017	703813	373647	53.08	192954	27.41	137212	19.50

Source: The West African Examination Council (WAEC) Head Quarters, Yaba, Lagos. (2019)

A cursory look at table 1 shows a fair but inconsistent performance of candidates in May/June WASSCE for five consecutive years. A lot of factors have been identified by previous researchers as being responsible for this inconsistency in achievement in Physics. As asserted by Adeyemo (2010) and NERDC (2011), the factors include inadequate modern laboratory facilities, inadequate qualified teachers, inadequate classrooms, inadequate teaching methods, and examination malpractice. National Examination Council 2011 Chief Examiners report cited by Achor (2020) indicated a high level of examination malpractices in core subjects including Physics. Furthermore, an unstructured interview conducted by the researcher among Physics Lecturers at Federal Collage of Education Technical Akoka on the relationship between students' performance in WASSCE Physics and their performance in Physics in the College of Education, revealed that most students who scored 'A' or 'B' in WASSCE could not solve simple Physics problems in the College of Education. This result is not far-fetched from what is obtainable in the Universities as the lectures from universities can attest to. This assertion confirms NECO Chief Examiners' report of a high degree of examination malpractices in SSCE and is an indication that many students who wrote and passed the SSCE are not independent learners. However, the researcher opined that if most of the candidates of WASSCE or NECO own the grades they enter tertiary institutions in Nigeria with, it may be that they were not able to retain most of the concepts taught in secondary school. Therefore, there is a need to make students independent learners who can take ownership of their learning. An independent learner is a lifelong learner. This necessitated the current study: (Effects of self-regulated learning instructional strategy on students' achievement in Physics concepts among senior secondary schools in Lagos state). Self–regulated learning has been commended as the main skill needed to start and sustain lifelong learning (EU Council, 2002 in Junyi et-al, 2018; Hoyle & Dent 2018).

An increasing body of study suggests that models of education planned to meet the needs of the industrial past are inadequate for the numerous challenges and opportunities facing 21st-century learners (Alberta Education, 2010; Barron & Darling-Hammond, 2008; Friesen & Jardine, 2009; Perkins, 2009 in Sharon & David 2013). New educational environments require different ways of planning learning outcomes for students and also

new methodologies for teaching and assessment of learning. Self-regulated learning is defined as the process of planning, monitoring, and controlling individual cognitive achievement before, during, and after the learning process (Junyi, Zongkui & Xiangen, 2018). It has been commended as the main skill needed to start and sustain lifelong learning (EU Council, 2002 in Junyi, Zongkui & Xiangen, 2018; Hoyle & Dent 2018). Educational policymakers assert that one major aim of formal schooling is directing learners on how to learn (Hoyle & Dent, 2018) and that for this aim to be achieved, learners must be able to self-regulate their learning. This will translate them into independent and professional learners and enable them to be lifelong learners thereby achieving the Nigerian national policy of lifelong learners (National Policy on Education, 2014).

Researchers in Western nations have shown that self-regulated learning is very effective in promoting academic achievement (Paris & Paris 2001; Dignath et al., 2008; Sadati & Simin 2015). Self-regulated learning is as fundamental to learners' success as reading, writing, and arithmetic and is regarded as the fourth R of education (Abdul & Abidha 2016). In recent years when many schools are going online, it is crucial that students can self-regulate as learners to be successful online learners (Yukselturk & Bulut,2007; Sun et al., 2008; Rakes & Dunn, 2010 You & Kang, 2014 in Ejubovic & Puska, 2019). The choice of gender as a moderator variable is due to inconclusive results obtained on gender and achievement in science (Physics). Researchers such as (Ezieim, 2006; Okwo Otubar, 2007; Achor & Gbadamosi 2020) observed that gender has a significant influence on achievement while (Babajide, 2016; Agommuoh & Nzewi, 2003) observed that gender does not affect the achievement of students in Physics. Therefore, the influence of gender on achievement is still a controversial issue among science researchers. It is hence necessary for more studies on the role of gender in students' achievement in science with particular reference to Physics to be carried out.

Theoretical Overview of Self-Regulated Learning

Two theoretical perspectives: social-cognitive and information-processing theories guided much of the research on self-regulated learning (Hoyle & Dent, 2018). Social –Cognitive theory was founded most prominently by Albert Bandura in 1953. The theory focuses on observational learning, modeling, and self-efficacy. Its major assumption is that human learns by observing the behavior of others and the consequences of their behavior. The information processing theory was originally proposed by American Psychologist George Armitage Miller in 1956. Miller and other Psychologists used metaphor processing to explain how the human mind works. The theory asserts that the human mind receives stimuli, processes them, stores them, locates them, and then responds. Social-cognitive and information-processing theories give corresponding accounts of how self-regulated learning, and self-regulation generally, progress. As believed by social cognitive theory, human functions depend on the way personal (e.g., biological, affective, cognitive), environmental, and behavioural factors interact (Bandura, 1986, 2001 in Schunk & Greene, 2018). Human actions, feelings, and thinking are not just a result of external factors and reinforcements, as behavioural theories have asserted (e.g., Skinner, 1987 in Schunk & Greene, 2018). Nor are individuals directed

merely by internal hidden drives and impulses, as claimed by psychodynamic theories (e.g., Freud, 1960 in Schunk & Greene, 2018), nor purely by their own free choice, as many humanists have argued. Personal, behavioural, and environmental influences jointly determine the human experience. In institutes of learning, learners' behaviours, including their degree of self-regulation, are directed jointly by internal and external influences. The theories are relevant to the study in that during a lesson, the learners make meaning out of the concept at hand while interacting with each other, the teacher, and the learning materials. There is observational learning, modeling, and self-efficacy all taking place during a lesson in the classroom.

Statement of the Problem

Education ought to be the training of the mind to think and raising of people who learn how to learn and not the learning of facts. Students must be taught how to think and not what to think. This means that the traditional learning approaches used in most Nigerian secondary schools cannot meet this need. This is because traditional education entails that the teacher is in an active position and downloads a lot of information that learners are not curious about or eager about. The learners in this case receive it without argument and internalize it, hence, they cannot learn how to learn due to the passive way they receive it. Self-regulated learning helps learners to learn how to learn, to acquire high-level thinking skills, and positive attitudes toward learning. However, the reverse is the case in most Nigerian secondary schools. The traditional talk-and-marker method employed in pedagogical processes in most Nigerian secondary schools does not encourage the act of thinking. The teacher often pours out facts into the minds of students they believe are empty just for them to reproduce the same during examination. Previous researchers had observed several strategies that could be used to produce students with very good performance in their examination as noted in the background of this study. Yet the problem of inconsistency in the achievement of Physics concepts taught in class persists. The researchers are of the view that employing a self-regulated learning instructional strategy will improve students' creative thinking and enable them to learn to prepare themselves for anything and attain and maintain very good performance in WASSCE and life. This paper explores the effect of self-regulated learning instructional strategy on students' achievement in Physics concepts among Senior Secondary Schools in Education District 2, Lagos State.

Purpose of the Study

The main purpose of this study was to determine the effects of self-regulated learning instructional strategy on students' achievement in Physics concepts among Senior Secondary Schools in, Education District 2, Lagos State.

Specifically, this study sought to determine the;

1. Effect of self-regulated learning instructional strategy on students' achievement in Physics.
2. Comparative effects of self-regulated learning and talk-and-marker instructional strategies on students' achievement in Physics.
3. Influence of gender on the achievement of students in Physics.

4. The interaction effects of treatment, and gender on students' achievement in Physics.

Research Questions

The following research questions guided this study:

1. What is the effect of self-regulated learning instructional strategy on students' achievement in Physics?
2. What are the comparative effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics?
3. What is the influence of gender on students' achievement in Physics?
4. What is the interaction effect of treatment and gender on students' achievement in Physics?

Hypotheses

The following hypotheses were tested at $\alpha = 0.05$ level of significance in this study.

$H_0$1: There is no significant effect of self-regulated learning instructional strategy on students' achievement in Physics.

H_{02}: There is no significant difference in the effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics.

$H_0$3: There is no significant influence of gender on students' achievement in Physics

$H_0$4: There are no significant interaction effects of treatment and gender on students' achievement in Physics

Design of the Study

The design for this study was a pre-test, post-test control group quasi-experimental research design. The design is represented symbolically below:

Self- Regulated group	$\mathbf{O_1}$	→	**S**	→	$\mathbf{O_2}$
Talk-and-marker	$\mathbf{O_1}$	→	**C**	→	$\mathbf{O_2}$

$\mathbf{O_1}$ represents pre-test observation and $\mathbf{O_2}$ represents the post-test observations. S represents the experimental group and C represents the control group.

The 2x2x2 factorial design was adopted for this study. The factorial design consists of the instructional strategy (Self-regulated learning, and control (talk-and-marker) instructional strategies and one moderator variable (gender at two levels: male and female)

Sampling and Sampling Technique

Multi-stage sampling technique was used; first, an education district (district 2) was chosen out of six education districts in Lagos state by simple random sampling technique. Then, a purposive sampling technique was used to select schools and teachers from the district based on the following criteria:

1. The school must be government-owned (public), co-educational, and have qualified Physics teachers with at least a bachelor's degree qualification in Physics Education or bachelor's degree qualification in Physics with a Postgraduate Diploma in Education.
2. The teachers must have at least five years' experience teaching Physics after graduation from the university.
3. The teacher must have an interest in participating in the study.
4. The teacher must show interest in taking part in the training.

Four teachers from four schools met the above criteria. They were then trained in the use of experimental treatment (Self-Regulated Learning Strategy). The teachers and their intact classes were purposively assigned to treatment depending on the teacher's demonstration of high competence in using a self-regulated instructional strategy. Two teachers who showed the highest competence by observing them teach with the strategy were purposively assigned to the different treatment groups while the other two were assigned to the control group. Therefore, there were two teachers for the experimental group and two teachers for the control group. Senior Secondary 2 students were selected for this study because they were not preparing for any external examination like WASSCE or Joint Admission and Matriculation Board (JAMB). Four intact classes of the selected schools were used.

Sample Size

A total of 109 students comprised the sample. Females (52) and males (57). By treatment: Fifty-two (52) students consisted of the experimental group while the control group consisted of 57 students. Male students in the experimental group were 27 while female students were 25. For the control group, male students were 30, and female students were 27.

Instruments for Data Collection

The research instrument was the Physics Achievement Test (PAT), adapted from the WASSCE (West Africa Senior School Certificate Examination) past questions. The Physics Achievement Test was validated by two experts from the Physics Education Department of Science Education University of Lagos and two from test development from the Federal College of Education Akoka Yaba. They removed some items from the instrument and added some. They also reframed some that were not properly worded. PAT had 20 objective questions adapted from WASSCE's past questions. Using Bloom's taxonomy of education. To ensure the internal consistency of PAT, it was pilot-tested to obtain its reliability coefficient. Kuder Richardson (KR-20) statistics were used to calculate the reliability of PAT which gave 0.74. All the items had an item difficulty index of 0.4 – 0.8. Also, the inter-rater was used to obtain the reliability coefficient of the stimulus instrument, it gave 0.76 using Scott's pi. This shows that the inter-rater reliability coefficient of the instrument was high.

Procedure for Data Collection
Week 1: Coordination program for research assistants and pre-test administration.
Week 2 – 5: These weeks were used to administer the treatment to both experimental and control groups using the instructional procedural steps for them.
Week 6: This week was characterized by administration of post–test to both experimental and control groups.

Self–regulated Learning Procedural instructional Strategy
Self–regulated learning instructional strategy consists of two components: The Facilitator's activities and the learners' activities.

Learners' Activities
It has two parts: What the learners do in their comfort zone outside the classroom and what they do in the classroom during lessons.

Learners' Activities at their comfort zone.
It consists of 3 phases: Planning, monitoring, and evaluating their learning.

A. **Learners plan their learning**

During planning, the learner will ask himself/herself these questions and internally provide answers to them: What does this task, Simple Harmonic Motion (S.H.M) entail? What am I required to do? (Explain the meaning of S.H.M. and mention the motion in my environment that is S.H.M.). What do I know before that will enable me to learn S.H.M?

B. **Learners monitor his/her learning.**

Am I getting what I am studying? If not, why? What have I not done well? If I am getting what I am reading, what made it possible?

C. **Learners evaluate his/her learning by asking the following questions:**

How much of what I am learning is clear to me? The part that is not clear what do I do to make it clear to me? Do I need additional help from either my peers who seem to understand it better; go over what I am learning again; or seek help from my teacher?

Table 1: Frequency and percentage distribution of students by demographic characteristics

Treatment	Gender	Frequency	Percentage
Self-Regulated	Female	25	22.94
	Male	27	24.77
Control	Female	27	24.77
	Male	30	27.52

Research Question One: What is the effect of self-regulated learning instructional strategy on students' achievement in Physics?

Table 2: Descriptive statistics of self-regulated learning instructional strategy students' pretest and posttest scores.

Self-regulated learning instructional strategy		
	Pretest	Posttest
Sample size	52	52
Mean	43.37	60.00
Mean percentage	43.37	60.00
Standard deviation	10.13	15.72
Variance	102.68	247.06
Pretest-posttest mean difference	16.63	
Gain percent	38.34	

The fifty-two (52) students who received treatment under the self-regulated learning instructional strategy had a pretest mean score of 43.37 (43.37%) with a standard deviation of 10.13. In the post-test, the students had a posttest mean score of 60.00 (60.00%) with a standard deviation of 15.72, Table 2. This gave a pretest-posttest mean difference of 16.63, in favour of the posttest. The mean difference accounted for a gain of 38.34%. This shows that the use of a self-regulated learning instructional strategy had the effect of enabling students to make a gain of 38.34% in Physics achievement.

Research Question Two: What are the comparative effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics?

The comparative effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics were obtained by getting the mean scores, pretest-posttest mean differences, and the gain percentages for each of the treatments. Table 4 contains the results.

Table 3: Comparative effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics.

Instructional strategy	Self-regulated learning		Talk-and-marker	
	Pretest	Posttest	Pretest	Posttest
Sample size	52	52	57	57
Mean	43.37	60.00	31.93	35.70
Standard deviation	10.13	15.72	9.81	11.24
Pretest-posttest mean difference	16.63		3.77	
Gain percent	38.34		11.81	

The fifty-two (52) students who were taught using a self-regulated learning strategy, had a mean score of 43.37 with a standard deviation of 10.13 in the pretest Table 3. For the posttest, the students had a mean score of 60.00 with a standard deviation of 15.72. The pretest-posttest mean difference was 16.63 which gave a mean gain percent of 38.34%. Furthermore, the fifty (57) students who were taught using the talk-and-marker instructional strategy had a mean score of 31.93 with a standard deviation of 9.809 in the pretest. For the posttest, the students had a mean score of 35.70 with a standard deviation of 11.238. The pretest-posttest mean difference was 3.77 which gave a mean gain percent of 11.81%.

Research Question Three: What is the influence of gender on students' achievement in Physics?

Table 4: Descriptive statistics of students' pretest and post-test scores based on gender

		Pretest		Posttest		Pretest-posttest	
Gender	N	Mean	Std. Deviation	Mean	Std. Deviation	mean difference	Std. Error Mean
Female	52	37.4038	10.31325	46.3462	16.77753	8.9424	2.32663
Male	57	37.3684	12.50376	48.1579	19.49431	10.7895	2.58208

For the pretest, female students had a mean score of 37.40381 with a standard deviation of 10.31325 while the male students had a mean score of 37.3684 with a standard deviation of 12.50376, Table 4. Also, it shows that for the post-test, female students had a mean score of 46.3462 with a standard deviation of 16.77753 while the male students had a mean score of 48.1579 with a standard deviation of 19.49431. The within group's pretest-posttest mean difference for the females was 8.9424 while the within group's pretest-posttest mean difference for the male students was 10.7595 The posttest mean difference between the females and the males was 1.8471 in favour of the male students.

Research Question Four: What is the interaction effect of treatment and gender on students' achievement in Physics?

Table 5: Descriptive statistics of students' pretest and posttest scores based on treatment and gender interaction

			pretest		Posttest		Mean	
Treatment	Gender	N	Mean	S. D	Mean	S.D	Difference	Position
Self-Reg.	Female	25	42.20	10.214	57.80	15.948	15.60	2nd
	Male	27	44.44	10.127	62.04	15.520	17.60	1st
Talk-and-	Female	27	32.96	8.350	35.74	8.627	2.78	4th
marker	Male	30	31.00	11.017	35.67	13.309	4.67	3rd

For the pretest and the posttest mean scores with standard deviations for the interaction between treatment and gender, and the mean differences are presented. The females

taught using a self-regulated learning strategy had a pretest mean score of 42.20 with a standard deviation of 10.214 and a posttest mean score of 57.80 with a standard deviation of 15.948, Table 5. The pretest-posttest mean difference for the females was 15.60. The males taught using a self-regulated learning strategy had a pretest mean score of 44.44 with a standard deviation of 10.127 and a posttest mean score of 62.04 with a standard deviation of 15.520. The pretest-posttest mean difference for the males was 17.60. The males taught using the talk-and-marker instructional strategy had a pretest mean score of 31.00 with a standard deviation of 11.017 and a posttest mean score of 35.67 with a standard deviation of 13.309. The pretest-posttest mean difference for the males was 4.67. Using the mean difference, the male students taught Physics using a self-regulated learning instructional strategy benefitted most from the interaction of treatment and gender. This was followed by the female students taught using a self-regulated learning instructional strategy. The third and fourth positions of mean difference were for the males and females who were taught using the talk-and-marker instructional strategy respectively.

Hypothesis One ($H_0$1): There is no significant effect of self-regulated learning instructional strategy on students' achievement in Physics.

Table 6: Analysis of the significance of the effect of using self-regulated learning instructional strategy on students' Physics achievement.

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig. (2-tailed)
pretest to posttest	-16.635	16.140	2.238	-21.128	-12.141	-7.432	51	0.000

The result of the paired sample t-test contained in Table 6 shows a t-value of -7.432 and a p-value of 0.000 (df = 51). Since $p < 0.05$, the difference in the mean between the pretest and the posttest was significant. Therefore, the null hypothesis ($H_0$2) that there is no significant effect of self-regulated learning instructional strategy on students' achievement in Physics is rejected. Hence, from the results obtained in this study, there is a significant effect of the use of self-regulated learning instructional strategy on students' achievement in Physics.

Hypothesis Two ($H_0$2): There is no significant difference in the effects of self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics.

Table 7: Analysis of the significance of the difference between students' post-test achievement scores based on treatments.

Posttest	Levene's test for equality of variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	sig	t	df	Sig. (2-tailed)	Mean diff	Std. Error diff	Lower	Upper
treatment	10.814	.001	-9.345	107	0.00	-24.298	2.600	-29.453	-19.144

For the independent samples t-test was conducted, the t-value was -9.345 and $p < 0.05$, (df = 107). Since $p < 0.05$, the difference in mean scores between students who were taught using self-regulated instructional strategy and talk-and-marker instructional strategy was significant. There was a rejection of the null hypothesis that there is no significant difference in the effects of, self-regulated learning, and talk-and-marker instructional strategies on students' achievement in Physics.

Hypothesis Three ($H_0$3): There is no significant influence of gender on students' achievement in Physics

Table 8: Analysis of Students' Achievement in Physics based on Gender

Posttest	Levene's test for equality of variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
	F	Sig	t	df	Sig. (2 - tailed)	Mean diff	Std. Error diff	Lower	upper
Gender	2.188	.142	-.518	107	.606	-1.8117	3.4997	-8.7496	5.1261

Equal variances assumed

The results displayed in table 8 show that the independent sample t-test has a t-value of -0.518 and $p > 0.05$, (df = 107). Since $p > 0.05$, the difference in mean scores between male and female students was not significant. There was a failure to reject the null hypothesis that there is no significant influence of gender on students' achievement in Physics. Hence, there was no significant influence of gender on students' achievement in Physics.

Table 9: Analysis of the Interaction Effects of Gender on Students' Physics Achievement

Tests of Between-Subjects Effects

Dependent Variable: posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16287.791[a]	3	5429.264	29.327	.000
Intercept	248118.044	1	248118.044	1340.225	.000
treatment	15911.202	1	15911.202	85.945	.000
gender	117.567	1	117.567	.635	.427
treatment * gender	126.084	1	126.084	.681	.411
Error	19438.815	105	185.132		
Total	279525.000	109			
Corrected Total	35726.606	108			

a. R Squared = .456 (Adjusted R Squared = .440)

For the effects of the interactions between treatment and gender, the interaction effects of treatment, and gender ($F_{(1,105} = 0.635$; $p = 0.427$), The following arises from the results: there is a significant influence of treatment on students' achievement in Physics; there is no significant influence of gender on students' achievement in Physics. There is no significant effect of the interaction between treatment and gender on students' achievement in Physics. There was a failure to reject the null hypothesis that there is no significant interaction effect of treatment and gender on students' achievement in Physics.

The major findings of the study are summarized as follows:

1. There is a significant effect of the use of self-regulated learning instructional strategy (SLIS) on students' achievement in Physics.
2. The students who were taught Physics using SLIS performed significantly better than the students who were taught Physics using TIS.
3. There was no significant influence of gender on students' achievement in Physics.

Discussion of Findings

Presentation of a detailed explanation of the result of the analysis.

Effect of self-regulated learning instructional strategy on students' achievement in Physics.

The effect of the self-regulated learning instructional strategy was obtained by comparing students' pretest and posttest achievement scores. The maximum and minimum scores obtained for the pretest and posttest were one hundred (100) and zero (0) respectively. The result shows that the fifty-two (52) students who received treatment under the self-regulated learning instructional strategy had a pretest mean score of 43.37 (43.37%) with a standard deviation of 10.13. In the post-test, the students had a posttest mean score of 60.00 (60.00%) with a standard deviation of 15.72. This gave a pretest-posttest mean difference of 16.63, in favour of the posttest. The mean difference accounted for a gain of 38.34%. This shows that the use of a self-regulated learning instructional strategy had the

effect of enabling students to make a gain of 38.34% in Physics achievement. The significant effect of the use of self-regulated learning instructional strategy on students' achievement in Physics was tested using a paired sample t-test at $p < 0.05$. Analysis of the main effect of SLIS showed that there is a statistically significant effect of the use of self-regulated learning instructional strategy (SLIS) on students' achievement in Physics. This positive outcome aligns with the findings of (Chen & Hu, 2008; Zhang et al., 2012a in Junyi, Zongkui & Xiangen, 2018) who reported that SLIS led to effective academic performance.

Conclusion

The main purpose of this study was to determine the effects of self-regulated learning instructional strategy on students' achievement in Physics concepts among Senior Secondary Schools in, Education District 2, Lagos State. This study revealed that SLIS is an effective learning instructional strategy that can potentially enhance students' achievement in Physics more than TIS study.

Acknowledgment

The researchers are greatly indebted to the following schools, their Principals, their Physics teachers, and their SS2 science students for the privilege they granted the researchers to use their schools for data collection: Shomolo Senior High School, Immaculate High School, Angus Senior High School, and Mende Senior High School all in Education District II Lagos State, Nigeria.

References

Abdul, G. K., & Abidha. K. (2016). Self–regulated learning: Motivational approach for learning mathematics, *International Journal of Education and Psychological Research 1(3)* https://www.researchgate.net/publication/309179662.

Achor, E., & Yakubu, P. A. (2021). *Effect of conceptual change pedagogy on students' academic performance in Thermal concepts of secondary school physics*, Proceeding of 61st Annual Conference of Science Teachers Association of Nigeria (STAN): Ethics and STEM Education (255-265), Abuja, Nigeria.www.researchgate.net.

Adegoke, B, A. (2009). Determining factors in secondary school students' choice of physics*, Journal of the Science Teachers' Association of Nigeria. 44* (1&2), 75-83.

Adeyemo, S. A. (2010). Teaching /learning of physics in Nigerian secondary schools: The curriculum transformation, issues, problems and prospects, *International Journal of Educational Research and Technology,1 (1),99-111.*

Amosa, A. G. A., Ogunlade, O. O., & Atobatele, A. S. (2016). Effect of field-trip on students' academic performance in basic technology in Ilorin Metropolis, Nigeria, *Malaysian Online Journal of Educational Technology 3 (2) 20-26.*

Anyichie, A. C., & Onyedike, C. C. (2012). Effect of self-instructional learning strategy on secondary schools students' academic achievement in solving mathematical word problems in Nigeria. *African Research Review*, 6 (4) p27.

Awofala, A. O. A., Akinoso, S. O., Olabiyi, O. S., & Ojo, O. T. (2022). Piaget's philosophy of intellectual advancement and learning: Implications for science, technology, and mathematics education. *Learning: The All-Inclusive Concept. A book of Readings, Faculty of Education, University of Lagos Akoka-Yaba, Lagos, Nigeria,* 51-63.

Azowenunebi, L. O., Adeyemo, S. A., & Babajide, V. F. T. (2019). Effect of inquiry instructional strategy on students' achievement in physics among senior secondary schools in education district II Lagos State, *Education and Science Journal of Policy Review and Curriculum Development, 9(1), 50-62.*

Babajide, V. F. T. (2014). Enhancing cognitive achievement in Physics: Impact on practical activities, *Education and Science Journal of Policy Review and Curriculum Development, 2(1), 16 – 23.*

Babajide, V. F. T. (2013). Effect of PowerPoint \ presentation strategy on secondary school students achievement and interest in Physics. *Lagos Education Review, 16(1),20-35.*

Bot, T. D., & Davou, D. S. (2016). Effects of back–to–back instructional strategy on junior secondary school students' motivation and achievement in Algebra in Jos, Plateau State, Nigeria, *Abacus: Journal of Mathematics Association of Nigeria, 41(1), 114-125.*

Catherine, C. H. (2001). *Effect of self–regulated learning strategy instruction on strategy use and academic achievement in middle school science classes.* https"//www.researchate.net.2.

Challenged Based Learning. (2013). Retrieved from *http://www.challengebasedlearning.org/pages/welcome*

Chijiuka. I., & Ugwu. I. (2019). Self-*regulated learning as correlates of academic achievement of students of economics in secondary schools in Imo State*, https://www.researchgate.net/publication/350546701

Choi, H. H., Merriënboer, J. J. G., & Paas, F. (2014). Effects of the physical environment on cognitive load and learning: Towards a new model of cognitive load, *Educational Psychology Review,* 26, 225–244.

Dada, F. H. (2021). *Effectiveness of 4-stage proficiency approach on the mathematical proficiency of public senior secondary school students in Lagos State*, Unpublished PhD Thesis School of Post-Graduate Studies University of Lagos.

Daramola, S. O., & Mosewo, E. O., (2012). An appraisal of the New Nigerian senior secondary school physics curriculum, *Journal of Education and Practice, 3 (8) 25-30.*

Duckworth, A. L., Gendler, T. S., & Gross, J. J. (2014). Self-control in school-age children, *Educational Psychologist, 49,* 199–207.

Ejubovic, A., & Puska, A. (2019). The impact of self-regulated learning on academic performance and satisfaction of students in the online environment. *Knowledge Management & E-Learning: An International Journal. 11 9(3), 345-363.https//doi..org/10.34105/j.kmel.2019.11.018*

Eladi, A. M., & Alkharusi. H. (2020). Relationships between self-regulated learning strategies, learning motivation and mathematics achievement, *Journal of Educational Sciences 15 (1), 104 – 111*

Eladi, A. M., & Ismail, M. E. A. (2021). *The effect of self-regulated learning strategies on developing working memory and achievement goal orientation among high school students,* https://www.researchgate.net/publication/356994405

Eniayeju, A. A. (2010). Effects of cooperative learning strategy on the achievement of primary six pupils in mathematics. *Abacus: Journal of Mathematics Association of Nigeria, 35(1), 1-9.*

Ezeudu, F. (2006). Effect of concept mapping on Students' achievement in chemistry. *International Journal of Research in Education 2 (1) 122 -126*.

Hoyle, R. H., & Dent, A. L. (2018). *Developmental trajectories of skills and abilities relevant for self-regulation of learning and performance. In D. H. Schunk & J. A. Greene (Eds.),* Handbook of self-regulation of learning and performance (2nd ed.). New York: Routledge.

Junyi, L., Hui, Y., Zongkui, Z., & Xiangen, H. (2018). What are the effects of self-regulation phases and strategies for Chinese Students? A meta-analysis of two decades research of the association between self-regulation and performance. *Frontiers in Psychology.*

Karabenick, S. A., & Gonida, E. N. (2018). *Academic help seeking as a self-regulation strategy: current issues, future direction. In Schunk, D. H. & Greene (Eds),* J. A. Handbook of Self-regulations of Learning and Performance (2nd ed.) New York: Routledge.

Khan, M., & Siddiqui, M. K. (2016). Study of achievement in Physics, study habits, and self concept among senior secondary students, *International Journal of Physicals and Social Science 6 (9) .http://www.ijmra.us.*

Masoud, G. L., Fatemeh, S. M., Elahe, H., & Maryam. D. (2011). The effect of self-regulation learning strategies training on academic motivation and self-efficiency. *Procedia Social and Behavioural Sciences* 29 (2011) 627- 632

National Research Council (2007). *Taking science to school: Learning and teaching science in grades K-8.* Washington, DC: The National Academies Press.

National Research Council (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*, Washington, DC: National Academies Press.

National Policy on Education (rev. ed) (2014). *Lagos federal ministry of education Press.*

Neisser, U. (1967). *Cognitive psychology,* Englewood Cliffs: Prentice-Hall.

NERDC, (2011*). Federal ministry of education: Senior secondary education curriculum physics for Senior Secondary Schools* 1-3.

Nota, L, & Zimmerman, B. J. (2020). Self-regulation and academic achievement and resilience: A longitudinal study, *International Journal of Educational Research 4 (3) 198- 215*

Ogunleye, A. O., & Owolabi, T. (2008). *A review of research studies in physics education in Nigeria,* (1973 -2006) EABR & TL.C. Conferences Proceeding Salzburg, Austria.

Ogunyemi, A. O., & Hassan, E. M. (2011). Academic self–efficacy, study habits, and attitude in school-based assessment, *African Journal for the Study of Educational Issues, 4, 3 – 6*

Okeke, U. (2019). *Students' achievement and low enrollment in Physics: The place of Physics teachers and other necessary resources*, https://www.researchgate, net/*publication/333163910.*

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions of research, *Frontiers in Psychology, 8*, 422. https://doi/10.3389/fpsyg.2017.00422.

Pastorino, E. E., & Doyle-Portillo, S. M. (2018*). What is psychology? foundations, applications, and integration*, Cengage Learning.

Renninger, K. A., & Hidi, S. E. (2015*). The power of interest for motivation and engagement*, New York: Routledge.

Robson, L. S., Shannon, H. S., Goldenhar, L. M. & Hale, A. R. (2001). *Quasi-experimental and experimental designs,* More powerful evaluation designs, chapter 4 of Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to show whether a safety intervention works, Institute for Work and Health, Canada.

Sadati, S., & Simin, S. (2015). The relationship between metacognition and self-regulated learning strategies with learners' L2 learning achievement, *International Journal of Research Studies in Language Learning, 5, 97-106. Doi:105861/ijrsII.2015.1267*

Sahni, B. K. (2017). *Research methods in psychology*, Books.google.com>books >about

Schunk, D. H. (2008). Metacognition, self-regulation, and self-regulated learning, *Research recommendations. Educational Psychology Review, 20, 463 467*

Schunk, D. H., & Greene. J. A (2018). *Handbook of self-regulation of learning and performance 2nd edition*, (11- 32) Routledge, VitaBookfile.

Schwinger, M., Wirthwein, L., Lemmer, G., & Steinmayr, R. (2014). Academic self - handicapping and achievement: A meta-analysis, *Journal of Educational Psychology, 106*, 744–761.

Sharon, F., & David, S. (2013*). Inquiry-based learning: A review of the research literature paper prepared for the Alberta Ministry of Education*.

Umaru, Y. (2010). *Effects of instruction in metacognitive skills on mathematics self–efficacy belief, interest and achievement of low*, Achieving Students in Senior Secondary Schools.

United Nations. (2000). The role of science, technology and innovation to foster the implementation of sustainable development in the United Nations, *Retried Nov 2017 from www. un. Org>upload> sited 2015/10*

West African Senior School Certificate Examination (WASSCE) Chief Examiners' Report (2015). https://waec:online.org.ng/e-learing/Physics/phys224mw.html.

Wimmer, R. D., & Dominic, J. (2000). *Mass media research: An introduction. 6th edition*, Wadsworth Publishing Company.

Woodward, J. (2006). Developing automaticity in multiplication facts: Integrating strategy instruction with timed practice drill, *Learning Disability Quarterly, 29* (fall), 269 – 289.

Yeager, D. S., Henderson, M. D., Paunesku, D., Walton, G. M., D'Mello, S., Spitzer, B. J., & Duckworth, A. L. (2014). Boring but important: A self-transcendent purpose for learning fosters academic self-regulation, *Journal of Personality and Social Psychology*, 107, 559–580.

Zehra. G., & Ahmadreza. A. (2016). The effect of metacognition on educational performance and self-directed learning in sixth grade female students of shiraz zone Two, *Mediterranean Journal of Social Sciences MCSER Publishing, Rome-Italy*.