




THE DECLINE IN SCIENCE STUDENTS' ENROLMENT IN NIGERIAN COLLEGES OF EDUCATION: CAUSES AND REMEDIES

 Aina, Jacob Kola¹⁺
Ayodele, Michael Olu²

¹Physics Education Department College of Education (Technical) Lafiagi
Kwara State, Nigeria

Email: akoja64@gmail.com Tel: +2348032304024

²Chemistry Education Department College of Education (Technical) Lafiagi,
Kwara State, Nigeria

Tel: +2348033813940



(+ Corresponding author)

ABSTRACT

Article History

Received: 5 July 2018

Revised: 23 August 2018

Accepted: 29 August 2018

Published: 3 September 2018

Keywords

Science education

Science enrolment

Quality teacher

Pedagogy content knowledge

Self-efficacy

Out-of-field teaching.

The article critically reviewed the decline in science students' enrolment in Nigerian Colleges of Education, causes and the solutions. The research evidence abounds that the students' enrolment for science education in the Nigeria colleges of education reduces every year. The causes for this drawback are the crux of this article. The Nigerian college of education is an institution saddled with the responsibility of training teachers for the primary and secondary schools. Nonetheless, the colleges had been criticised for lack of standards in its admission policy and also of qualified academic personnel. The reviewed literature indicates that there are many challenges confronting colleges of education in Nigeria. Some of these are teachers' inadequate pedagogical content knowledge (PCK), out-of-field teaching and low teachers self-efficacy. The paper however observed that this problem and others are the results of bad governance experiencing in the nation. Consequent upon these challenges, the students' enrolment in science education continues to decline every year unabated. The paper identified many causes of the students' enrolment among these are, the proliferation of private Colleges of Education, loss of interest by the students, lack of science equipment and many others. The paper suggested some recommendations to raise the standard of the Nigeria colleges of education and improve science education students' enrolment. Among these suggestions is the full government commitment to the funding of the Colleges of Education's academic programmes.

Contribution/Originality: This study contributes to the existing literature on the science enrolment in Nigerian colleges of education. Principally, it provides an insight into the causes of the low enrolment in the Nigerian colleges of education. Essentially, suggestions for improving students' enrolment was made at the end of the paper.

1. INTRODUCTION

There is no doubt that science education is facing severe challenges globally. However, the case of Nigeria is different because of a leadership problem and corruption. The Science education involves the teaching and learning of scientific knowledge with the purpose of sharing the knowledge with the society for sustainable development. The teaching and learning of scientific knowledge (Science education) start from pre-school age in Nigeria. The little children start the learning of colour, energy, growth, living and none living things from home. Science at this period is in career awareness stage: pupils continue at this stage until the school age at the primary level. The next stage is the career exploration stage where students deepened their knowledge in science learning. At both levels,

the learners developed an interest in learning and are curious about it. Parents also are eager to enroll their children in science class. It is unfortunate, that as students move to the next level, which is the career orientation stage, students interest, and attention starts to change due to many problems. Finally, at the last stage called career specialization, the challenges to the students' learning became pronounced, and interest and enrolment in science classes in all school levels became a national debate.

Science education is not well treated as a field of study at the career awareness, exploration and orientation stages. The recognition of science education as a field of study is at the career specialization stage. However, the foundation laid in the earlier stages had significant influences on the latter stage. There are different categories of institutions in Nigeria established to train students in the field of science education. One of the institutions is the College of Education. The National Commission coordinates the college of education programmes for Colleges of Education in Nigeria. The principal college objective is to train teachers for the primary school and the junior secondary schools. Science education is one of the academic programmes of the college of education in Nigeria. The primary challenge of this programme is low enrolment which is a factor among many others. Table 1 below shows a case study of five years' enrolment in a college of education in the South-West in Nigeria.

Table-1. Five Years Enrolment in a College

Year	Biology	Chemistry	Physics
2012	548	103	60
2013	540	272	14
2014	547	196	124
2015	335	86	58
2016	217	55	19

Source: College of Education Technical, Lafiagi.

Many research studies and publications indicate that the government is the principal cause of this problem. The research evidence and observation show that Nigeria as a sovereign nation since her independent in 1960 has been having a leadership problem. It is this leadership problem that affected the Nigeria education system which includes science education. The teachers who are the critical variable in science learning are severely affected. The teachers lacked adequate teaching knowledge, besides; there was no laboratory equipment and other educational resources all these lead to the loss of interest among the students and the high attrition rate. All these and many more are the causes of the low enrolment as reviewed in the literature below.

2. REVIEW OF THE RELEVANT LITERATURE

Science education in Nigerian schools has been facing lots of challenges since the country independence. The problems in science education are not peculiar to Nigeria but a global issue. Research studies indicate that there is a shortage of qualified teachers to teach many of the science subjects in schools around the world (Forni, 2007; Subair and Talabi, 2015; Aragon, 2016). Science teachers feel overwhelmed by the expectations and scope of the job and isolated and unsupported in their classrooms (Mangrubang, 2005). In developing countries like Nigeria, science teachers have high status but remuneration is very poorly, and science teaching is no longer the career of the first choice (Adesoji, 2018). There is a lack of motivation for the teachers. How employees perform depends on the extent of motivation he or she received as an individual to work upon required tasks to meet the goals (Panjwani, 2018). Motivation can be a driving force within a human organism that move or make individual wanting to channels his behaviour towards the achievement of an organizational goal (Abdullahi and Jimoh, 2018).

Ingersoll and Perda (2009) observed the shortage of mathematics and science teacher even in the developed nation like the USA. Lack of qualified science teachers remains one of the problems of science learning in Nigeria (Omorogbe and Ewansiha, 2013; Osuolale, 2014). This shortage had resulted in another problem of out-of-field teaching. Out-of-field is when a teacher teaches subjects or year levels without having the appropriate qualifications (Du Plessis *et al.*, 2013). Out-of-field teaching is a global problem in all subjects according to Caldis (2017) research

indicates this problem in teaching geography in Australia. According to Du Plessis *et al.* (2017) effective educational leadership has an influence when teachers are assigned to a position for which they are not suitably qualified. Most of the out-of-field teachers would also have the problem of pedagogical content knowledge (PCK).

PCK is a characteristic of teacher knowledge of how subject matter should be interpreted (Koh *et al.*, 2010). Pedagogical content knowledge (PCK) is a critical component of teacher competence that affects student progress (Kleickmann *et al.*, 2013). Additionally, they have low teacher self-efficacy. The teachers who believed not in their abilities to teach science and have doubts about students' abilities to learn science may result in avoiding their science instruction at all possible means (Koc and Yager, 2016). Both the PCK and the self-efficacy are critical educational constructs that determine teacher effectiveness. Supporting this Park and Oliver (2007) said PCK is a specialized body of knowledge of teacher required to perform teaching within complex and varied context successfully. One cannot overemphasize the critical role of PCK in teacher education as Van Driel *et al.* (1997) asserted that PCK is a knowledge base for teaching. Melo *et al.* (2013) explain that PCK is unique to how a teacher teaches each particular subject. Many of the lecturers who had their degrees through the sandwich programme may not and cannot teach science well. However, these teachers are employed to teach because of the government lack of vision for quality science education.

Another problem is that of bad governance. Governance is the way in which governments exercised power for the management and distribution of a country's social and economic resources (Ogundiya, 2010). The essential features of good governance include the conduct of a comprehensive management wherein all the critical stakeholders are allowed to have a say in the decision-making process (Odo, 2015). According to Aina *et al.* (2017) lack of good governance in Nigeria causes poor infrastructure, lack of funds for research in science education. Florence *et al.* (2015) attributed the problem in the Nigerian civil service to the bad governance which consequently impacted the education system negatively. According to Odo (2015) most Nigerian leaders showed a lack of commitment to education and allowed personal interest, religion, ethnicity to override the national goals. Odisu (2016) attribute the corruption in the Nigerian Judiciary system to the problem of governance which has its toll on the other sectors like education. Efebeh (2015) blamed the government for the high poverty rate in Nigeria because of impunity and the lawlessness perpetrated by the government officials. Due to the lack of vision for education, the Nigeria government do not allocate enough money to the education section in their yearly budget. Hence, in recent time, the budgetary allocation to education in Nigeria is considerably low when compared to other sectors of the economy (Oyewole and Osalusi, 2016). As a result of the low budgetary allocation to education, the standard of colleges of education as teachers training institutions are also affected.

The college of education in Nigeria is the train-the-trainers' institution which trains the primary and secondary schools (Oritsebemigho, 2014). There are criticisms that the college of education lack standards in students' admission and enrolment policies. (Akinbote, 2007). Aina (2018) worried about different academic programmes mounted by these colleges which are not meant to benefit the students but for financial purposes. These colleges are crucial in Nigeria because the certificate awarded in these institutions is the minimum qualification a teacher can possess to teach in the country (Akindutire and Ekundayo, 2012). However, many things are affected such as teacher education, and lack of teaching and learning resources had affected these colleges.

Teacher education in Nigeria is not in the right position. Many science education teachers lack knowledge and skills in research methods. According to Taber (2017) another potential barrier to science education development is the teacher's lack of knowledge and skills in research methods. One of the critical requirements to promote and strengthen education is the training of teachers (Sarita and Dahiya, 2016). Teachers and the quality of teaching are often considered the most critical elements of student success in learning science (Koc and Yager, 2016). Because of the inadequate teacher training, most teachers lacked the skill to teach. Skill in teaching requires cognitive and psychomotor behaviours for proficiency as these skills acquisition depends on functional training (Onyebuenyi *et al.*,

2017). The skills include teaching methods. The factor that comes from outside the students that affect them negatively includes a teaching method that is lacking effectiveness and making the students passive recipients (Wartono *et al.*, 2018).

Laboratories and teaching resources are lacking in many schools. Most students cannot recognise common science equipment and teaching materials. The reason is that most students have not seen this science equipment and resources as these are usually borrowed from schools in the urban centers for external examinations (Clement *et al.*, 2017). Hence, the students' enrolment in these institutions has not been encouraging in the recent time for science education due to the problems reviewed above.

Enrolment in science education in Nigeria schools has not been encouraging especially colleges of education. It is fascinating that this is not only the Nigeria problem, but it is also a global issue mainly, among the female students. According to Murphy and Whitelegg (2006) females lack behind the boys in the UK entry rate to Physics than chemistry and biology. Aina and Adedo (2013) also asserted the low science enrolment in Nigerian schools due to many factors among which is the lack of interest by the students. Anecdotal account reveals that science enrolment in the Nigerian Colleges of education declines every year. According to Mbamara and Eya (2015) research survey indicated that there is low enrolment in Physics in schools which are caused by many factors such as students' negative attitude, insufficient teaching materials, and others. Some schools also lacked resources like computers and internet connectivity.

In the light of the above literature review, the paper considered the reviewed challenges as it affected the science education enrolment in Nigerian Colleges of educations. The challenges may not be affecting another field of studies, however; as it affects science education enrolment in the colleges of education is the principal concerns of this paper.

3. CHALLENGES FACING SCIENCE EDUCATION IN NIGERIA

Science education has lots of problems confronting its development globally (Aina and Adedo, 2013). However, the issue of the Nigerian colleges of education is unique because of the poor governance (Aina *et al.*, 2017). The Nigeria government is the principal cause of the challenges facing science education in Nigeria.

First and the foremost of this myriad of problems is the appointment of the non-professional as the Chairman of the Governing Council of the colleges. Many of these Council members are politicians, and some are semi-illiterate who knew nothing about science education. Their appointment is nothing but compensation for their loyalty to the political party. In most cases, they contributed nothing to the development of the science education development. Few of the crimes of some of these Governing Council are misappropriating of funds budgeted for science equipment and appointment of unqualified lecturers. Some awarded the contract of the laboratory building to themselves and failed to execute the project correctly. Many deserving lecturers are denied their promotions because they challenged the wrongdoing of Governing Council members. The appointments of the College principal officers such as the Provost and the Registrar are no longer on merit but tribal or religion. Nonetheless, not all of them are bad; few of them are doing well.

The situation in many colleges of education is so bad that most science education lecturers obtained their degree through the sandwich programme. The sandwich programme is for the in-service training of teachers in the primary and the secondary education. The appointment of this cohort of teachers to teach at this level is not appropriate because they lack the required pedagogical content knowledge (PCK) to teach science.

Given the above, many of these lecturers are not confident to teach a large number of concepts and topics in science and even when they do: they lacked the required PCK. Thus, they have a low teacher self-efficacy. Teacher self-efficacy is the beliefs a teacher has about his or her perceived capability in undertaking specific teaching tasks. It is the belief a teacher has about his or her ability to accomplish a particular teaching task (Lunenburg, 2011). Teachers' self-efficacy is the set of beliefs a teacher holds regarding his or her abilities and competencies to teach

and influence student behaviour and achievement regardless of outside influences or obstacle (Steele, 2010). Pendergast *et al.* (2011) said teachers with a high level of teacher self-efficacy had been shown to be more resilient in their teaching and likely to persist in a difficult time to help all students reach their academic potential.

Because of the poor PCK and the low self-efficacy, the teaching paradigm of many of these teachers is terrible. Many of these teachers may have the adequate content knowledge but cannot impact the students with this knowledge. The classroom instruction has evolved from the conventional method to the research-based strategies where the students' critical thinking with technology is paramount. Riveros (2012) queried that a teacher's way of teaching either encourage or discourage the students from learning. Many lecturers are more concerned about selling handouts to the students than improving their teaching method and knowledge through the professional development. Professional development is activities that develop individual skill, knowledge, expertise and other characteristics as a teacher (OECD, 2009). It is a conscious and systematic step to ensure teachers up-grading and continuous self-improvement (Oluremi, 2013). Professional development is critical to the retention and improvement of any teacher in the classroom (The American Association of Physics Teachers, 2009).

The consequence of the above-discussed challenges is that students are gradually losing interest in the College of education to study science. The society also is not having trust in the science education programme of the college of education. Many students and parents prefer the Polytechnic programme than the College of Education because of the above-highlighted problems and many others. Moreover, the teacher's related issue in the Nigerian College of Education is more damaging to students' enrolment than any others. Some scholars like Boyd *et al.* (2008) observed that the most important educational resource is the teacher. Aaronson *et al.* (2007); Rockoff (2004) strongly concurred that a teacher could significantly influence students' achievement.

Given the preceding, the focus of the paper is now on the students' enrolment in science education programme at the Nigerian colleges of education. Over the years there has been declining in science students' enrolment in the Nigerian college of education.

4. CAUSES OF LOW SCIENCE ENROLMENT IN THE NIGERIAN COLLEGES OF EDUCATION

One of the significant challenges confronting science education in the Nigerian colleges of education is the declining students' enrolment (Harry, 2011). Table 1 above indicates that enrolment in the three core science subjects is poor and reducing year after year. The reasons for this are many, but research studies indicate that the secondary school science enrolment has been poor which may be a factor. Akanbi (2003) had observed this problem in the Nigerian schools many decades ago. In the same vein, Aderemi *et al.* (2013) concurred that the science students' enrolment in Nigerian schools is not encouraging particularly for the female students. Osokoya and Junaid (2015) had been worried about the poor science enrolment in our schools.

Given this, the causes of this low enrolment in the colleges of education are the next focus of the paper. There are many reasons attributed to the low science enrolment, but the discussion of a few cases is below

The proliferation of Colleges of Education: In the recent years, individuals and religious bodies have been in the business of establishing private colleges in Nigeria. The proprietors of these schools lower the admission standard to attract students. There is a particular state in Nigeria that have almost twenty private colleges of education. It is worrisome that these schools operate using unqualified lecturers, poor teaching equipment and lousy condition of service. The National Commission for Colleges of Education (NCCE) who supposed to monitor and check these colleges seems to be ineffective. These colleges offer cheap certificates to their students, and that makes students prefer private colleges to the public where they will not face rigorous learning activities.

Poor Quality Lecturers: Gone are the days when quality lecturers are employed to teach in the Nigerian colleges of education. It is discouraging today in most of our colleges of education to hear that some lecturers are graduates of the sandwich programme. The sandwich programme is not to produce lecturers for higher institutions

but for the in-service staff who may not have time to attend direct university education (Okpaga, 2016). The quality of education of this programme is not fit for lecturing in higher institutions. Most of these teachers in their sandwich training are poor in PCK and self-efficacy. Their science teaching is not inspiring and does not create interest in learning in students. However, there are exceptional cases of some good teachers in the sandwich programme. Some students left science for other courses like the Art and Humanities while some do not even enroll in science because of the poor quality of lecturers.

Lack of Interest: Interest is vital in whatever anyone does. The students of this age have lost interest in science learning. Olufunke contended that students' interest would determine what they can learn and how well they may learn. Agbaje and Alake (2014) in their study on "The student variables as a predictor of secondary school students' academic achievement in science subjects" concluded that students' interest is vital to learning. There is no more interest in the students' learning of science, and that is why the enrolment is reducing every year in the colleges of education. Due to the loss of interest in the learning of science, students have developed a negative attitude towards science education in schools (Harry, 2011).

Lack of Science Equipment: Science learning in many colleges of education has been turned into mere demonstration because there is no equipment for the right experiment. Science learning without practical activity has made learning dull and uninteresting to the students. Given this, not many students are ready to enroll in science class as it was in some decades back.

Poor Governance: Corruption pervaded everywhere in Nigeria, and this had not allowed the citizen to enjoy the good governance. The governance affects the living standard of the average Nigerian; attending school is difficult for many who are of school age. The poverty is on the increase every day resulting in students dropping out of schools.

These and much more are the causes of low science students' enrolment in the Nigerian colleges of education. Nevertheless, there is no problem without a solution. Therefore, the next focus of the article is the way forward.

5. THE WAY FORWARD

Given the problems and causes of poor students' science enrolment in the Nigerian Colleges of Education above, the script discussed the way forward below.

The government should be more committed to the funding of the Colleges of Education academic programmes. It could be through the recruitment of highly qualified lecturers for all the educational programmes of the colleges. The situation where some state governments no longer give monthly subvention to the college for the payment of staff salary is an "aberration." The payment of staff salary should be the full responsibility of the government. Colleges should stop the funding and pay of workers' salaries through the students' school fees. The government should stop running colleges of education as a money-making venture. Education is essential for the development of every child and must be free for all citizens.

The National Commission for Colleges of Education (NCCE) should put up severe measures that will control and regulate the establishment of new colleges. The body should ensure the existing colleges follow the standards set by the government. The NCCE should close down any existing private colleges that have not met the criteria.

The government should motivate students to learn and study science in the colleges of education by given them scholarship and bursary. Science education lecturers also should always enjoy research grants like their counterparts in the Universities to develop their research ability in science education.

It is essential to give our teachers the best training as much as possible as there cannot be a good education without a good teacher. Everybody in the nation is aspiring to be like the nations of America, the United Kingdom, Finland, Germany and other in technological advancement but, the government is not ready to invest on the science education. The government forgot that science education is critical to the development of any nation and must make it viable in all institutions of learning towards sustainable development (Abdullahi and Jimoh, 2018).

The Nigeria government is not prepared to invest in the science teacher, and that is why the Nigerian teachers are backward in the use of research-based teaching pedagogy. Teacher education requires special consideration in any deliberation on education because no organized education is expected to rise above the quality of its teachers (Osuji, 2009).

Attracting students to science classes required that the teacher shift entirely from the old way of teaching to the research-based pedagogies. Students love to learn independently with only coaching and scaffolding (Herrington *et al.*, 2010). There are research-based teaching paradigms that offer students maximum social interaction to create interest and retain them in science class. The Peer Instruction (PI) and the Brain-Based Learning (BBL) are two strategies we have adopted in Physics classes, and the result was fascinating.

The peer instruction is an interactive teaching strategy where the students are allowed to teach themselves with use of what is called *ConcepTest* (Ouko *et al.*, 2015; Al-Hebaishi, 2017). This strategy makes students very active in the class and arouses their interest in learning. One of the authors of this paper used Peer instruction to teach electromagnetism among Physics students for his doctoral dissertation in 2015. The result indicates that peer instruction is an interest arouser and attention grabber. To reduce dropout in science classes and attract more students, the teacher needs pedagogy like the peer instruction. Besides the peer instruction, the same author also discovered that the brain-based learning could help promote students interest in science learning.

The brain-based learning instructional paradigm is a learner-centered and teacher-facilitated method that employed learners' cognitive endowments (Gladys *et al.*, 2018). According to Connell (2009) it is learning viewed as techniques gathered from research in neurology and cognitive science used to enhance teacher instruction.

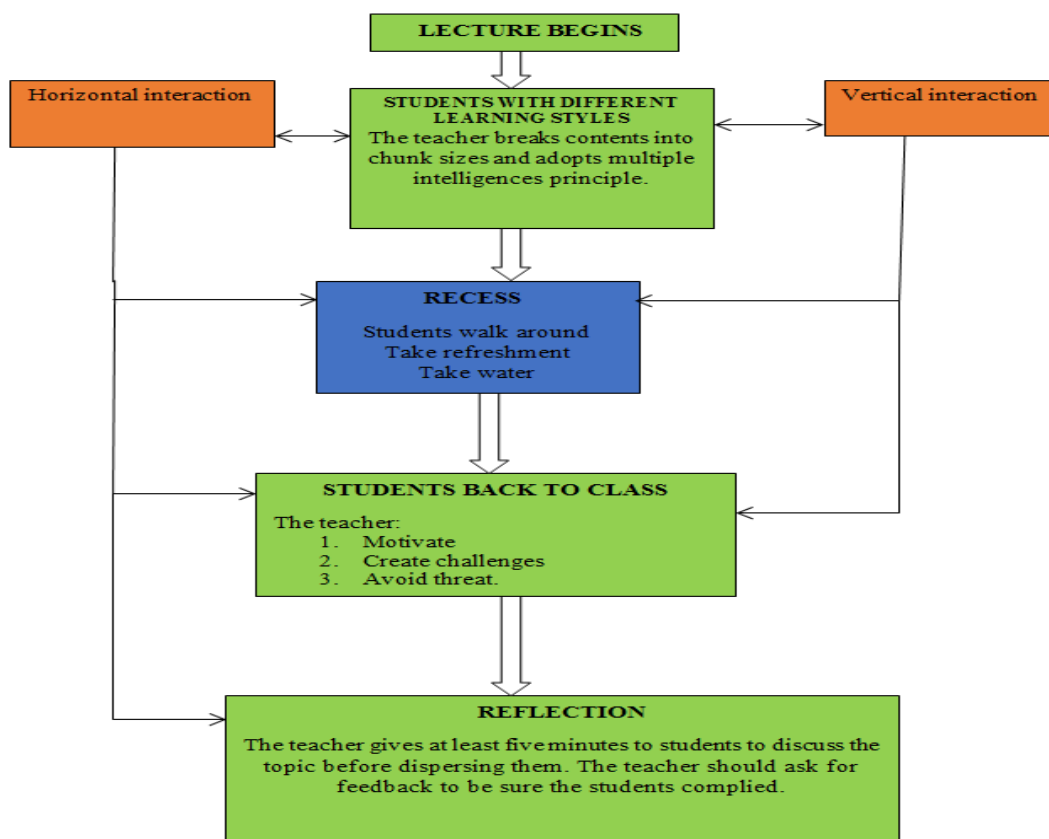


Figure-1. The brain-based flowchart.

The strategy is about knowing how the brains functions and recognizes that during the class instructions. The author explored the method in a Physics class and discovered that many teachers are destroying science education

through our method of teaching. The figure 1 above shows the simple way of implementing the strategy based on the author experience.

As the lecture began, the teacher should know he or she has students with different learning styles in the class. Therefore, adopting the principle of multiple intelligences to reach all the students is imperative. Two types of interactions emerge which are vertical and horizontal interactions. Student-student is horizontal while teacher-student is vertical. The class resumes after the short period of the recess, and the teacher makes the students physically and emotionally safe through motivation, creating learning challenges and avoid the threat. The students reflecting on their learning before leaving the class is crucial to the brain-based learning. The teacher allows the students to spend at least five minutes on discussing among themselves the topic of the day. To ascertain the students took time to reflect on their learning the teacher may request for feedback from the class through the class representative. This section is processing and reflection time which is vital for learning environment (Prince, 2005). The horizontal interaction is throughout class activities while vertical interaction does not include reflection time.

It is essential that the teacher help to attract students to science through his or her teaching methods. Many students left the science class for other courses because the teacher cannot impress them through the method of teaching employed. There are many other teaching strategies the teacher can use: the two examples were the one the author used.

Finally, on the way forward, adopting the mobile learning strategy using the WhatsApp, Facebook and the YouTube could be of help. It might look strange to anyone, but it could work out here in Nigeria. Students are savvy about WhatsApp, Facebook, and the YouTube. These social media are ubiquitous in campuses in Nigerian schools. However, it is worrisome the way students used the media. The media possesses potential that could be useful for educational purposes. WhatsApp messaging has the potential of reinforcing the class material and positively influence discussion, collaborative work, and authoring (Sayan, 2016). It offers the student the opportunity to watch and listen to the recorded video of a lecture at any time most convenient for the students (Bouhnik and Dshen, 2014; Sayan, 2016; Shariffuddin *et al.*, 2017). Research suggested that Facebook is a potent tool useful for promoting the active academic practice, and students have extended its uses from social origins to educational purposes (Madge *et al.*, 2009). YouTube is a learner-directed and self-regulating context which interacts with other social networking sites having the interactive-engagement as the principal activity (Tan, 2013). The students can access the learning resources on YouTube in the farm, kitchen, toilet, and bedroom, on the playing ground (Alsaadat, 2017).

Learning through the WhatsApp, Facebook and the YouTube is another way of authentic learning. It allows students to collaborate, reflect on their learning; it also gives room for multiple roles and perspectives which are elements of authentic learning (Herrington *et al.*, 2010). The students are always happy when they have some freedom in learning with the teacher acting as a coach not as an information provider.

The above measures could tremendous improved the science education enrolment in our colleges if all stakeholders in education are serious about it.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Contributors/Acknowledgement: Both authors contributed equally to the conception and design of the study.

REFERENCES

- Aaronson, D., L. Barrow and W. Sander, 2007. Teachers and student achievement in the Chicago public high schools. *Journal of Labor Economics*. 25(1): 95-135. [View at Google Scholar](#) | [View at Publisher](#)
- Abdullahi, N., J.K. and A.A.G. Jimoh, 2018. Head teachers' role in managing science education towards sustainable development in North-central zone, Nigeria. *Malaysian Online Journal of Educational Sciences*, 6(3): 20-29. [View at Google Scholar](#)

- Aderemi, H.O., O.M. Hassan, W.O. Siyanbola and K. Taiwo, 2013. Trends in enrollment, graduation and staffing of science and technology education in Nigeria tertiary institutions: A gender participation perspective. *Educational Research and Reviews*, 8(21): 2011-2020. [View at Google Scholar](#)
- Adesoji, F.A., 2018. National and global trend on stem education and economic development. *Advances in Social Sciences Research Journal*, 5(6): 143-146. [View at Google Scholar](#) | [View at Publisher](#)
- Agbaje, R.O. and E.M. Alake, 2014. Students' variables as predictor of secondary school students' academic achievement in science subjects. *International Journal of Scientific and Research*, 4(9): 1-5. [View at Google Scholar](#)
- Aina, J.K. and G.A. Adedo, 2013. Perceived causes of students' low enrolment in science in secondary schools, Nigeria. *International Journal of Secondary Education*, 1(5): 18-22. [View at Google Scholar](#) | [View at Publisher](#)
- Aina, J.K., 2018. Educational reforms in Nigeria: The Kaduna state teachers' competency test. *Open Journal of Educational Development*, 1(1): 01-15.
- Aina, J.K. and G.A. Adedo, 2013. Correlation between continuous assessment (CA) and students' performance in physics. *Journal of Education and Practice*, 4(6): 6-9. [View at Google Scholar](#)
- Aina, J.K., N.N. Gana and O.O. Ibitomi, 2017. The lack of good governance in Nigeria and its impact on functional science education. *International Journal of Development and Sustainability*, 6(9): 1036-1047.
- Akanbi, A.O., 2003. Trend in physics education in secondary school in Kwara State. *Lafiagi Journal of Science Education*, 5(1&2): 69-75. [View at Google Scholar](#)
- Akinbote, O., 2007. Problems of teacher education for primary schools in Nigeria: Beyond curriculum design and implementation. *Essays in Education*, 22(Fall 2007): 4-11.
- Akindutire, I.O. and H.T. Ekundayo, 2012. Teacher education in a democratic Nigeria: Challenges and the way forward. *Educational Research*, 3(5): 429-435. [View at Google Scholar](#)
- Al-Hebaishi, S.M., 2017. The effect of peer instruction method on pre-service teachers' conceptual comprehension of methodology course. *Journal of Education and Learning*, 6(3): 70-82. [View at Google Scholar](#) | [View at Publisher](#)
- Alsaadat, K., 2017. Mobile learning technologies. *International Journal of Electrical and Computer Engineering*, 7(5): 2833~2837.
- Aragon, S., 2016. Teacher shortages: What we know. Teacher shortage series. Education Commission of the States. Broadway Suite: ERIC. Retrieved from <http://www.ecs.org> [Accessed August 20, 2018].
- Bouhnik, D. and M. Deshen, 2014. Whatsapp goes to school: Mobile instant messaging between teachers and students. *Journal of Information Technology Education: Research*, 13(1): 217-231. [View at Google Scholar](#) | [View at Publisher](#)
- Boyd, D., H. Landford, S. Loeb, J. Rockoff and J. Wyckoff, 2008. The narrowing gap in New York City teacher qualifications and its implications for student achievement in high-poverty schools. *Journal of Policy Analysis and Management*, 27(4): 793-818. [View at Google Scholar](#) | [View at Publisher](#)
- Caldis, S., 2017. Teaching out of field: Teachers having to know what they do not know. *Geography Bulletin*, 49(1): 13-17. [View at Google Scholar](#)
- Clement, I., M. Bello and S.A. Sunusi, 2017. Science education and Nigeria national development effort: The missing link. *International Journal of Education and Evaluation*, 3(5): 46-56.
- Connell, J.D., 2009. The global aspects of brained- based learning. *Educational Horizons*, 88(1): 28-38. [View at Google Scholar](#)
- Du Plessis, A.E., A. Carroll and R.M. Gillies, 2017. The meaning of out-of-field teaching for educational leadership. *International Journal of Leadership in Education*, 20(1): 87-112. [View at Google Scholar](#) | [View at Publisher](#)
- Du Plessis, A.E., R.M. Gillies and A. Carroll, 2013. Out-of-field teaching and professional development: A transnational investigation across Australia and South Africa. *International Journal of Educational Research*, 66: 90-102. [View at Google Scholar](#) | [View at Publisher](#)
- Efebeh, E.V., 2015. Democracy and the rule of law in Nigeria: 1999 – 2015. *Research on Humanities and Social Sciences*, 5(20): 72-81.

- Florence, A.C., O.C. Osawe and C.J. Igbokwe-Ibeto, 2015. The civil service and democratic governance in Nigeria: Issues, prospects and new hopes. *Journal of Research and Development*, 2(8): 1-13. [View at Google Scholar](#) | [View at Publisher](#)
- Forni, A.P., 2007. Shortage of qualified science teachers in Norway. A system dynamics approach. (Master's Thesis, The University of Bergen).
- Gladys, J.U., D.G. Stella and G.B. Omobolanle, 2018. Effect of brain-based learning model on colleges of education students' retention and attitude in "current electricity" in Taraba state, Nigeria. *Journal of Education, Society and Behavioural Science*, 25(2): 1-15. [View at Publisher](#)
- Harry, I.H., 2011. Attitudes of students towards science and science education in Nigeria. (A case study in selected secondary schools in Obio/Akpor local government area of rivers state). *Continental Journal of Education Research*, 4(2): 33-51. [View at Google Scholar](#)
- Herrington, J., T.C. Reeves and R. Oliver, 2010. A guide to authentic e-learning. New York: Routledge.
- Ingersoll, R.M. and D. Perda, 2009. The mathematics and science teacher shortage: Fact and myth. CPRE Research Report# RR-62. Philadelphia, PA: University of Pennsylvania, Consortium for Policy Research in Education Citeseer.
- Kleickmann, T., D. Richter, M. Kunter, J. Elsner, M. Besser, S. Krauss and J. Baumert, 2013. Teachers' content knowledge and pedagogical content knowledge: The role of structural differences in teacher education. *Journal of Teacher Education*, 64(1): 90-106. [View at Google Scholar](#) | [View at Publisher](#)
- Koc, I. and R.E. Yager, 2016. Preservice teachers' alternative conceptions of science and their self-efficacy beliefs about science teaching. *European Journal of Education Studies*, 2(6): 1-22. [View at Google Scholar](#)
- Koh, J.H.L., C.S. Chai and C.-C. Tsai, 2010. Examining the technological pedagogical content knowledge of Singapore pre-service teachers with a large-scale survey. *Journal of Computer Assisted Learning*, 26(6): 563-573. [View at Google Scholar](#) | [View at Publisher](#)
- Lunenburg, F.C., 2011. Self-efficacy in the workplace: Implications for motivation and performance. *International Journal of Management, Business and Administration*, 14(1): 1-6. [View at Google Scholar](#)
- Madge, C., J. Meek, J. Wellens and T. Hooley, 2009. Facebook, social integration and informal learning at university: It is more for socialising and talking to friends about work than for actually doing work. *Learning, Media and Technology*, 34(2): 141-155. [View at Google Scholar](#) | [View at Publisher](#)
- Mangrubang, F.R., 2005. Issues and trends in science education: The shortage of qualified science teachers. *American Annals of the Deaf*, 150(1): 42-46. [View at Google Scholar](#) | [View at Publisher](#)
- Mbamara, U. and P.E. Eya, 2015. Causes of low enrolment of physics as a subject of study by secondary school students in Nigeria: A descriptive survey. *International Journal of Scientific Research in Education*, 84(4): 127-149. [View at Google Scholar](#)
- Melo, L., F. Canada, V. Mellado and A. Buitrago, 2013. Initial characterization of a Colombian high school physics teacher' pedagogical content knowledge on electric fields. Paper Presented at the International Conference on the new Perspectives in Science Education. Florence, Italy.
- Murphy, P. and E. Whitelegg, 2006. Institute of physics report, girls in the physics classroom: A review of the research into the participation of girls in physics. Retrieved from <https://www.researchgate.net/publication/42792404> [Accessed August 20, 2018].
- Odisu, T.A., 2016. The Nigerian judiciary and the travails of rule of law. *Scientific Journal of Review*, 5(9): 449-452.
- Odo, L.U., 2015. Democracy and good governance in Nigeria: Challenges and prospects. *Global Journal of Human-Social Science (F)*, 15(3): 1-9. [View at Google Scholar](#)
- OECD, 2009. Organization for international cooperation and development teaching and learning international survey (Talis). Paris: OECD.
- Ogundiya, I.S., 2010. Democracy and good governance: Nigeria's Dilemma. *African Journal of Political Science and International Relations*, 4(6): 201-208. [View at Google Scholar](#)

- Okpaga, A., 2016. Distance learning, sandwich and open education system in Nigeria: Challenges and prospects for educational development. *International Journal of Academia*, 1(1): 343-352.
- Oluremi, O.F., 2013. Enhancing educational effectiveness in Nigeria through teacher's professional development. *European Scientific Journal*, 9(28): 422-431. [View at Google Scholar](#)
- Omorogbe, E. and J.C. Ewansiha, 2013. The challenge of effective science teaching in Nigerian secondary schools. *Academic Journal of Interdisciplinary Studies*, 2(7): 181-188. [View at Google Scholar](#)
- Onyebuanyi, P.N., C.O. Mbah and P.E. Odeluga, 2017. Enhancing practical skill acquisition among technical college students through information and communication technologies (ICTS) for self-reliance in Abia State. *Odumegwu Ojukwu Journal of Vocational Education and Research*, 2(1): 252-264.
- Oritsebemigho, T.O., 2014. An appraisal of the revised Nigeria certificate in education minimum standards (English Language Curriculum). *European Scientific Journal*: 165-171. [View at Google Scholar](#)
- Osokoya, M.M. and I.O. Junaid, 2015. Enrolment and achievement of persons with special education needs in secondary schools in science subjects: Facts and patterns. *British Journal of Education, Society & Behavioural Science*, 7(2): 137-149. [View at Google Scholar](#) | [View at Publisher](#)
- Osuji, S.N., 2009. Teacher education curriculum in Nigeria in the perspective of lifelong education. *Journal of International Social Research*, 2(8): 296-301. [View at Google Scholar](#)
- Osuolale, O.J., 2014. Problems of teaching and learning science in junior secondary schools in Nasarawa state, Nigeria. *Journal of Education and Practice*, 5(34): 109-118. [View at Google Scholar](#)
- Ouko, S., C. Aurah and M. Amadalo, 2015. Peer instruction and secondary school students achievement in vectors. *Journal of Education and Practice*, 6(27): 175-180. [View at Google Scholar](#)
- Oyewole, B.K. and F.M. Osalusi, 2016. Towards actualising sustainable education standards in Nigeria. *International Journal of Learning, Teaching and Educational Research*, 15(9): 44-54. [View at Google Scholar](#)
- Panjwani, N., 2018. Motivation: An integral part towards job satisfaction among nurses. *International Journal of Science and Research Methodology*, 9(2): 23-38.
- Park, S. and J.S. Oliver, 2007. Revisiting the conceptualization of pedagogical content knowledge (PCK): PCK as a conceptual tool to understand teachers as professionals. *Research in Science Education*, 38(3): 261-284. [View at Google Scholar](#) | [View at Publisher](#)
- Pendergast, D., S. Garvis and J. Keogh, 2011. Pre-service student-teacher self-efficacy beliefs: An insight into the making of teachers. *Australian Journal of Teacher Education*, 36(12): 46-58. [View at Google Scholar](#) | [View at Publisher](#)
- Prince, A., 2005. Using the principles of brain-based learning in the classroom how to help a child learn. Using the principles of brain-based learning in the classroom how to help a child learn. [Accessed August 20, 2018].
- Riveros, H.G., 2012. Pleasure as a teaching tool. *Latin American Journal of Physics Education*, 1(59): 6 [View at Google Scholar](#)
- Rockoff, J.E., 2004. The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review*, 94(2): 247-252. [View at Google Scholar](#) | [View at Publisher](#)
- Sarita, D. and R. Dahiya, 2016. Recent issues and problems in India: Teacher education. *International Journal of Multidisciplinary Research and Development*, 3(9): 19-22.
- Sayan, H., 2016. Affecting higher students learning activity by using WhatsApp. *European Journal of Research and Reflection in Educational Sciences*, 4(3): 88-93. [View at Google Scholar](#)
- Shariffuddin, S.A., W.R.W. Shaaidi and S.M. Hashim, 2017. Social networks as instructional tools beyond a classroom. *International Journal of Advanced and Applied Sciences*, 4(12): 185-192. [View at Google Scholar](#)
- Steele, N.A., 2010. Three characteristics of effective teachers. *Update: Applications of Research in Music Education*, 28(2): 71-78. [View at Google Scholar](#) | [View at Publisher](#)
- Subair, S.T. and R.B. Talabi, 2015. Teacher shortage in Nigerian schools: Causes, effects administrators coping strategies. *Asia Pacific Journal of Education, Arts and Sciences*, 2(4): 31-37. [View at Google Scholar](#)

- Taber, K.S., 2017. Science education as a field of scholarship. In K. S. Taber & B. Akpan (Eds.), Science education: An course companion. The Netherlands: Sense Publishers. pp: 3-22.
- Tan, E., 2013. Informal learning on YouTube: Exploring digital literacy in independent online learning. Learning, Media and Technology, 38(4): 463-477. [View at Google Scholar](#) | [View at Publisher](#)
- The American Association of Physics Teachers, 2009. The role, education, qualifications, and professional development of secondary school physics teachers. College Park, MD: AAPT.
- Van Driel, J.H., N. Verloop and W. De Vos, 1997. Developing science teachers' pedagogical content knowledge. Journal of Research in Science Teaching, 3(6): 673-695. [View at Google Scholar](#)
- Wartono, W., J.R. Batlolona and C.H. Sholikhan, 2018. Influence of discovery learning-based empiricaltheoretical study assisted by animation phet on the physics problem-solving in high school. Advances in Social Science, Education and Humanities Research, 164: 47-51. [View at Google Scholar](#) | [View at Publisher](#)

Views and opinions expressed in this article are the views and opinions of the author(s), International Journal of Education and Practice shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.