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REVIEW PAPER

REVIEW OF INNOVATIVE TEACHING STRATEGIES IN SENIOR SECONDARY SCHOOLS SCIENCES

By

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ABSTRACT

Information and knowledge of science are very necessary and vital inputs for growth and survival in modern times. Science is a body of knowledge that can be rationally interpreted and applied consistently in human endeavors. Science as a form of information is a way to examine a process and a way of thinking in the quest for an understanding of nature. The aim of this study is to review teachers' strategies of teaching science. Innovative practices are devices that empower both the students and tutors. The interests of the learners are fulfilled through investing in creative activities as it reflects the students ' desire for learning in doing so. To educators, new approaches are exciting, as they help teachers in involving students in realistic inquiry learning. The authors reviewed articles on innovative teaching strategies. It was concluded from the survey that Innovative teaching strategies are activity-based and characterized by students sharing some degree of responsibility for making decision in the learning process.

Keywords: Innovative Teaching, Teaching Strategies, Senior Secondary School, Teachers, Information and Knowledge, Science.

INTRODUCTION

In modern times, knowledge of information and science stand out as a very significant and critical input for growth and survival. Science as a structured enterprise, constructs and organizes knowledge in the form of testable theories and predictions of universal phenomena. Science is a body of knowledge that can be explained rationally and applied reliably in human endeavour. Science as a body of knowledge is a way of investigating a method and a means of reasoning in the quest for understanding of nature (Abimbola & Omosewo, 2012). Science which is a dynamic human activity is concerned with the world's technological evolution. It is the basis on which technological breakthroughs of modern times are built. This is why there is a paradigm shift in the educational system in Nigeria toward science, technology and innovation. This shift is necessary to be considered by science teachers to adopt the innovation in science. Khairnar (2015) confirmed that science plays a major role in creating new knowledge, in economic development and in creating wealth. This ensures social well-being by eradicating poverty and providing better health care which in several ways improves the quality of human life. Science finds its application in all aspects of life, such as agriculture, medicine, power and energy supply, biotechnology, space research and nuclear technology.

There has been much concern about the persistent unsatisfactory performance in science education at the Secondary School level in Nigeria. Gbadamosi (2013) opined that there are several problems associated with the teaching of science, some of which are;

development of passivity, misrepresentation, docile learning, over dependence of students on teachers and books, poor performance, absence of skills and appropriate scientific attitudes, dwindling interest and enrolment in science. Factors which contribute to science education are many but the most important of them is the method of teaching science in the senior secondary schools. Oludipe (2012) noted that a significant shortcoming of our education system is that science is portrayed dogmatically in most schools as disjointed facts and ideas that are difficult for students to apply to the real world. The inappropriate teaching method of science could be linked to persistent low enrollment and performance in science subjects especially at School Certificate level. (Achor et al. 2010; Gengle et al., 2017; Ullah et al., 2018; Etokeren & Okwelle, 2019) have given rise to the assumption that most secondary school science teachers are unable to use a variety of types of teaching methods to cope with the particular challenges that teachers and students encounter in teaching and learning science. A research by Oyelekan et al. (2018) reiterated this point, showing that science teachers have seldom used novel teaching strategies in their lessons. This may mean they are well educated in the science substance but not in the pedagogic aspects. This problem needs to be addressed in such a way that the aim is to provide science skills for students to live efficiently in our science and technology society. Students need to learn sufficient knowledge, intellectual, physical and social skills and abilities to survive in, and make a meaningful contribution to social development as articulated in Nigeria's National Education Policy (Federal Republic of Nigeria, 2013).

Science is often subdivided into two classifications- physical and biological or life sciences. The physical sciences includes chemistry, physics, geology and so on, that deal with laws and the structure of the physical universe. Biological or life science deals with the laws and nature of plant and animal life. The disciplines of science which are of main concern to this study are biology, chemistry, and physics. Biology, which is one of the science topics taught at high school level, occupies a central position in any nation's scientific and technological growth. It's called the key to fields like medicine, agriculture, pharmacy, nursing, dentistry and so on. Adejoh and Itokyaa (2012), Nasr and Soltani (2011), said biology is life science. Chemistry as one of the science topics taught in high schools is concerned with the nature, structure, and properties of matter, as well as changes in the chemical reactions they undergo. Chemistry as a branch of science discusses the essence of matter; its properties and conditions (Arokoyu & Ugonwa, 2012). Ezeliora (2009) argued that the power of chemistry is what creates an enabling infrastructure providing food, medicine and materials that are characteristic of modern life. Physics is the third science which is taught in high schools. It is the science branch that deals with the fundamental questions about the structure of matter and the interactions between the elementary constituent of nature that are susceptible to experimental research. Omosewo (2012) noted that Physics is one of the oldest academic disciplines, perhaps the oldest through its inclusion in astronomy. Danjuma (2015) described physics as a natural subject which explores concept like mass, energy, matter and its motion. Adolphus and Aderonmu (2013). reported that Physics like any other science is the basic of modern technology, thus has found wide applications on several field including medicine, agriculture, engineering, food science, communication, mining, teaching, among others.

Biology, chemistry and physics which are the main science subjects taught in senior secondary school are of tremendous importance to humanity for they serve as the foundation upon which modern day science and technology were built.

1. Objective of the Study

The objective of this study is to;

- Review teachers' strategies of teaching science
- Review articles on innovative teaching strategies

1.1 Review of Teachers' Strategies of Teaching Science

Teaching is generally a process by which a qualified or an experienced individual helps other people to learn. It is an

active process in which a person exchanges information with others to give them information which will change their behaviour. On the other hand, learning is the process of assimilating knowledge with a corresponding change in behaviour, and teaching-learning is a structured activity which facilitates behavioral change that is not the product of maturation or chance (Madu & Iyiola, 2013; Musa & Kanya, 2014).

Teaching strategies are referred to as the ways teachers choose to achieve the goals they have set in their lesson. It can be a method, process or a combination of carefully designed classroom interactions that could be closely followed to teach a subject, concept, idea or way teachers choose to achieve curriculum goals (Darda, 2014). Zundel and Deane (2010) emphasized the need to shift focus from teaching to learning and embrace the many ways students can learn, instead of focusing on conventional methods. Lots of things happen to learners with learning difficulties when these issues remain unresolved. The impact of learning difficulties on a student may not be far out of proportion to the apparent severity of the problem, since emotional pressure builds up around the area of weakness of the student (Oyelekan et al., 2018). The student can fall behind teacher, parent and school administration expectations or standards. According to Bimbola and Daniel (2010), most educators have to recognize that simultaneous improvements in curriculum and teaching will support changes in the outcomes of the students. They also reported that it is obvious that most of today's teachers are caught up in changes for which they are not professionally trained. Because of advancement in modern science, it is clear that many of today's teachers have been educated in classrooms where students have a role to play in memorizing information, conducting well-regulated experiments, performing mathematical calculations and testing their ability to repeat tasks or remember specific facts.

Colburn (2000) conducted research on undergraduates in a large lecture hall and found that only 20 percent of students understood what they were taught because they were too busy taking notes to internalize the content, only 15 percent of students paid attention after a few minutes of lecture, teachers ' conventional methods of teaching as only knowledge is given. The instructor ultimately manages the teaching process, the material is passed on to the entire class and the teacher appears to emphasize factual knowledge. The teacher delivers the substance of the lecture and the student listens; thus, learning appears to be passive and the learners play a small part in the learning process. The modern classroom lecture approach is typically of limited effectiveness in the teaching and learning of science in classrooms.

Some methods of teaching might be more facilitative in teaching than others, but this depends on the subject. Ezekannagha (2016), accepted by most science teachers, teaches integrated science using incorrect methods such as lecture or chalk and talk methods, rather than active learning like a laboratory or exploration process, which is more appropriate for teaching science subjects. Achor (2008) supported the above claim by stating that certain modes of teaching are learner-centered, interest-based, and activity-oriented, and in most cases teachers are required to use a number of them during teaching. In some situations, what should compel the professor to use it or not is the utility of a curriculum and its appropriateness. Different subjects and concepts to be taught, skills to be created, the demand for different methods of teaching or innovative strategies to be used in class.

Adesoji and Arowosegbe (2004) worked on the isolation of factors in teachers' perception of senior secondary chemistry practical in Nigeria. The sample includes 145 chemistry teachers in public secondary school in Ibadan Metropolis. Using factors like; strategies for teaching chemistry, time allocated for the study among others. A researcher designed questionnaire was administered to isolate and identify the major factors perceived by the teachers to hinder effectiveness in the learning of chemistry practical in their schools. The result of the study showed that teachers do not use inquiry approach to teach chemistry attributing this fact to the content of chemistry curriculum being overloaded and the time allocated for the subject being too small.

Bimbola and Daniel (2010) conducted a study on how constructivist-based teaching approach in integrated science affects students academic performance. We used a pre-test, post-test and post-test to answer questions about whether the student's memorization of information or understanding of different concepts taught by the professor was compromised after two weeks of the post-test. The study included 120 junior high school 3 students selected at random from four public high schools in the Ijebu Ode local government area of Ogun State. The students subjected to constructivist instruction were found to have a higher mean score for both post-test and post-test delays than those exposed to lecture methods; thus, they concluded that if constructivism is used to teach student integrated science, the student's academic performance in the subject will be improved.

A group of one hundred and twenty high school students from three private schools in Oyo State were involved in the Yusuf and Afolabi (2010) study on the effect of computer-assisted teaching on high school students in Biology. The researchers used a pre-test and post-test control test group to build. The result showed that students exposed to computer-aided instruction were either individually or collectively higher than those exposed to traditional classroom instruction, and indicated the need for computer-aided instruction packages to teach biology in Nigeria's secondary schools.

Alice (2011) examined the impact of teaching the students of NCE biology with analogy and academic performance, and retaining assessment and definition. The sample was randomly selected from 280 students from FCE, Kontagora and FCE, Minna. The research followed the quasi experimental and control group configuration pre-test, post-test, after-test. The subjects were taught principles of evolution. The study findings indicate that the students taught using analogy performed better than the ones taught using the teaching method. There was also a significant difference in students ' retention capacity taught using analogy compared to those taught using experimental community lecture form of instruction.

Omosewo (2012) researched the assessment of the application of information technology to physics education by university graduate students. The study was from Ilorin University's eighty-five (85) final year education technology graduates. This used a standardized questionnaire. It was found that 96 percent of the students agreed that the use of information technology as a teaching method would enhance the students ' cognitive development, while 88 percent supported the enhancement of the affective domain. 94 percent endorsed the enhancement of the psychomotor domain and 85 percent proposed that computer-aided instructions should be used since this is the digital age; these products include the use of images, computer graphics, projected media and video tapes.

Khurshid and Ansari (2012) looked at the impact of innovative strategy on results from an English medium school for 50 grade 1 students in Islamabad. The experiment was done on the basis of science teaching. A pre-test on general science was given to students and reported. The students were then split into two classes; one group was used as a control group and exposed to conventional methods; the second group was taught by teachers who used innovative strategies such as team projects, individual project, field trip, role-playing, digital computer aids and mind maps, etc. A post-test was conducted after a period of one month, and it was found that the students taught using novel methods obtained significantly higher scores than those taught using lecture form.

Okafor and Udeani (2012) investigated the comparative effectiveness of the expository and concept mapping instructional technique of introducing concepts of secondary school biology to slow learners for two weeks in their respective biology lessons. The students were divided into 2 classes. The first group was taught using expository approach whilst the second group was taught using concept mapping method. The group was post-tested after two weeks of teaching for any significant differences in its biological achievement. Analysis of post-test scores found that the group taught by concept mapping instructional strategy performed significantly better

($p<0.05$) than their expository group equivalent, which has implications for biology teachers in implementing effective methods to tackle teaching problems.

Ganyaupfu (2013) conducted a study exploring the differential efficacy of teaching methods on the students ' academic performance. A selection of 109 undergraduate students from the university's department of economic and business science were used for the study. The students ' assessment test scores were taken from the instructor's internal class evaluation using the inferential statistics course. Using the General Linear Model based univariate ANOVA (Ogundokun et al., 2019a,b; Lukman et al., 2018, Awotunde et al., 2019) methodology, the differential efficacy of the three teaching methods on students academic performance were analysed. The results showed significant differences about the success of the three methods of teaching. The mean scores suggested that the collaborative teacher-student method was the most effective teaching method, followed by the student-centered method, while the teacher-centered approach was the least effective teaching method.

Ogunji (2019) tackled this topic using a mixed methodology analysis strategy that involves five focus group interviews and survey results from 460 respondents across four federal universities in south-east Nigeria. Findings in this study showed that the level of knowledge and inadequate use of novel teaching approaches were substantially weak. Any of the fundamental factors restricting the use of novel instructional approaches by academics in those universities were insufficient resources and supplies, poor expertise and a classroom layout.

1.2 Review Articles on Innovative Teaching Strategies

Innovative teaching strategies as used in this study are a good way of reaching all the students in other words, plans or patterns that can be used to impart knowledge such that students are more engaged, lessons more interesting, understanding easily facilitated and students' learning and retention improved. Innovative teaching approaches in science classrooms that include the use of new teaching methods, the addition of new ideas in curriculum content, learning experiences or the introduction of new or current teaching materials, as well as the adoption of new improvements in the evaluation of teaching and learning outcomes. It could also mean the use of new or restored existing ideas, processes, equipment that are often not brand new but are rather new applications of existing techniques and seem innovative to others because they have not yet been widely adopted.

Gbadamosi (2013) described innovative teaching strategy as the use of new instructional or assessment methods that are different from traditional 'talk and chalk' Lecture methods. These strategies may be used to teach a topic, a collection of concepts, theme, idea or some specific science subjects.

Innovative teaching methods are often attempted in an effort to make one's teaching more effective or to resolve a question or difficulty in instruction. Both of these factors are related to a general desire to improve the learning process of students as well as value different talents in the student.

In the 21st century, teaching strategy should be innovative. The teaching of science subjects demand active student's participation which can be achieved through the use of innovative teaching strategies. Oyekefi and Nzewi (2012) affirmed that science is activity- based and student centred and as such requires learner-centred activities so as to encourage student's participation during the teaching and learning process).Innovative teaching approaches in science education may include the use of new teaching techniques, the addition of new concepts in curriculum content, learning experiences or the introduction of new or current teaching materials and the adoption of a new change in the assessment of scientific learning outcomes (Cox, 2020).

In a research conducted by Agommuoh and Ifeanacho (2013), a purposive sampling technique was used to pick 190 out of a population of 394 secondary school year 1 physics and mathematics students in Umuahia North LGA of the Umuahia Abia State Education Area. Students were

made to assess the innovative teaching strategies adopted in the class by their teachers to improve the achievement of the students. Results showed that inquiry process, exploration learning, debate, role-play, simulation, games, team teaching, brainstorming were agreed to be creative teaching methods that could boost physics and mathematics achievements.

Gabriel et al. (2018), considered Cooperative learning and Individualized instructional strategies as innovative teaching strategies employed by teachers to improve chemistry students' achievement in Awka south LGA of Anambra State. The study suggested that chemistry teachers adopt cooperative learning strategies and individualized instruction to better involve the students in the learning process and make them more accountable for their own learning.

The results of two groundbreaking teaching strategies were studied by Oluwatoyin and Gabriel (2018). Kolawole's problem solving and the use of Labless Kit approaches on secondary school students ' academic performance in Biology in Ekiti-State. Quasi–experimental pre-test / post-test research design was adopted. Two hundred and nine students were chosen for the study. Kolawole's strategy for problem solving and Lab-less kits have been used as treatment. The research has shown better performance by the experimental groups. The study suggested that biology teachers use Kolawole's Problem Solving Strategy and Lab-less Kit approaches in their teaching.

Oyelekan et al. (2018) listed the teaching strategies that are used to impart knowledge in the science classroom. These are demonstration method, discovery method, project method, laboratory investigation method, field trips, discussion method, inquiry method, play-way and cooperative method, competitive method and the computer assisted instructions. Other innovative teaching strategies that could be used in teaching science include inquiry- based learning strategies, quick response (QR codes) project-based learning, wisely managed classroom technology, jigsaw, team teaching, collaborative learning instructional strategies, mastery learning instructional strategy, mind map, teaching with sense of humour, personalized system of instruction, Think-pair- share, Jigsaw team work/puzzle, Z-A approach Concept Formation, Mnemonic-word-Words approach, Online Virtual Laboratories, Peer tutoring, Hands on Learning approach, Brain based strategy, Experiential Learning, Reciprocal Learning Strategy, Integrating debate into course assignment, Blended Learning.

Conclusion

Innovative practices are devices that empower both the students and tutors. The interests of the learners are fulfilled through investing in creative activities as it reflects the students ' desire for learning in doing so. To educators, new approaches are exciting, as they help teachers in involving students in realistic inquiry space between can be inferred from the study that creative teaching methods are activity-based and characterized by students having some degree of responsibility in the learning process to make decisions. Using innovative teaching strategies, teachers are often identified as collaborators and facilitators in the teaching and learning process and not as knowledge holders, so innovative teaching strategies are referred to as student-centered learning approaches.

Innovative teaching strategies are learner centered, encourage creativity, encourages working in groups, motivate students to learn new concept, reduce anxiety and stress in dealing with difficult concept, provide active learning environment to facilitate interest, encourage interest, self-motivation, best performance and class attendance,

Innovative teaching strategy increases emotional stability and encourages social learning, creativity, divergence thinking, Critical thinking and ability to invent. It improves Psychomotor, cognitive and affective domain of the learner because it provides a lively atmosphere to facilitate interest.

Recommendations

Based on the survey, the following recommendations were made

- The high school biology teachers used master's educational delivery model to teach the subject

- Senior high schools biology teachers make every attempt to include daily preparation and retraining programs that strengthen their teaching skills and increase the academic success of the students
- The improvisation will be introduced in any episode of instructional delivery for high school students to get the most of their learning time.

References

[1]. **Abimbola, I. O., & Omosewo, E. O. (2012).** Views of Nigerian science teacher educators on the American minimum professional knowledge standards for science teacher educators. *European Scientific Journal,* 8(5), 200-208.

[2]. **Achor, E. E. (2008).** Repositioning physics teaching and learning in secondary schools in Benin state: Focus on strategies for teaching difficult concepts. In *Workshop material on retraining for maximum efficiency in secondary schools* by Benue State Ministry of Education, pp. 178-187.

[3]. **Achor, E. E., Samba, R., & Ogbeba, J. (2010).** Teachers' awareness and utilization of innovative teaching strategies in secondary school science in Benue state, Nigeria. *Educational Research,* 1(2), 032-038.

[4]. **Adejoh, M. J., & Itokyaa, F. M. (2012).** An assessment of the provision of the material resources for implementing biology programme in secondary schools in Benue State. *STAN proceedings of 53rd Annual Conference,* Aug 2012, pp. 246-252.

[5]. **Adesoji, F. A., & Arowosegbe, O. (2004).** Isolation of factors in teachers' perception of senior secondary chemistry practical in Nigeria. *International Journal of Science Education,* 20(2), 9-25.

[6]. **Adolphus, T., & Aderonmu, T. S. (2013).** Difficulties Students Encounter in Reporting Physics Practical at the Senior Secondary School level in Rivers State, Nigeria. *Asian Journal of Education and E-Learning,* 1(1), 29-33.

[7]. **Agommuoh, P. C., & Ifeanacho, A. O. (2013).** Secondary School Students' Assessment of Innovative Teaching Strategies in Enhancing Achievement in Physics and Mathematics. *Journal of Educational and Social Research,* 3(8), 121.

[8]. **Alice, J. (2011).** *Effects of teaching- with- analogy on academic performance and retention of evolution concepts among Nigeria Certificate in Education biology students* (Unpublished M.Ed. Thesis). Ahmadu Bello University, Zaria, Nigeria.

[9]. **Arokoyu, A. A., & Ugonwa, R. C. (2012).** Assessment of resource availability for chemistry instruction in the secondary schools in Rivers State. *Journal of Emerging Trends in Educational Research and Policy Studies,* 3(3), 346-351.

[10]. **Awotunde, J. B., Ogundokun, R. O., Ayo, F. E., Ajamu, G. J., Adeniyi, E. A., & Ogundokun, E. O. (2019, September).** Social Media Acceptance and Use Among University Students for Learning Purpose Using UTAUT Model. In *International Conference on Information Systems Architecture and Technology* (pp. 91-102). Springer, Cham. https://doi.org/10.1007/978-3-030-30440-9_10

[11]. **Bimbola, O., & Daniel, O. I. (2010).** Effect of constructivist-based teaching strategy on academic performance of students in integrated science at the junior secondary school level. *Educational Research and Reviews,* 5(7), 347-355.

[12]. **Colburn, A. (2000).** Constructivism: Science education's "grand unifying theory". The Clearing House: *Journal of Educational Strategies, Issues and Ideas,* 74(1), 9-12. https://doi.org/10.1080/00098655.2000.11478630

[13]. **Cox, J. (2020).** *What is the role of a teacher?* https://www.thoughtco.com/what-is-the-role-of-a-teacher-2081511

[14]. **Danjuma, B. A. (2015).** *Effects of computer assisted instruction on academic achievement among NCE physics students of different abilities in Niger state, Nigeria* (Unpublished M.Ed. Thesis). Ahmadu Bello University, Zaria, Nigeria.

[15]. **Darda, R. (2014).** *Handbook on advanced pedagogy.* Monarch: Monarch University Publications.

[16]. **Etokeren, I. S., & Okwelle, P. C. (2019).** Effect of Cooperative Learning Strategy on Biology Students' Academic Performance in Senior Secondary School in Rivers State. *Journal of Scientific Research and Reports,*

23(6), 1-11. https://doi.org/10.9734/jsrr/2019/v23i630138

[17]. Ezekannagha, G. (2016). *Effects of concept mapping and cognitive styles on achievement of students in integrated science* (Doctoral dissertation), University of Nigeria, Nsukka.

[18]. Ezeliora, B. (2009). Nurturing young chemist. In M. A. Olayiwola, & W. S. Umoh (Eds.). Effective methods of teaching inorganic chemistry. *STAN (2009) Chemistry Panel Workshop Proceedings Series 3, Kano, Nigeria.*

[19]. Federal Republic of Nigeria (2013). *National policy on education.* (6th Ed.). Lagos: FME/NERDC, Nigeria.

[20]. Gabriel, I. A., Osuafor, A. M., Cornelius, N. A., Obinna, P. P., & Francis, E. (2018). Improving Students' Achievement in Chemistry through Cooperative Learning and Individualized Instruction. *Journal of Education, Society and Behavioural Science,* 26(2), 1-11. https://doi.org/10.9 734/JESBS/2 018/42873

[21].Ganyaupfu, E. M. (2013). Teaching methods and students' academic performance. *International Journal of Humanities and Social Science Invention,* 2(9), 29-35.

[22]. Gbadamosi, A. F. (2013). *Biology teachers' awareness and utilization of innovative teaching strategies* in Oyo, South Senatorial district, University of Ilorin, Ilorin, Nigeria.

[23]. Gengle, H. I., Abel, M. A., & Mohammed, B. K. (2017). Effective teaching and learning strategies in science and mathematics to improve students' academic performance in Nigeria. *Journal of Education, Society and Behavioural Science,* 19(1), 1-7.

[24]. Khairnar, C. M. (2015). Advance pedagogy: Innovative methods of teaching and learning. *International Journal of Information and Education Technology,* 5(11), 869-872.

[25]. Khurshid, F., & Ansari, U. (2012). Effects of innovative teaching strategies on students' performance. *Global Journal of Human Social Science Linguistics & Education,* 12(10), 46-53.

[26]. Lukman, A. F., Adebimpe, O., Onate, C. A., Ogundokun, R. O., Gbadamosi, B., & Oluwayemi, M. O. (2018). Data on expenditure, revenue, and economic growth in Nigeria. *Data in Brief,* 20, 1704-1709. https://doi.org/10.1016/j.dib.2018.08.191

[27]. Madu, B. C., & Iyiola, F. B. (2013). NEEDS assessment of Nigeria senior secondary school science teachers for improvement of science instruction in Taraba state, Nigeria. *Developing Country Studies,* 3(9), 14-24.

[28]. Musa, S. A., & Kanya, R. A. (2014). Integrating ICT in teaching and learning process in Nigeria: The pros and cons. *Paper Presented at 1st International Conference of Arts and Social Sciences at Sa'adatu Rimi College of Education,* Kumbotso, Kano, Nigeria, 46-51.

[29]. Nasr, A. R., & Soltani, A. K. (2011). Attitude towards biology and its effects on student's achievement. *International Journal of Biology,* 3(4), 100-104.

[30]. Ogundokun, R. O., Adebiyi, M. O., Abikoye, O. C., Oladele, T. O., Lukman, A. F., Adeniyi, A. E., Adegun, A. A., Gbadamosi, B., & Akande, N. O. (2019a). Evaluation of the scholastic performance of students in 12 programs from a private university in the south-west geopolitical zone in Nigeria. *F1000Research,* 8:154. https://doi.org/1 0.12688/f1000research.16762.1

[31]. Ogundokun, R. O., Adebiyi, M. O., Abikoye, O. C., Oladele, T. O., Lukman, A. F., Adeniyi, A. E., Adegun, A. A., Gbadamosi, B., & Akande, N. O. (2019b). Evaluation of the scholastic performance of students in 12 programs from a private university in the south-west geopolitical zone in Nigeria [version 2; peer review: 1 approved, 2 approved with reservations]. *F1000 Research* 2019, 8:154 https://doi.org/10.12688/f1000research.16762.2

[32]. Ogunji C. V. (2019). Innovative Pedagogies: Unpacking the Awareness Level and Extent of Utilisation Among Academic Staff of Universities in South-Eastern Nigeria. *Journal Plus Education (Educatia Plus),* 144-151

[33]. Okafor, P. N., & Udeani, U. (2012). The effect of concept mapping instructional strategy on the biology achievement of senior secondary school slow learners. *Journal of Emerging Trends in Educational Research and policy studies,* 3(2), 137-142.

[34]. Oludipe, D. I. (2012). Gender difference in Nigerian junior secondary students' academic achievement in basic science. *Journal of Educational and Social*

Research, 2(1), 93-99.

[35]. Oluwatoyin, A. B., & Gabriel, M. T. (2018). Two Innovative Teaching Strategies and Academic Performance of Senior Secondary School Students in Biology: Ekiti State Experience. *American Journal of Educational Science,* 4(4), 127-135

[36]. Omosewo, E. O. (2012). University undergraduate students' assessment of the application of information technology to physics education. *European Scientific Journal,* 8(3), 161-170.

[37]. Oyekefi, Q. O., & Nzewi, U. M. (2012). Assessment of ICT competencies possessed by biology teachers in Nsukka education zone. In O. Abonyi (Ed.), *Meeting the challenges of UBE through STM Education, STAN 53rd Annual Conference* (pp. 300-305). Ibadan: HEBN Publishers Plc.

[38]. Oyelekan, O. S., Igbokwe, E. F. & Olorundare, A. S. (2018). Science teachers' utilisation of innovative strategies for teaching senior school science in Ilorin, Nigeria. *Malaysian Online Journal of Educational Sciences,* 5(2), 49-65.

[39]. Ullah, I., Tabassum, R., & Kaleem, M. (2018). Effects of peer tutoring on the academic achievement of students in the subject of biology at secondary level. *Education Sciences,* 8(3), 112. https://doi.org/10.3390/educsci80 30112

[40]. Umoren, G., & Ogong, A. S. (2007). Prior Presentation of Behavioural Objectives and Students' Achievement in Biology. *Educational Research and Reviews,* 2(2), 22-25.

[41]. Yusuf, M. O. & Afolabi, A. O. (2010). Effect of Computer Assisted Instruction (CAI) on Secondary School Students' Performance in Biology. *The Turkish Online Journal of Educational Technology,* 9(1), 62-69.

[42]. Zundel, P. & Deane, P. (2010). *It's time to transform undergraduate education.* Final Report of task force on Innovative Teaching Practice to Promote Deep Learning at the University of Waterloo. University Affairs Press.

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