



Age, Gender and Verbal Ability as Predictors of Students' Achievement in Biology

Saheed Ayodeji Adejimi 
University of Rwanda, Rwanda

Wenceslas Nzabairwa 
University of Rwanda, Rwanda

William Aino Shivoga 
Masinde Muliro University of Science and Technology,
Kenya

To cite this article:

Adejimi, S. A., Nzabairwa, W., & Shivoga, W. A. (2020). Age, gender and verbal ability as predictors of students' achievement in Biology. *International Journal of Studies in Education and Science (IJSES)*, 1(1), 80-91.

The International Journal of Studies in Education and Science (IJSES) is a peer-reviewed scholarly online journal. This article may be used for research, teaching, and private study purposes. Authors alone are responsible for the contents of their articles. The journal owns the copyright of the articles. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of the research material. All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations regarding the submitted work.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.



International Journal of Studies in Education and Science (IJSES) is affiliated with the **International Society for Technology, Education, and Science (ISTES): www.istes.org**

Age, Gender and Verbal Ability as Predictors of Students' Achievement in Biology

Saheed Ayodeji Adejimi, Wenceslas Nzabalarwa, William Aino Shivoga

Abstract

This study examines the relationship between age, gender, verbal ability and achievement in biology among senior secondary school students within Ibadan metropolis, Oyo State, Nigeria. The study adopted an ex-post factor research design. The sample for the study consisted of 305 senior secondary school II students selected randomly from two local governments within the metropolis. Two research instruments were used to collect data from respondents selected for the study. Independent t-test and one-way ANOVA were used to analyze the data collected for the study. Results from the study reveal a significant difference in students' achievement based on age, gender and verbal ability. The call for biology stakeholders and curriculum planners to ensure that the medium of instruction is given adequate and necessary attention was highlighted. The need for authors of biology textbooks to reduce gender bias and ways to sustain students' interests irrespective of gender, age or level were also highlighted.

Keywords: Age, Biology, Gender stereotype, Students' achievement, Verbal ability

Introduction

Biology can be defined as a natural science subject which study all living things of contents from in the biosphere and earth surface (Okwo & Tartiyus, 2004). It is one of the core science subjects offered at the senior secondary school level in the Nigerian educational system. It is also a required subject for all science candidates at the Secondary School Certificate Examination (SSCE) because of its link to man's successful living (Akindele, 2009). Its relevance to the study of medicine, pharmacy, biotechnology, nanotechnology, microbiology, genetic engineering, nursing, and other related courses at a higher level of education is obvious. It is also the preferred subject by non-science students over the other subjects, chemistry and physics to fulfil the requirement of offering at least one science subject and this is due to the perceived nature of it being a 'simple' subject.

The importance of biology to the individual and the community cannot be overemphasized. According to Ezeazor (2003), studying biology brings one closer to knowledge of self as well as knowledge of the environment and surrounding. According to Ugwu and Eze (2005), the study of biology affords individuals the

knowledge to understand themselves, their body parts and their functions. It develops in an individual attributes such as scientific, social and problem-solving skills. The study of biology therefore transforms one mind into critically questioning superstitions. Biology is undoubtedly related to social problems, and its knowledge is therefore critical in proffering solution to them.

Despite the perceived 'simple' nature, importance and role of biology in the life of an individual and the community at large, students' poor achievement in the subject remains a major concern to all especially experts in the field of biology education. Students' performance in biology at internal and external examinations has been reported to be consistently unsatisfactory, Olatoye (2004) cited in Sanni and Emeke (2017). Comments of the chief examiner of the West African Examinations Council (WAEC) corroborated this assertion, (chief examiner reports, 2008, 2012, 2015 & 2018). Many factors have been attributed to students' poor achievement in biology. These factors include age (Okoli, 2017; Momanyi, Too & Simiyu, 2015), gender (Nnenna & Adukwu, 2018) and verbal ability (Olatoye & Aderogba, 2011).

The effects of demographic variables on student academic achievement have been conducted in several studies. Such demographic variables include age, gender, parent education level, parent socio-economic status, parent occupation among others. Couple with these demographic variables, verbal ability is another factor that has been studied for its influences on students' academic performance. This study specifically looked at age, gender and verbal ability as it affects students' achievement in biology.

In the opinion of Abubakar and Oguguo (2011), age is a good indicator of scholastic success. According to them, the age of children on admission plays an important role in their academic performance. In addition, Ebenuwa-Okoh (2016) further reports age as an important variable affecting students' achievement. He stressed further that the development of learners' thinking abilities and their levels of maturity affect participation in intellectual activities. As an individual advanced in age, the cognitive domain functioning develops simultaneously for the mastery of manipulative skills. The development of these skills enhances the total human functioning that includes both academic activities and achievement (Ebenuwa-Okoh, 2011).

Results of previous studies on the effect of age on students' academic achievement are inconclusive. The result of the study by White (1982) revealed that students achievement level decline as they become aged. In the study by Grissom (2004) he averred, that over time the rate at which the academic achievement decline as students aged becomes constant. Abubakar and Oguguo (2011) and Rabgay (2015) reported a weak, but positive correlation between students' age and their academic achievement, which indicates that age does not determine students' academic achievement. Also, Aremu and Tella (2009) in their study reported an insignificant correlation between students' age and mathematics achievement. Jabor, Machtmes, Kungu, Buntat and Nordin, (2011) Momanyi, et al (2015) and Okoli (2017) reported a significant effect of age on students' academic achievement in favour of students in the lower age groups.

Gender is another factor that could determine the academic achievement of students in any school subjects. According to Ebenuwa-Okoh (2016), it is a factor that resides within a learner. Abubakar and Uboh, (2010),

opined that gender is the characteristics that differentiate organism based on biological role of reproduction. Yang (2010) defined gender as a socially construed characteristics and opportunities related to being male and female, as well as the relationships between a man and woman; a girl and a boy, as well as those between women and those between men. All these constructs (characteristics, opportunities and relations) are acquired through the socialisation process. Okeke (2008) refers to gender as a socially culturally constructed characteristics and roles which are ascribed to males and females in any society.

Gender equality is a core component of the millennium development goals (MDGs). Gender inequality exist both in the educational and research sectors of science and it is of great concern to stakeholders, (Nwakwo & Madu, 2014). Okeke (2007) stated that the consequences of gender inequality transverses all sectors, but is more profound within the field of science and technology. The opportunity cost of education, early marriage among girls, lack of female role models, poor self-concept, inherent sex differences, teaching methods and gender stereotyping among students and teachers are some of the identified probable reasons responsible for gender disparity by Offor (2007). Hansman, Tyson and Zahidi (2009) affirmed that no country in the world is yet to bridge the gap to attained gender equality in different critical sectors of the economic including the science and technology sector.

Several pieces of research have been conducted on the influences of gender on students' academic achievement, with varied outcomes. This should, however, be expected as studies vary in contexts. These contexts include the methodology, disciplines, subjects, location, and time of studies, research tasks, and classroom settings. Farooq, Chaudhry, Shafiq and Berhanu (2011), Jabor, Machtmes, Kungu, Buntat and Nordin, (2011) and Ochonogor (2011), all reported that the female performed academically better than the male students. Ezeudu and Obi (2013), Nnenna and Adukwu (2018) and Odagboyi (2015) conversely reported that the male achieved academically better than the female students. Agbejoye, Aleburu, Olugbaike and Ogunjimi (2015), Aniodoh and Egbo (2013), Ebebuwa-Okoh (2016), Olasehinde and Olatoye (2014), all reported that gender has no influence on students' academic achievement.

The inconsistency in these results prompted Ochonogor in 2006 to conclude that, 'science in general and biology or life science, in particular, ought to be all encompassing and not gender-biased in nature. This implies that irrespective of natural gender disparity, learners of all age in any given science class are expected to be taught in a common learning environment, using non-stereotyped pedagogical approaches, contents and activities. With such foundation for all recipients of science knowledge contents, their performances can, therefore, be evaluated and analyzed on a common platform'.

Verbal ability is an important part of human existence since no human is an island unto him/herself. He or she needs to communicate often with a fellow human. It is the medium through which feelings and thoughts are communicated. It is also essential for human learning. Bloom (1974) averred that verbal ability is a necessity if a child is to learn in school. Ayodele (1987) cited by Iyamu (2005) submitted that pupils' deficiency in diction and good command of language is a precursor to educational failure in that this deficiency leads to a severe learning difficulties, which increases and continue through school life.

Andrew, Cobb and Giampietro (2005) define verbal ability as a person's ability at putting thoughts into words, both oral and written. It is an aspect of the conventional and traditional intelligence test constructs that measure verbal ability, quantitative reasoning, and logical thinking. To Mozuraitis, Chambers and Daneman (2016), verbal ability is the teachers' judgments about a child's reading skill. The characteristics of verbal ability according to Andrew et al (2005), entails not only the possession of a strong working vocabulary, but also possessing the appropriate diction to convey information to a selected audience, the ability to organize words coherently and being eloquent. Adegbile and Alabi (2007), listed elements of verbal ability test to include: word power, sentences arrangement, words arrangement, and substitution of elements and logical selections of appropriate words.

Adegbile and Alabi (2007) stated that verbal ability may show a significant level of relationship with students' grades. Gustin and Corazza (1994) submitted that verbal ability is associated to better achievement in science than any other discipline. Griffin, Wiley, Britt and Salas (2012), reported that verbal ability can be regarded as the most reliable factor in predicting learning outcomes in a multi-faceted inquiry task for seventh-grade students. Olatoye and Aderogba (2011) reported a significant relationship between students' verbal ability and performance in general aptitude test. Tzu-Ling Wang (2008) in her study also reported a strong significant relationship between verbal ability and students' science achievement. Smith and Sanders (1981) also reported a significant relationship between students' verbal ability and achievement. All these studies concluded that the higher the students' verbal ability, the better their achievement irrespective of the subjects.

Problem Statement

Students' achievement has been understood to depend on many factors. Biology, one of the branches of science is believed to be the 'simplest' subject by most non-science students. Despite its perceived 'simple' nature, students' achievement in this subject is a cause of concern for biology stakeholders. Many studies have been conducted to determine the factors that contribute to students' poor achievement in biology. Most of the studies focused on the effects of students' demographic factors (age and gender) on their achievement, but with little focus on the effects of students' verbal ability on their achievement. The study, therefore, aims to determine the effects of students' age, gender and verbal ability on their learning outcomes in biology within Ibadan metropolis, Oyo State Nigeria.

The study set out to achieve the following objectives

1. The effect of age on students' achievement in biology
2. The effect of gender on students' achievement in biology
3. The effect of verbal ability on students' achievement in biology

The following hypotheses were tested at 0.05 level of significance

1. There is no significant difference in students' achievement in biology based on their age
2. There is no significant difference in students' achievement in biology based on their gender
3. There is no significant difference in students' achievement in biology based on their verbal ability

Methodology

Research Design

The study adopted the ex-post facto or causal-comparative research design. Inference was made on the relationship between the independent and dependent variables, without a direct manipulation of the variables (Kothari, 2004). This means the researchers studied in retrospect the likely effect of the independent variables on the dependent variables. The variables of interest in this present research were therefore not subjected to any manipulation. The participants in this study were 305 senior secondary two (SS. 2) students selected by simple random sampling techniques drawn from six secondary schools within Ibadan metropolis, Oyo state, Nigeria. Their ages ranged from between less than 15 to 18 years and above with a mean of 16.3 years and a standard deviation of 8.6. Of the 305 students, 124 were males and 181 were females.

Instruments

The instruments for the study are the Biology Achievement Test (BAT) and the Students' Verbal Ability Test (SVAT). The BAT was researchers constructed question designed to tests the students' cognitive ability in specific topics (ecological management and nutrient cycling in nature) of the senior school two biology syllabus. It consisted of 40 objective questions with options ranging from A to D. each correct response was rewarded one mark. The reliability coefficient of 0.738 was obtained using Kuder Richardson (KR20), to establish the internal consistency of the items. The SVAT was adapted from the Australia Council for Educational Research (ACER). The verbal ability test assessed students' ability to spell words correctly, use correct grammar, understand word meanings, understand words relationship and interpret detailed written information. The reliability coefficient of 0.776 was obtained using Kuder Richardson (KR20) to establish the internal consistency of the retained test items. The demographic data were gleaned from the section of the biology achievement test and the students' verbal ability test that asked for the students' age and gender

Procedure and Data Analysis

The two instruments were group administered by the researchers to the subjects in the participating schools with the help of a research assistant and some class teachers. The students were instructed to attempt all the items on the instruments as it was not for grading purpose, but for a diagnostic purpose to assists policy makers in the formulation of policies. Scoring was done based on the scoring guides prepare by the researchers. Independent t-test and the one-way ANOVA were used for analyzing the collected data. The criterion measure or dependent variable was a biology achievement test while the predictor or independent variables were age, gender and verbal ability.

Results

***Ho1:** There is no significant difference in the achievement of male and female students in biology.*

Table 1 reveals that there is a significant difference in the achievement of male and female students in biology ($t = 3.87$; $df = 303$; $p < 0.05$). Table 1 shows that male students ($\bar{X} = 31.15$) had higher achievement in biology than their female counterparts ($\bar{X} = 28.81$). This difference in their mean scores is statistically significant. Therefore, hypothesis 1 was rejected. This means that gender has a significant effect on students' achievement in biology in favor of male students.

Table 1. Difference in Achievement of Students' based on Gender

Variables	N	Mean	Std.d	Df	t	P-value	Remark
Male	124	31.15	5.43	303	3.871	0.000*	Sig.
Female	181	28.81	4.98				

* denotes significant at $p < 0.05$

Ho2: *There is no significant difference in the achievement of low and high verbal ability students in biology.*

Table 2 indicates a significant difference in the achievement of low and high verbal ability students in biology ($t = -24.60$; $df = 303$; $p < 0.05$). Table 2 reveals that high verbal ability students ($\bar{X} = 33.37$) had higher achievement in biology than their low verbal ability counterparts ($\bar{X} = 24.76$). This difference in their mean scores is significant. Hence, hypothesis 2 was rejected. This implies that verbal ability has a significant effect on students' achievement in biology in favor of high verbal ability students.

Table 2. Difference in Achievement of Students based on Verbal Ability

Variables	N	Mean	Std.d	Df	t	P-value	Remark
Low	130	24.76	3.63	303	-24.599	0.000*	Sig.
High	175	33.37	2.55				

* denotes significant at $p < 0.05$

Ho3: *There is no significant difference in the achievement of students in biology based on their age.*

Table 3 shows that there is a significant difference in the achievement of students in biology by their age ($F_{(3, 302)} = 4.66$; $p < 0.05$). Hence hypothesis 3 was rejected. This implies that the age of the students had a significant effect on their achievement in biology.

Table 3. ANOVA Showing Difference in Students' Achievement by Age

Model	Sum of Squares	Df	Mean Square	F	Significant
Between Groups	254.279	2	127.139	4.658	0.010*
Within Groups	8243.249	302	27.296		
Total	8497.528	304			

To explore the magnitude and determine which of the age group causes this specific difference between pairs

of groups in students' achievement in biology, the Bonferroni post-hoc test is carried out across the age groups, while the result is presented in Table 4.

Table 4. Bonferroni Post-hoc Analysis of Achievement by Age

Age	N	Mean	<15	15-18	>18
<15	71	30.01			*
15-18	228	29.85			*
>18	6	23.33	*	*	

Table 4 indicates that the students with age less than 15 years have the highest achievement mean score in biology (30.01) which is not significantly different from those within the age range 15-18 years (29.85) but is significantly different from those with age higher than 18 years (23.33). Table 4 indicates that it is significantly different in the achievement mean scores of students within the age range of 15-18 and those with age higher than 18 years. This indicates that the significant difference revealed by the ANOVA analysis is due to the difference between the students with age less than 15 years and those higher than 18 years, and also between 15-18 years and those with age higher than 18 years.

Discussion

The result from the study shows that there is a significant difference in students' achievement in biology based on their age, gender and verbal ability. The result from table 1 shows that there was a significant difference in students' achievement in biology based on gender. The mean achievement score for the male students of 31.15 is higher than the mean achievement score of the female students of 28.81. This mean difference is statistically significant ($t = 3.87$; $df = 303$; $p < 0.05$). Hypothesis 1 states that there is no significant difference in the students' achievement in biology based on gender was therefore rejected. There was a significant difference in students' achievement in biology based on gender in favour of male students. This result is in agreement with the study of Iroegbu and Famakinwa (2015), and Nnenna and Adukwu (2018)), but contrary to the result of Arslan, Canli and Sabo (2012), Veloo, Perumal and Vikneswary (2013) who both reported that female achieve better compare to their male counterpart and Aniodoh and Egbo (2013), Awolaju (2016), Michelli (2013) and Ibrahim, Sabitu and Magaji (2016) whom all reported no significant difference in the achievement of male and female students.

The result of hypothesis 2, presented in Table 2 indicates a significant difference in the achievement in the biology of low and high verbal ability students. The mean score of low verbal ability students is 24.76, while the mean score of high verbal ability students is 33.37. The mean difference is statistically significant ($t = -24.60$; $df = 303$; $p < 0.05$). It, therefore, leads to the rejection of the hypothesis which states that there is no significant difference in students' achievement in biology based on verbal ability. This result shows that students' verbal ability is a determining factor of high achievement in biology. Unlike the other branches of pure science which are symbolic and mathematical in nature, biology is an expressive subject which requires individuals to express their thoughts about a phenomenon. This result agrees with the result obtained by Adeyemi (2017), Anazia (2019), Corengia, Pita, Mesurado and Centeno (2013) Iyamu (2005). Adegbile and Alabi (2007) concluded that

students' grade is greatly related to their verbal ability. It is hereby concluded, that the higher the verbal ability of students, the higher their achievement in whatever disciplines.

The result of hypothesis 3, presented in Table 3 shows a significant difference in the achievement in the biology of students of different age grades. Hypothesis 3 which states that there will be no significant difference in the achievement of students in biology was therefore rejected. Further analysis using the Bonferroni Post-hoc test in table 4 gives the source and the magnitude of the differences in biology achievement based on students age. The result indicates that the younger the age of the students, the better their achievement. This result agreed with the study of Jabor, Machtmes, Kungu, Buntat and Nordin, (2011) and Varughese (2010), but against the study of Lake and Boyd (2015) and Milun, Mardešić and Kovač (2016), who reported high achievement in favour of the older students. Aremu and Tella (2009) reported no significant relationship between students' age and students' achievement in mathematics.

Conclusion

The study investigated how age, gender and verbal ability predicts students' achievement in biology. The result from the study shows that each of the study variable age, gender and verbal ability all have effects on students' achievement in biology. The following recommendations are hereby suggested:

1. All students should be treated equally irrespective of their age and gender
2. Teachers and textbooks author should avoid gender bias and be gender inclusive in the classroom
3. The medium of instruction used in the classrooms should be geared towards easy assimilation by the students
4. Authors should be careful of the dictions used to convey their messages in the course of writing textbooks.

References

- Abubakar, R.B and Oguguo, D.O (2011). *Age and Gender as Predictors of Academic Achievement of College Mathematics and Science Students. Proceedings of the 2011 International Conference on Teaching, Learning and Change*. International Association for Teaching and Learning (IATEL).
- Abubakar, R. B. and Uboh, V. (2010). Breaking the Gender Barrier in Enrolment and Academic Achievement of Science and Mathematics Students. *Akoka Journal of Pure and Applied Science Education*, 10(1), 203-213
- Adegbile, J.A and Alabi, O.F (2007). Effects of Verbal Ability on Second Language Writers' Achievement in Essay Writing In English Language. *International Journal of African & African American Studies*, 6 (1), 61-67.
- Adeyemi, B.A. (2017). Students' Self-Concept, Knowledge of Verbal Reasoning Skill and Learning Readiness as Correlate of Achievement in Civic in Senior Secondary Schools in Osun State, Nigeria. *Psychology Research*, 7(1), 50-56. <https://doi.org/10.17265/2159-5542/2017.01.005>.
- Agbejeye, S.J, Aleburu, J.O, Olugbaike, K.J and Ogunjimi, A.D (2015). *Effect of students' Gender, School*

- Environment and Teachers on the Students' Learning Outcomes in Basic Technology in Secondary Schools in Lagos State in Nigeria*. International Conference on Contemporary Issues in Education 17 - 19 May 2015 / Dubai - United Arab Emirates.
- Akindele, I. (2009): Increasing Teacher Capacity on the use of Dissection and experimentation Techniques for Effective Conduct of Biology Practical for Senior School Certificate Examination. *STAN, Biology Panel series*, Nwagbo, C. R.: Nsewi, U. M., Ajewole A.G. (Eds) *Nsukka Bel's Books*, 79-87.
- Anazia, I.U (2019). Quantitative and Verbal Attitude as Predictors of Senior Secondary Schools Students' Performance in Economics. *IAFOR Journal of Education*, 7(1), 7-18.
- Andrew, M. D., Cobb, C. D., & Giampietro, P. J. (2005). Verbal Ability and Teacher effectiveness. *Journal of Teacher Education*, 56(4), 343–354.
- Aniodoh, H.C.O and Egbo, J.J (2013). Effect of Gender on Students' Achievement in Chemistry Using Inquiry Role Instructional Model. *Journal of Educational and Social Research MCSER Publishing, Rome-Italy*, 3(6), 17-22.
- Aremu, A and Tella, A. (2009). The Relationship between Gender, Age, Mental Ability, Anxiety, Mathematics Self-Efficacy and Achievement in Mathematics. *Cypriot Journal of Educational Sciences* 4 (2009) 113-124.
- Arslan, H, Canli, L and Sabo, H.M (2012). A Research of the Effect of Attitude, Achievement and Gender on Mathematics Education. *Acta Didactica Napocensia*, 5(1), 45-52.
- Awolaju, B.A. (2016). Instructional Materials as Correlates of Students' Academic Performance in Biology in Senior Secondary Schools in Osun State. *International Journal of Information and Education Technology*, 6(9), 705-708. <https://doi.org/10.7763/IJMET.2016.V6.778>.
- Bloom, S.B. (1974). Implication of IEA Studies for Curriculum and Instruction. *University of Chicago School Review*, 14, 2-6
- Corengia, A, Pita, M, Mesurado, B and Centeno, A. (2013). Predicting Academic Performance and Attrition in Undergraduate Students. *Liberabit. Revista de Psicologia*, 19(1), 101-112.
- Ebenuwa-Okoh, E.E. (2011). Family Violence and Sibling Abuse in Nigeria Families. *Research Journal of Applied Sciences*, 6(4), 240-243. URL; <http://www.medwelljournals>
- Ebenuwa-Okoh, E.E (2016). Family Emotional Climate, Gender, Age and Level as Correlates of Academic Performance among Undergraduates. *Journal of Advances in Social Science-Humanities*, 2:3, 1-6.
- Ezeazor, M.E.N. (2003). *School Environment and Teacher Effectiveness as Determinants of Student Achievement in Biology: A case study of selected secondary schools in Ibadan*. An Unpublished PhD Thesis, University of Ibadan.
- Ezendu, F.O. and Obi, T.N. (2013). Effect of Gender and Location on Students' Achievement in Chemistry in Secondary Schools in Nsukka L.G.A. of Enugu State, Nigeria. *Research on Humanities and Social Sciences*, 3(15), 2013.
- Farooq, M.S, Chaudhry, A.H, Shafiq, M and Berhanu, G (2011). Factors Affecting Students' Quality of Academic Performance: A Case of Secondary School Level. *Journal of Quality and Technology Management Volume VII, Issue II, December 2011, 1 - 14*.
- Griffin, T. D., Wiley, J., Britt, M. A., and Salas, C. (2012). The Role of CLEAR Thinking in Learning Science from Multiple-Document Inquiry Tasks. *Int. Electron. J. Elem. Educ.* 5, 63–78

- Grissom, J. B. (2004). Age and Achievement. *Education Policy Analysis Archives*, 12(49). Retrieved July 17, 2010, from <http://epaa.asu.edu/epaa/v12n49/>.
- Gustin W.C, Corazza L (1994) Mathematical and Verbal Reasoning as Predictors of Science Achievement. *Roeper Rev* 16: 160-162.
- Hansman, R., Tyson, L. & Zahidi, S. (2009). The Global Gender Gap Report. *A report published by the World Economic Forum, Geneva, Switzerland*, Retrieved from <http://www.weforum.org/pdf/gendergap/report2009.pdf>. on 12/10/2012
- Ibrahim, S.T, Sabitu, A and Magaji, Y.M. (2016). Comparative Analysis of Gender Performances in Biology, Chemistry and Physics among Pre-Degree Students of Federal University, Dutsinma. *International Journal of Educational Benchmark (IJEB)*, 5(1), 108-118.
- Iroegbu, V.I and Famakinwa, A. (2015). The Effect of Modelling and Direct Teaching Strategy on Achievement of Primary School Pupils in Basic Sciences. *International Journal of Research in Arts & Social Sciences*, 8(2), 313-321.
- Iyamu, E.O.S (2005). Relationship between Verbal Ability and Students' Achievement in Secondary School Social Studies in Southern Nigeria. *Language in India*, 5(2), 1-7. <http://www.languageinindia.com/feb2005/verbalabilitynigeria2.html>
- Jabor, M.K, Machtmes, K, Kungu, K, Buntat, Y, and Nordin, M.S. (2011). *The influence of age and gender on the students' achievement in mathematics*. International Conference on Social Science and Humanity, IPEDR vol. 5, IACSIT Press, Singapore.
- Kothari, C.R. (2004). *Research Methodology; Methods and Techniques*, 2nd edition. New Age International (P) Limited, Publishers.
- Lake, W and Boyd, W. (2015). Age, Maturity and Gender, and the Propensity towards Surface and Deep Learning Approaches amongst University Students. *Creative Education*, 6, 2361-2371. <http://doi.org/10.4236/ce.2015.622242>.
- Michelli, Madeleine P., (2013). "The Relationship between Attitudes and Achievement in Mathematics among Fifth Grade Students". *Honours Theses*. Paper 126.
- Milun, T, Mardešić, J and Kovač, G (2016). *Do Gender and Age Impact Student Success?* Proceeding: Contemporary Issues in Economy & Technology (CIET2016), S198-S208. www.paper.researchbib.com/view/paper/88516
- Momanyi, M.J, Too, J and Simiyu, C. (2015). Effect of Students' Age on Academic Motivation and Academic Performance among High School Students in Kenya. *Asian Journal of Education and e-Learning*, Volume 03 – Issue 05, October 2015, 337-342.
- Mozuraitis, M Chambers, C.G and Daneman, M (2016). Verbal Ability, Argument Order, and Attitude Formation. *Front. Psychol.* 7:1374. <https://doi.org/10.3389/fpsyg.2016.01374>.
- Nnenna, G.E and Adukwu, B.C (2018). Influence of Gender and School Location on Senior Secondary School Student's Achievement in Biology Inagbani Education Zone of Enugu State, Nigeria. *Journal of Education and Practice*, 9(21), 45-51
- Nwankwo, M C and Madu, B.C. (2014). Effect of Analogy Teaching Approach on Students' Conceptual Change in Physics. *Greener Journal of Educational Research*, 4 (4), 119-125, <http://doi.org/10.15580/GJER.2014.4.032414160>

- Ochonogor, E. C. (2006). Gender Barriers in Science, Technology and Mathematics Education (STME). In E. A. C. Okeke, & M. Opara (Eds.), *JSTAN, Gender and STM Education* (series No. 1, 90-100).
- Ochonogor, E. C. (2011). Performance Analysis of Science Education Undergraduates: A Case Study of Biology Education Students. *US-China Education Review A* 5 (2011) 682-690.
- Odagboyi I, A. (2015). The Effect of Gender on the Achievement of Students in Biology Using the Jigsaw Method. *Journal of Education and Practice*, 6(17), 176-180.
- Offor, E. I. (2007). Gender Stereotyping in some Popular Primary Science Textbooks used in Primary Schools in Imo State: *Journal of Women in Academies*, 4(1), 232-240.
- Okeke, E.A.C. (2007). *Making Science Education Accessible to All. 23rd Inaugural Lecture*, Nsukka, University of Nigeria.
- Okeke, E.A.C. (2008). Clarification and Analysis of gender concepts. *Focus on Research, Reproductive Health Education, and Gender sensitive classrooms. Science teachers association of Nigeria-Gender and STM Education series No. 2.* 5-8.
- Okoli, O.D (2017). Age and Parental Variables Influence on Academic Performance of Senior Secondary Students in Biology: A Study of Umuahia Education Zone of Abia State. *International Journal of Research in Social Sciences*, 7(11), 168-175.
- Okwo, F.A., and Tartiyus (2004). Effect of Position of Diagram and Cognitive Style on Biology Achievement of Pre-National Diploma Students. *Journal of Science Teacher Association of Nigeria*. 39.1 & 2: 89-93
- Olasehinde, K.J and Olatoye, R.A (2014). Comparison of Male and Female Senior Secondary School Students' Learning Outcomes in Science in Katsina State, Nigeria. *Mediterranean Journal of Social Sciences MCSE Publishing, Rome-Italy*, 5(2), 517-524.
- Olatoye, R.A and Aderogba, A.A (2011). Performance of Senior Secondary School Science Students in Aptitude Test: The Role of Student Verbal and Numerical Abilities. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* 2 (6): 431-435.
- Rabgay, T (2015). A Study of Factors Influencing Students' Academic Performance in a Higher Secondary School in Bhutan. *Rabsel - the CERD Educational Journal CERD* 16(2), Autumn 2015, 74-97.
- Sanni, K.T and Emeke, E.A (2017). Direct and Indirect Effects of Personality Type and Learning Style Preferences on Students' Achievement in Senior Secondary School Biology in Osun State, Nigeria. *European Journal of Educational Studies*, 3(11), 825-839. <https://doi.org/10.5281/zenodo.1133870>
- Smith, R.L and Sanders, K (1981) The Effects on Student Achievement and Student Perception of Varying Structure in Social Studies Content, *The Journal of Educational Research*, 74:5, 333-336, <https://doi.org/10.1080/00220671.1981.10885325>
- Tzu-Ling Wang, M.S. (2008). *Brain Hemispheric Preferences of Fourth- and Fifth-Grade Science Teachers and Students in Taiwan: An Investigation of the Relationships to Student Spatial and Verbal Ability, Student Achievement, Student Attitudes, and Teaching Practice*. Dissertation Presented in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of The Ohio State University. Available at: https://etd.ohiolink.edu/!etd.send_file?accession=osu1213169329&disposition=inline
- Ugwu, F.J and Eze, S.O. (2005). *Comprehensive Biology Methods*. Goodseed Publishers, Nsukka.

- Varughese, V.K. (2010). Academic Achievement of International Biological Science Students under Two Teaching Regimes, *Bioscience Education*, 16:1, 1-8, <https://doi.org/10.3108/beej.16.5>
- Veloo, A, Perumal, S and Vikneswary, K. (2013). Inquiry-Based Instruction, Students' Attitudes and Teachers Support Towards Science Achievement in Rural Primary Schools. *Procedia-Social and Behavioural Sciences* 93, 65-69.
- White, K. (1982). The Relation between Socioeconomic Status and Academic Achievement. *Psychological Bulletin*, 91,461-481.
- Yang, D. H. (2010). Gender and Classroom Learning. *Psychology in the Schools*, 22, 08–223.

Author Information

Saheed Ayodeji Adejimi

 <https://orcid.org/0000-0002-7344-3852>
African Centre of Excellence for Innovative
Teaching and Learning Mathematics and Science
University of Rwanda-College of Education
Rwanda
Contact e-mail: jimmysaheed@gmail.com

Wenceslas Nzabalirwa, Prof.

 <https://orcid.org/0000-0002-8299-2001>
Department of Educational Foundations,
Management and Curriculum Studies
University of Rwanda-College of Education
Rwanda

William Aino Shivoga, Prof.

 <https://orcid.org/0000-0002-1694-9339>
Department of Biological Sciences
Masinde Muliro University of Science and
Technology, Kakamega
Kenya
