Impact of Self-Regulated-Learning Strategy with Youtube Videos on Secondary School Students' Interest in Practical Physics.

[1]Fidelis Obi Nnadi & [2]Obasi Onyebuchi Ali
[1&2]Department of Science Education, Enugu State University of Science and Technology (ESUT), Enugu – Nigeria.
Email: [1]obi.nnadi@esut.edu.ng & [2]obasiali3@gmail.com

ABSTRACT

This study integrated YouTube video and the conventional five steps self-regulated learning to optimize students' poor interest in practical Physics learning. The design of the study was nonequivalent groups quasi-experimental. The population for the study was 10,679 senior secondary school 2 Physics students in the thirty-one secondary school in Ohaukwu Local Government Area of Ebonyi state. The sample for the study was 378 senior secondary school two Physics students from 4 purposively sampled co-educational secondary schools in Ohaukwu Local Government Area. The study was guided by 2 research questions and 2 hypotheses. Physics classroom situational interest scale (PCSIS) was the instrument for data collection. Kuder-Richardson formula (K-R 21) was used to determine the internal consistency reliability of PCSIS, which gave a reliability coefficient of 0.88. Arithmetic mean with standard deviation was used in answering the research questions while analysis of covariance was used to test the hypotheses at .05 level of significance. The result of the study showed that the students who learned Physics using YouTube videos with self-regulated learning strategy had more interest than those students who learned Physics using expository lecture method. The result of the study also showed that there was no significant difference between the mean situational interest scores of male and female students taught Physics using SRLS. It was recommended that Physics teachers need to provide Physics students with many opportunities and different techniques that can make the students to self-regulate their learning of Physics. The instructional amalgam bridges the gender-divide in Physics interest.

Keywords: YouTube video, self-regulated learning, interest and Physics.

INTRODUCTION

Science and technology (S&T) have revolutionalized the world. The discoveries of different forms of artifacts used to solve human's challenges are rooted in science and technological theories. Any nation that does not invest in Science and technological fields in order to overcome its challenges may soon become a dumping ground of S&T products. Science is an organized body of knowledge used to explain nature. It is rooted on empiricism. Technology on the other hand is the use of artifacts which are formulated based on scientific laws to solve a social Physical challenge. Technological product can be goods or services. Science is not complete without technology and vice versa. Science is a veritable tool for fine-tuning the socio- economic, political development of any nation. As a result of this, developed nations attach a lot of importance to the study of Science (Nneji, 2011). It embraces all processes through which citizens acquire knowledge and skills, to live and advance the society. Science is a tool through which people acquire the ability to respond and interact with the environment. Its most important function is that it liberates the individual from ignorance, lack of awareness and high rate of docility (Nneji, 2011). Science brings

about economic and social development by providing employment as well as improving the welfare of the citizenry (Oyekan, 2013).

Science has been defined as a systematic and verifiable search for objective explanations of nature (Ugwu, 2017). Olanka (2011) opines that science is the totality of man and there is no nation or individual that can survive without depending on science, and Nigerian cannot be exempted. The importance of science in national and individual development prompted the Federal Government of Nigeria to place a lot of emphasis on the teaching and learning of science with special focus on science education, as contained in the National Policy on Education. The policy is geared towards equipping the students to live effectively in this modern age (FME, 2013). This can be achieved by the inculcation in the learners the necessary scientific skills and knowledge which can be achieved through the proper teaching of the various science subjects such as Biology, Chemistry, Physics, Mathematics and Health Science. A tiny difference exists between S &T. The applications of S &T in solving human challenges have left no sector of any nation untouched. In the education sector, S &T have been infused into classrooms to better the conditions of teaching and learning. In Nigeria, Physics is one of the science subjects studied in senior secondary schools. Just like other Science subjects, Physics has witnessed consistent poor classroom situational interest of students with its resultant effect on poor achievement, especially at the senior secondary school certificate examinations. Poor classroom situational interest in Physics is operationally defined as low interest of Physics students during Physics physical instruction in the classroom or laboratory activities. Interest is indispensable for learning. Consequently, Onuora (2012) pointed out that no real education may take

place without interest. In other words, interest is able to compel attention and foster achievement. Onoh and Nnabuike (2017) defined interest as the attraction that forces a child to learn. It is the quality which arouses concern or curiosity which holds a child's attention on an object. Unfortunately research evidence has shown that majority of students showed poor interest in Physics (Musa, 2014). Nze, Hedges, & Konstantopoulos (2011) asserted that there is general decline in students' interest in Physics at secondary school level. Nnabuike (2017), Anibueze (2017) and Musa (2014) in their independent studies revealed that students' interest in Sciences (Physics is included) has continued to decline. The West African Examinations Council (2012, 2017 & 2019) have indicated that the students had weaknesses which included reading measurements made from instruments, poor mathematical knowledge and plotting graphs when values are negatives in practical Physics. The researchers attributed those weaknesses to poor students' interest and the method of instructional delivery. There is a dearth of studies which are uploaded on the web that utilized self-regulated learning with YouTube videos on interest in Physics. This is another strong point why this study should be carried out.

For decades, the style of teaching Physics has been monotonous-the use of Physical teachers, peers/wards, textbooks and in extreme cases radio/television/newspaper to enhance teaching and learning. In case of school closure in Nigeria, as a result of sudden rise in insurgence, pandemic or public holidays formal physical teaching and learning in the classroom may stop till further notice. Some contents in the school curriculum are lost during spontaneous school closures. All these drawbacks are associated to formal physical teaching and learning in the classroom. Teaching and learning school subjects like Physics in an

informal classroom setting is a forgone alternative which S &T have transformed to cater for the drawbacks that are inherent in the monotonous style of Science instruction. S &T have come to address the challenges associated to self teaching and learning in Physics. Self teaching and learning is also referred to as self-regulated learning (SRL). Schunk (2001) defined SRL as learning that results from self-generated thoughts and behaviours that are systematically oriented towards the attainment of their learning goals. SRL has been developed to address the question of psychological mechanisms that are directed towards making students become determinants of their learning rates (Zimmerman, 1998). SRL strategy has been defined as a personal method that can be adopted by students to facilitate their learning and to measure progress (Ashi, 2017). SRL strategy is useful for teachers and students alike because it enhances the dynamics of teaching and learning (Snyder, 2012). Snyder (2012) further maintained that SRL strategy has to do with periodic appraisal of one's thinking. Thompson (2016) in his study revealed that self-regulated learning strategy has roots in our biological makeup, which starts from the maturation of certain areas of the brain, especially the frontal lobes, that helps children to resist interference and inhibit response.

Students are self-regulated to the degree that they are meta-cognitively and motivationally active participants in their own learning process (Pierce, 2011). The most central concept in self-regulated teaching and learning is that it is self-directed. Information and communications technology (ICT) tools have been developed to aid self-regulated teaching and learning. The theoretical framework of this study is anchored on Winne and Hadwin's (1998) self-regulated learning theory. The theory posits that learning takes place through information processing. The use of YouTube videos in self-regulated learning enhances information processing and assimilation. YouTube videos, as cloud-based information and communications technology tools help the learner to apply the science process skill of observation during online of offline teaching and learning processes. They also aid the learner in the development of motor skills. YouTube videos are asynchronous cloud-based ICT tools. This is because; there is no real-time interaction between the learner and the teacher who delivers the lesson in the video. However, the asynchronous mode of YouTube videos is advantageous to the learner because the video speed can be lowered to fit the learner's need. The video can also be downloaded for offline use. ICT tools provide opportunities and foster the development of self-regulated teaching and learning capabilities of the students using videos (Putri, 2019). YouTube has become very popular (Alimemaj, 2010) among video-repository websites. YouTube is a repository of many different kinds of videos including educational videos. Hadijah (2016) observed that the use of video can facilitate the students in more interesting learning activities, because they can get different learning experiences, improve their cross-cultural understandings, develop their creativity and increase their motivation in learning. YouTube is very effective for a student to individually learn both theoretical and practical aspects of Physics with ease. Practical Physics is chosen in this study because of reported poor students' achievement in the paper (WAEC, 2012: 2019 and 2019). Practical Physics is the activity oriented aspect of Physics teaching and learning. In Nigerian secondary schools, practical Physics is done with the sole aim of verifying physical constants and laws. Due to inadequate provision of practical Physics human and materials resources in Nigerian secondary schools, Physics students are not adequately trained in practical skills. The problem of students'

inadequate training in practical Physics degenerates to poor interest in practical Physics. The only remedy to this lacuna is the use of cloud-based ICT tools like YouTube videos on practical Physics to enhance students' conceptualization of practical skills. YouTube videos support self-regulated learning.

In 1998, Winne and Hadwin proposed a five-step recursive model of self-regulated learning. The learner may not strictly observe the steps while learning practical Physics. The model was adapted in this study by integration with YouTube videos on practical Physics. The five steps of SRL in this study include: Step1: Conditions. This involves the identification of the materials and the possible constraints in actualization of the task. Identification of the softskills and materials needed. Step2: Standards. Students set the standards for completing the task. This is planning stage. Procurement of devises like android phones or computers. Digital learning skills. Procurement of materials for the experiment. Step3: Operations. This is information manipulation process to solve a problem. They include digital skills: airtime conversion to data, manipulating keyboard, typing keywords in the Youtube search engine field, downloading and saving required YouTube videos in practical Physics, video pulsing, fast-forwarding and video sharing to other online platforms. Step4: Products. Products are the results obtained from the YouTube lesson. They include determination of physical constants in a secondary school Physics experiments: focal length of a lens, internal resistance of a cell using the YouTube video as a regulator of learning. Step5: Evaluations. This step involves comparison of theoretical and experimental results. Theoretical readings are obtained using equations that connect the variables in the experiment. When one or two variables are measured, others readings can be computed. The necessary theory can be sourced from the YouTube.

Another variable whose effect was sought in the study was the student gender. It is operationally defined as being male of female. Makarova, Aeschlimann, & Herzog (2019) indicated that gender gaps in Science, Technology, Engineering and Mathematics (STEM) fields existed. The authors showed that second masculinity attribution after Mathematics was Physics. However, few studies that sought the effect of self-regulated learning using information and communications technology tools on students' gender were reported. Male and female students reported significant posttest differences with regards to gender on SRL through artificial intelligence (Walter, 2012; Xia & Chiu, 2022). Male students were found to have more self-regulation then their female counterparts (Appiah-Kubi, Amponsah, Nti-Adarkwah & Asoma, 2022).

Statement of the Problem
The problem of poor students' interest in learning practical Physics partly necessitated the study. The poor interest in Physics by the students has been attributed to the use of conventional self-regulated learning strategies like the use of printed texts, peers, wards and their teachers as the only means of gaining new knowledge in Physics. Literature indicated that gender gap in Physics interest existed as a result of method of instruction. The integration of self–regulated learning strategy with YouTube video is an attempt to address the problem of poor classroom situational interest and gender inequality in Physics interest. Hence, the problem of the study put in question form is: What is the impact of self-regulated learning strategy with YouTube videos on secondary school students' interest in practical Physics?

Purpose of the Study

The purpose of the study was to measure the impact of self-regulated learning strategy with YouTube videos on senior secondary two (SS II) students' situational interest in Physics. The study specifically sought to determine:

1. Arithmetic mean interest with standard deviation scores of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned Physics using conventional self-regulated learning strategy in the pretest and posttest respectively.
2. Arithmetic mean interest with standard deviation scores of male and female Physics students who learned Physics using self-regulated learning strategy with YouTube videos in the posttest.
3. If a significant difference in arithmetic mean interest score exists between Physics students' who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned Physics using conventional self-regulated learning strategy in the posttest.
4. If a significant difference in arithmetic mean interest scores exists between male and female Physics students' who learned Physics using self-regulated learning strategy with YouTube videos in the posttest.

Research Questions

The following research questions guided the study:

1. What are the arithmetic mean interest with standard deviation scores of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned Physics using conventional self-regulated learning strategy in the pretest and posttest respectively?
2. What are the arithmetic mean interest with standard deviation scores of male and female Physics students who learned Physics using self-regulated learning strategy with YouTube videos in the posttest?

Hypotheses

The following null hypotheses tested at .05 level of significance guided the study.

Ho_1: There is no significant difference between the interest arithmetic mean scores of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned same Physics contents using conventional self-regulated learning strategy in the posttest.

Ho_2: There is no significant difference between the interest arithmetic mean scores of male and female students who learned Physics using self-regulated learning strategy with YouTube videos in the posttest.

METHOD

Nonequivalent groups quasi-experimental, specifically pretest-posttest design was adopted in the study. This is a design where intact classes that may not have equivalent inabilities are randomly assigned to treatment and no-treatment conditions, with the administration of pretest and posttest before and after the treatment to both groups respectively (Idoko, 2011). The choice of the design was influenced by nonrandomization of the research subjects into approximately equal ability groups. So, intact classes of students were used. This study was conducted in senior secondary schools in Ohaukwu Local Government Area of Ebonyi state. Ohaukwu Local Government Area is made up of three (3) communities; Ngbo, Ezzamgbo and Effium. The choice of Ohaukwu Local Government Area was because the Physics students have very poor interest in studying Physics. Secondly, the use of expository lecture method in Physics teaching is prevalent in

the area. The students in the area prior to this study have not been exposed to self-regulated learning with YouTube videos (Ebonyi State Secondary Education Board, EB*SEB*, 2021).The population for the study comprises the entire 10,679 students in 31 public secondary schools in Ohaukwu Local Government Area of Ebonyi State (Planning, Research and Statistics Department, Secondary Education Board (*SEB*, 2021). The sample was 378 consisting of 195 (121 male and 62 female) students exposed to self-regulated instruction with YouTube videos and 183(85 male and 98 female) senior secondary two (SII) students exposed to expository-lecture method was used for the study. Four schools that had computer laboratories were purposively sampled in the area. Two streams of SSII Physics students were sampled in each school. Two schools were coded as self-regulated instruction with YouTube videos whereas the other two schools were coded as expository-lecture group.

Materials and instructional procedure:
The materials used in the study included: Android Phones or computers, internet access, knife edge, calibrated meterstick, sets of masses, converging lenses, screen, improvised or real raybox, lens stand. Others include connecting wires, 10m length of potentiometer, two cells of varying EMF, Jockey, centre-zero galvanometer and plugkey.

The self-regulated-learning strategy with YouTube videos formed the experimental group while the students exposed to the conventional self-regulated formed the control group. Briefing on how to access specific practical Physics videos online and how to download and use them for self-regulated teaching and learning was given to the experimental group prior to the commencement of the practical Physics sessions. The control group received no cloud-based ICT briefing. They learnt the specific practical Physics skills on using textbooks, practical manuals and peer consultations. The classroom situational interest pretest was administered to all categories of the students before the study began. The experiment lasted for 4 weeks. The classroom situational interest posttest was administered to all categories of the students at the end of the experiment.

Physics classroom situational interest scale (PCSIS) developed by the researchers was used for data collection. PCSIS had 25 items. It was both face and construct validated prior to its usage. The face validation targeted clarity, appropriateness and structure (positively and negatively worded) of the wordings of PCSIS, whereas exploratory factor analysis (EFA) was used to measure the alignment of the indicators of PCSIS unto one latent construct. The preliminary result of the EFA showed that all the items of PCSIS measured one construct. PCSIS contained two sections: A and B. Section A sought for the students' personal data while section B was used to elicit information on the students' classroom interest in Physics as a result of using self-regulated learning. Section B was structured into four options: 4(*Strongly Agree*), 3(*Agree*), 2(*Disagree*) and 1(*Strongly Disagree*). Arithmetic mean and standard deviations were used in answering the research questions. Mean was used because it was the most appropriate statically tool to use for such situations, which took all measurements into consideration. Standard deviation was used because it showed how the scores spread from the mean. Analysis of covariance (ANCOVA) was used in testing the null hypotheses at 0.05 alpha level. ANCOVA was used because intact classes were used and the pretest scores were included as a cofactor in order to measure the initial interest levels of the students before the commencement of treatment. The decision rule for the hypothesis is that if the estimated

probability, p value is less than the .05 level of significance set for the study, the null hypothesis is rejected. Similarly, if the estimated probability, p value is more than the .05 level of significance set for the study, the null hypothesis is not rejected.

RESULTS

Research Question 1:
What are the arithmetic mean interest with standard deviation scores of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned Physics using conventional self-regulated learning strategy in the pretest and posttest respectively?

Table 1 below displays the result of the arithmetic mean with the standard deviations of students exposed to self-regulated learning and their counterparts exposed to conventional self-regulated learning during the pretest and posttest respectively.

Table 1:   Pretest and posttest interest mean ratings and standard deviations of self-regulated strategy (SRL) with YouTube videos and conventional self-regulated learning strategy

Method	N	Pretest		Posttest		Gained mean
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
SRL with YouTube videos	195	2.45	0.91	3.72	0.26	1.27
SRL	183	2.49	0.90	2.52	0.86	0.03

From Table1, the pretest mean interest rating and standard deviation for the students that received the self-regulated instruction were 2.45 and 0.91 respectively, while the posttest mean interest rating and standard deviation were 3.72 and 0.26 respectively. For the students in the expository method group, the pretest mean interest rating and standard deviation were 2.49 and 0.90 respectively, while posttest mean interest rating and standard deviation were 2.52 and 0.86 respectively. Table 1also shows that students' interest increased by a factor of 1.27 for students that received self-regulated instruction with YouTube videos. For the conventional self-regulated learning strategy group, the change in pretest and posttest interest score was 0.03. Also, Table 1 shows that the difference in posttest interest score between students under self-regulated instruction with YouTube videos and conventional self-regulated learning strategy was 1.2. This indicates that the posttest interest mean appears to be higher in self-regulated learning with YouTube videos than the conventional self-regulated learning strategy.

In terms of standard deviations, the students exposed to self-regulated instruction with YouTube videos had its standard deviation values reduced from 0.91 to 0.26, showing that the interest score was becoming more stable. In the case of the conventional self-regulated learning strategy group, the change in standard deviation from 0.90 to 0.86 was relatively smaller. So, the mean of the self-regulated with YouTube group appeared more stable than the mean of the conventional self-regulated learning strategy group because it had smaller standard deviation value.

Research Question 2:
What are the arithmetic mean interest with standard deviation scores of male and female Physics students who learned

Physics using self-regulated learning strategy with YouTube videos in the posttest?

Table 2 below displays the result of the arithmetic mean interest with the standard deviations of male and female students exposed to self-regulated learning with YouTube videos in the posttest.

Table 2: Posttest interest mean ratings and standard deviations of self-regulated learning strategy with YouTube videos

| Gender | N | Posttest | | Mean Difference |
		Mean	Standard Deviation	
Female	98	2.72	0.96	0.07
Male	85	2.65	0.96	

The posttest mean interest for female students exposed to self-regulated learning strategy with YouTube video is 2.72 with a standard deviation of 0.96 as shown in Table2 while their male counterparts had a mean interest score of 2.65 with a standard deviation of 0.96. The mean difference is .07.

HO$_1$: There is no significant difference between the interest arithmetic mean scores of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned same Physics contents using conventional self-regulated learning strategy in the posttest.

Table3: Analysis of Covariance (ANCOVA) of the main effects.

Source	Type II Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	136.640[a]	4	34.160	60.436	.000	
Intercept	46.124	1	46.124	81.602	.000	
Pretest_Interest	129.000	1	129.000	228.227	.080	NS
Method	4.959	1	4.959	8.774	.003	S
Gender	.759	1	.759	1.343	.247	NS
Error	210.829	377	.565			

a. R Squared = .393 (Adjusted R Squared = .387)

From Table 3, it is observed that the F-value due to method maineffect is 8.774. The probability, p value representing the level of significance attached to the F value is .003. Since the p-value of .003 is less than 0.05 set for the study, the null hypothesis is

rejected. This means that there is a significant difference between the mean interest ratings of students who learned Physics using self-regulated learning strategy with YouTube videos and their counterparts who learned same Physics contents using conventional self-regulated learning strategy in the posttest. The difference is in favour of experimental group.

HO₂: There is no significant difference between the interest arithmetic mean scores of male and female students who learned Physics using self-regulated learning strategy with YouTube videos in the posttest.

Table 3 shows the F-value due to gender maineffect as 1.343. The probability, p value representing the level of significance attached to the F value is .247. Since the p-value of .247 is greater than 0.05 set for the study, the null hypothesis is not rejected. This means that there is no significant difference between the mean interest ratings of male and female students who learned Physics using self-regulated learning strategy with YouTube videos.

Discussion of the Findings
The results of the study indicated that self-regulated learning strategy with YouTube videos was better than the conventional self-regulated learning strategy in enhancing Physics students' classroom situational interest in Physics. This finding is line with Pierce (2011), students are self-regulated to a degree than they can meta-cognitively and motivationally become active participants in their own learning process. This shows that self-regulated learning strategy can arouse the curiosity in students and holds the students' attention in Physics self-regulated lesson. The result of the preinterest factor in the analysis of covariance model, indicated that no significant difference existed between the experimental and control

groups before the study began. The result justifies the equivalence of the groups. So, there was no initial group difference in classroom situational interest between the groups that could have marred the results of the analysis of covariance. The result of the study authenticates the self-regulated learning theory in the sense that it can be applied to both the conventional and hybrid self-regulated learning. The hybrid self-regulated learning is of course the integration of the conventional self-regulated learning with an information and communications technology tool. Technology can actually enhance individualized instruction in Physics thereby boosting who we are as learners.

It was also found from the study that gender was not a significant factor on situational interest in Physics. This means that there was no significant difference between male and female Physics students' classroom situational interest arithmetic mean scores as a result of use of self-regulated learning with YouTube videos. The result disagrees with earlier studies which say that there is gender variation in Physics classroom situational interest when the teaching method applied was regulated using ICT tools (Walter, 2012; Xia & Chiu, 2022). Male students were found to have more self-regulation then their female counterparts (Appiah-Kubi, Amponsah, Nti-Adarkwah & Asoma, 2022). The result of the study is very apt in addressing the gender-gap in Physics classroom situational interest.

Conclusion and Recommendations
The YouTube video has been found very efficient in enhancing the effectiveness of self-regulated learning to boost students' situational interest in Physics. Learning Physics with self-regulated learning with YouTube video has solved the problem of gender divide on Physics interest. It was recommended that Physics students should use self-regulated learning with YouTube

videos which is gender friendly to boost interest in Physics.

REFERENCES

Adebayo, E. (2013). *The history and methodology of Mathematics.* Ibadan: Labode Printing Press.

Anibueze C.O. (2017). The effect of Mathematics scrabble game on junior secondary school students' achievement and interest in Mathematical computational skill. *Unpublished Master's Dissertation,* Department of the Department of Science and Computer Education, Enugu State University of Science and Technology (ESUT), Enugu.

Appiah-Kubi, E., Amponsah, M. O., Nti-Adarkwah, S. & Asoma, C. (2022). Assessing the influence of gender on self-regulated learning and academic engagement among senior high school students in Ghana. *European Journal of Educational and Developmental Psychology*, 10, (2), 28-41.

Ashi, A. (2017). Cognitive competence and teachers' ability of Physics teachers in Nigeria secondary school. *Journal of Nigeria Education Research Association* (NERA), 37 (1& 2 July): 100 – 117.

Egbo, A. (2012). Gender differences and students' academic achievement and retention in Physics. *European Journal of Education Studies* 4(1): 30 – 44

Egbo, J. J. (2014). Effects of two instructional methods on senior secondary schools students' perception of the difficulty in learning some science concepts and their achievement gains. *Journal of Educational Foundations and Management*, 1 (1):57-63

Hadijah, S. (2016). Teaching by using video: ways to make it more meaningful in EFL classrooms. *Proceedings of the Fourth International Seminar On English Language and Teaching.*

Idoko, C. E. (2011). *Research in Education and Social Sciences (Practitioner's companion)*.Our Saviour Press Limited: Uwani-Enugu.

Jegede, S. A. & Adedayo, J. O. (2013). Enriching Physics Education in Nigeria towards enhancing sustainable technology Development *Greener Journal of Educational Research*. 3(2): 80-84.

Kochanska, J. (2005). *The structure of scientific knowledge.* Chicago: University of Chicago Press.

Makarova, E., Aeschlimann, B. & Herzog, W. (2019). The gender gap in STEM fields: The impact of the gender stereotype on Math and Science on secondary school career aspirations. *Secondary Educational Psychology*, 4.https://doi.org/10.3389/fedu.201900060

Musa A. M. (2014). Effects of two modes of computer instruction on students' achievement and interest in theoretical Physics. *Journal of Educational Professionals* 5(2): 15 – 27.

Nneji, S. O. (2011). *Effect of Problem solving approach in teaching science Federal College of Education Katsina.*

Nworgu, B. G. (2014). *Educational research: Basic issues and methodology*. Nsukka: University Trust Publishers

Nze, B., Hedges, L. V. & Konstantopoulos, S. (2011). The long-term effects of small classes in early grades: Lasting benefits in Physics achievement at grade 9.*The Journal of Experimental Education*, 69 (3): 245-257.

Onoh, D. O. & Nnabuike E. K. (2007). Improving secondary school students'achievement and interest in

Mathematics. *Journals a phriapub* 4(4): 1 – 12.

Onuora, J.C. (2012). Secondary school students' interest in Christian Religion Studies in Nsukka Education Zone. *Unpublished MED Thesis ,The University of Nigeria, Nsukka*.

Onuorah, B. F. (2017). *Active learning in the Mathematics classroom. Training manual capacity building workshop for secondary and primary school Mathematical Science teachers*. Abuja: National Mathematical Centre.

Oyekan, J. E. (2013). Effective problem solving in Physics: Challenges and prospects. *Journal of Issues in Science and Mathematics*, 1(1), 25-37.

Pierce, J. (2011). *Science of education and the psychology of the child*. New York: Viking.

Putri, F. H. (2019). YouTube for self-regulated language learning: An EFL perspective. *Jurnal Tadris Bahasa Inggris*, 12(2), 42-58.

Sander, J. R. (2011). What students' learning of representations tells us about constructivism? *Journal of Mathematical Behavior* 19 (4), 481–502.

Snyder, C. R. (2012). *Hypothesis.there is hope*. I n C. R. Snyder(Eds). *Hand book of hope theory, measures and applications* (pp.3-21). San Diego: Academic press.

Sun, Z. (2015). The role of self-regulated learning on students' learning in an undergraduate flipped Flipped Maths class, *Unpublished Ph.D Thesis*, Graduate School of The Ohio State University.

Thompson, R. A. (2016). Emotion regulation. A theme in search of a definition. *Monographs of the society for Research in child Development*, 59 (2-3 serial NO.240), 25-52.

Walter, J. (2012).The impact of gender and pedagogy on the development of self-regulated learning strategies in undergraduate engineering classrooms. *Master's Dissertation*, 70. https://digitalcommons.bucknell.edu/masters_thesis/70

West African Examinations Council (2012). *WAEC e-learning*. Physics paper3 Nov/Dec. Weaknesses_and_Remedies.https://www.waeconline.org.ng/elearning/Physics/Phys321nw.html

West African Examinations Council (2017). *WAEC e-learning*. Physics 3 WASSCE (school candidate, SC). Weaknesses_and_Remedies.https://www.waeconline.org.ng/elearning/Physics/Phys326mw.html

West African Examinations Council (2019). *WAEC e-learning*. Physics 3 WASSCE (school candidate, SC). Weaknesses_and_Remedies.https://www.waeconline.org.ng/elearning/Physics/Phys328mw.html

Xia, Q., Chiu, T. K. E. & Chai, C. S. (2022). Gender differences in AI in education: The moderating effects of gender and need satisfaction on self-regulated learning through artificial intelligence (AI). Education and Information Technologies, *Advanced online publications*, https://10.1007/s10639-022-11547-x

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In B. J. Zimmerman and D. H. Schunk (Eds) *Self–Regulated Learning: From teaching to self-reflective practice* (pp.1-19). New York, NY: Guilford publications.