



Relationship between Instructional Resources Availability and Students' Academic Performance in Biology at Advanced Level in Buikwe District

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Abstract

The study aimed to establish the relationship between instructional resource availability and students' academic performance in Biology at an advanced level in Buikwe District. A correlational research design was used, and data were gathered from 102 respondents using a self-administered questionnaire and observation checklist. There was a significant relationship between instructional resources availability and students' performance in Biology with Spearman's rho Correlation Coefficient = 0.276, $r = 0.005$. School administrators should work hand in hand with parents and other stakeholders to ensure that laboratory resources are available for students and teachers. The government should supply essential library resources to all secondary schools through special funds. School administrators should work hand in hand with the government, parents, and other stakeholders to ensure that laboratory and library resources can be available to enhance students' performance in Biology.

Keywords: Instructional Resources, Library resources; Laboratory resources, Academic performance

Résumé

L'étude visait à établir la relation entre la disponibilité des ressources pédagogiques et la performance académique des étudiants en biologie à un niveau avancé dans le district de Buikwe. Une conception de recherche corrélationnelle a été utilisée. Les données ont été recueillies auprès de 102 répondants à l'aide d'un questionnaire auto-administré et d'une liste de contrôle d'observation. Les résultats ont montré qu'il y avait une relation significative entre la disponibilité des ressources pédagogiques et la performance des étudiants en biologie avec le Coefficient de Corrélation rho de Spearman = 0,276, $r = 0,005$. Les administrateurs scolaires doivent travailler main dans la main avec les parents et les autres parties prenantes pour s'assurer que les ressources de laboratoire sont disponibles pour les élèves et les enseignants. Le gouvernement devrait fournir des ressources documentaires essentielles à toutes les écoles secondaires et alloué des fonds spéciaux. Les administrateurs scolaires

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doivent travailler main dans la main avec le gouvernement, les parents et les autres parties prenantes pour s'assurer que les ressources de laboratoire et de bibliothèque peuvent être disponibles pour améliorer les performances des élèves en biologie.

Mots-clés : Ressources Pédagogiques, Ressources de la Bibliothèque ; Ressources de Laboratoire, Performance Académique

Introduction

Biology performance at the Advanced level remains a challenge. Biology has been seen as key, but students' performance has been discouraging (Boud et al., 2016). Biology is related to many things in human's daily life, and it is a prerequisite for certification at the senior secondary school level and for admission into the tertiary institutions for most science-oriented students that will pursue careers in science-related fields such as medicine, nursing, pharmacy, nutrition, and medical laboratory. However, students' performance remains a challenge. According to UNDP (2017), Biology as a science subject is studied or taught by using different methods which employ the use of all sense organs, including olfactory (smell), gustatory (taste), auditory (hearing), kinesthetic (skin), and optical (seeing) of which only the application of theory in teaching and learning could not yield 100-percent accuracy without the use of instructional resources. Hence instructional materials are part of the success of Biology teaching and learning that affects students' performance differently.

Studies done worldwide indicate that the presence of instructional materials enables students to translate what seems to be abstract into practical realities, thereby affecting students' performance in Biology (UNICEF, 2020; Gauthier, 2018; Okongo et al., 2015). This implies that poor performance in Biology is a problem for many students. German colonials initiated the education system in Rwanda, and through the aid of missionaries, they initiated not only primary and secondary schools but also higher learning education. Missionaries provided these schools with instructional resources, infrastructures, and other necessary educational materials (Bizimana & Orodho, 2014). The indication is that instructional resources supported teaching for years. Colleges of education and Universities with preservice science teachers' programs must be well-equipped with various instructional resources for producing competent teachers (Nnorom & Okoli, 2014). Instructional resources are materials that assist instructors in making students' learning of concepts clear and understandable. They reduce oral teaching and increase learners' engagement, interest, and motivation toward learning sciences (Tuimur & Chemwei, 2015).

In Africa, poor performance in Biology puts education goals in jeopardy. Education investment has been linked to faster growth and development in the country. Most countries, especially sub-Saharan countries, are now investing in education at all levels to achieve their targets (Kjaer & Muwanga, 2016). Among the strategies for achieving the best from education include increasing enrolment in schools and improving the quality of education provided. However, even though all these are done, the education system and quality of education, mainly academic performance, are still ranked low in most sub-Saharan countries (Kioko et al., 2014). Hence, it is likely that the underlying causes of poor-quality education need to be sufficiently addressed as many students fail Biology.

The use of biology instructional resources has diverse importance for preservice biology teachers' education and for all kinds of students. Their use becomes fruitful, especially

when students manipulate the used materials. For instance, Adebule and Ayoola (2016) affirmed that instructional resources used in teaching raise students' level of discovery and stimulate students to learn more as they see what they are taught. Besides, Johnson & Cotterman (2015) found that video clubs increased the preservice science teachers' understanding of their science subject content. Technology-related instructional resources are imperative for training preservice science teachers, as they afford the required technical skill essential for a qualified teacher in this digitalized world (Oren, 2017). Besides, Arokoyu and Chimuanya (2017) attested that teaching becomes less stressful for teachers and students when instructional materials are used. Therefore, identifying available instructional materials at schools, especially at higher learning institutions, is of imperative need as learning by hands-on and observation of instructional resources raise students' memory levels and enhance learning achievement.

A review of students' performance in Biology in the West African Senior Secondary Certificate Examination (WASSCE) from 2005 to 2013 in Nigeria revealed a fluctuation and downward trend in the students' performance (Stella, 2017). This has attracted much concern among science educators. In order to achieve the objectives and aspirations of the government and to improve the performance of students in Biology, efforts need to be made to improve the teaching and learning of the subject.

East African countries are still experiencing the challenge of poor performance among students in Biology, like in Kenya and Tanzania (Union, 2014). Scholars, policymakers, and school managers have resolved to address the poor academic performance in secondary schools by conducting research on its antecedents, such as a lack of instructional materials, ensuring quality teachers, admitting good students, remuneration and the motivation of teachers, improving discipline and community participation in schools (Agutu et al., 2020). Studies have revealed that adequate staffing, infrastructure, and resources such as laboratories, libraries, dormitories, classrooms, furniture, playgrounds, and effective administration are stimulants of good students' Academic Performance (Mudulia, 2012). Hence provision of these resources would foster the improvement in the academic performance of Biology.

In Uganda, studies done in the past on resources and academic performance do proclaim that resources like teacher training and experience, laboratories, and libraries are essential for improving school performance (Kasirye, 2009). Access to classroom resources raises children's cognitive outcomes, and a child having either their place to sit significantly impacts learning outcomes (Kasirye, 2009). A survey in Uganda on the analysis of factors influencing the learning achievement of students in Uganda found that students' age, language spoken, time spent on a subject, class size, textbook, and pupil-desk ratio are significant factors influencing learning achievement. The study also revealed that teachers' qualifications, experience, and in-service training affect pupils' performance. It was also found that school administration was another significant factor influencing learning achievement in grade six in Uganda (Nanyonjo, 2007). All the above studies show a significant influence of resources and academic performance in schools and indicate that most institutions face challenges such as a lack of adequate instructional materials. These tend to affect the quality of graduates produced negatively.

Buikwe District comprises 110 secondary schools (Buikwe District Local Government, 2020). For the last three years, the District has been ranked among the Districts with the worst UACE academic performance in Biology subject nationwide (Buikwe District

Local Government, 2020). Despite the many government interventions done towards education improvement in the District, like constructing new schools in the District and introducing universal secondary education (USE), among others, the academic performance, particularly in Biology at UACE, is still deficient, below the national level (ISER, 2018).

The UACE performance in Biology in Buikwe District was 18.5% in 2016 and 13.1% in 2017, while in 2018, it was 6.3% (Buikwe District Examination Statistics, 2019). This is a low pass rate compared to Districts like Mukono, Kayunga, and Jinja, with 35%, 28%, and 15%, respectively, for the year 2018 (UNEB Report, 2019). This risks the extremely low enrolment at an advanced level in Buikwe District. The decline in academic performance in Biology subjects results in a reduction in the number of students opting for Biology at A level, which greatly impacts human resources in Biology fields like health in the whole country (Ssebunonyi, 2016).

Literature Review

Bosibori et al. (2015). Musah and Umar (2017) classified instructional resources used in biology instructional methods into different categories: material resources, human resources, and physical resources. Arop et al. (2015) categorized types of resources used in biology instructional methods into three main types: Visual, audio, and audiovisual resources. Visual resources support instruction through sight, and students can manipulate them; they include flashcards, posters, charts, textbooks, tangible objects, models, chalkboards, and images. Audio resources support instruction through hearing; they include tape recorders and radios, among others. Audiovisual resources are those instructional resources that teachers use as a combination of audio and visual tools; they stimulate the sight and hearing senses. Computers, television, tape recorder, radios, and videos are excellent examples. Iji et al. (2014) attested that they could be made from industries, by teachers, or by students made from locally available materials through materials improvisation. Therefore, the particularity is that the present study categorized biology instructional resources as classroom resources, basic biology laboratory resources, library resources, and ICT resources. This classification is justified because they wrap the significant instructional resources for biology teaching and learning in higher learning institutions.

Teaching is said to be effective when resources such as laboratory practical activities, diagrams, charts, models, field works, and natural objects are efficiently utilized to explain the subject matter Nwagbo (2016). Practical activities in Biology are important for concretizing theoretical classroom learning experiences and stimulating the student's urge to study Biology. It also provides an opportunity for students to interact with materials and ideas, and by so doing, stimulate the development of affective and psychomotor dimensions of learning alongside with the cognitive dimension in order to ensure an all-round and comprehensive development of the student (Agbowuro, 2006). Experimental activities in Biology are a method that could be adopted to make the task of teaching Biology more concrete or tangible to students as opposed to the theoretical or abstract presentation of principles, facts, and concepts.

Experimental activities in Biology are important to students' academic performance because it is a teaching method that has to do with the practical demonstration of scientific concepts, principles, theories, and laws. From its experimental engagement, the students ultimately gain the capacity to acquire new facts and develop concepts, principles, and skills,

which lead to the cultivation of scientific attitudes and habits (Onyegegbu, 2006). For instance, practical activity on the influence of carbon (iv) oxide on photosynthesis offers students the opportunity to collect relevant data and conceptualize the appropriateness of the theories associated with photosynthesis and carbon (iv) oxide. It is because of the above that, Nwagbo (2016) stated that "the used of practical activities approach to the teaching and learning of Biology concepts should therefore be made mandatory other than an option to Biology teachers if we hope to produce students that would be able to acquire the necessary knowledge, skills, and competence needed to meet the demands of the nation." This implies that a student's academic performance in any science-based subject like Biology is closely related to theoretical and practical knowledge.

Alison (2013) said that Biology is centered on problem-solving, and the laboratory is the most convenient place for careful observations, accurate calculations, and logical inferences. Therefore, practical activities should be regarded as the main instructional procedures in determining the cause and effect of any concept. Rughill (2011), in his study on laboratory investigative approach for a successful teaching methodology for high school science instruction, revealed that students showed significantly high grades for this cognitive dimension. Ajevalemi (2011) blames the state of students' poor performance in Biology on the lack of laboratory facilities.

In another study to examine the role of instructional materials in academic performance in community secondary schools in Rombo District, Tanzania, findings revealed that most community secondary schools in the District suffered a shortage of essential teaching and learning materials (City, 2016). Findings indicated that schools with more resources performed better than those less endowed. The study also showed that the most commonly used instructional materials were posters, maps, and past papers, which are ready-made and the teachers are not required to develop (City, 2016). A similar study aimed at finding out the extent and direction of resources and academic performance of secondary school students in Ondo State of Nigeria showed that many secondary schools in Ondo State have poor material resources of the sampled schools 70% did not have adequate teaching aids (Ehinola & Oyewole, 2011). However, these two scholars looked at academic performance as general, that is, in all subjects, and did not specifically look at the influence of resources on academic performance in Biology subject alone.

In another study done by Pareek (2019) in India that aimed at exploring the utilization of a science laboratory for the teaching and learning of science, in which a descriptive survey methodology was adopted, findings showed that many teachers faced difficulties when conducting science activities due to inadequate equipment and materials (Pareek, 2019). However, this study used students as the primary respondents, which could lead to missing out on important information from teachers and administrators.'

According to Morgan (2014), the provision of well-designed textbooks to learners provides the ability to make learning more fun, lasting, and meaningful and may actively engage learners' cognition in many ways through such mechanisms as visual processing, analytical thinking, posing questions, testing hypotheses, and verbal reasoning. In a study investigating the factors influencing poor performance in science subjects in secondary schools in Shinyanga municipality of Tanzania that used the quantitative technique with survey research design, six public secondary schools out of eighteen public secondary schools

were sampled for the study. The form four National Examination results for the past five years in selected secondary schools were used to show the performance trend in science subjects.

From the study results, the lack of teaching and learning materials like textbooks was among the significant factors that influenced the poor performance of science subjects (Majo, 2016). From the study, textbooks and other science teaching and learning materials were among the suggested solutions to the problem of poor performance in science subjects in secondary schools (Majo, 2016). However, this study also looked at the influence of instructional materials on students' academic performance in science subjects but did not specifically look at Biology subjects alone.

In the same lane, from another correlational survey research study done by Adesoji and Olatunbosun (2014) to investigate textbook utilization and students' involvement as predictors of academic achievement, results among others showed that there existed a positive textbook utilization ($r=.186$), students' involvement ($r=.186$) and students' academic achievement. The study also showed that textbook utilization and students' involvement were significant in their composite academic contribution to predicting students' academic achievement ($F=5.316$; $p<0.05$; $R = .121$, $R^2=.015$, $Adj. R^2= .012$). However, this study only addressed students' involvement as predictors of academic achievement rather than students' academic performance in Biology subject specifically.

Whereas, in a study done in 2014 on finding out whether student learning was influenced by the adoption of open textbooks instead of traditional publisher-produced textbooks in Provo, USA, that used a quantitative quasi-experimental design, found out that students who used open textbooks scored 65 points higher on end-of-year state standardized science tests than students using traditional textbooks when controlling for the effects of 10 student and teacher covariates. The study also revealed the presence of statistically significant positive gains for students using the open chemistry and Biology textbooks, with no significant difference in student scores for earth systems of physics courses (Robinson et al., 2014). However, this study only correlated students' use of open textbooks versus traditional textbooks and did not look at the influence of textbooks on students' academic performance.

Methodology

Study Design

A correlation research design with a quantitative and qualitative approach was used in the study's design. Correlational research is a non-experimental method where a researcher studies the relationship between quantitative independent variables and one or more quantitative dependent variables. Given this fact and the researcher's interest in finding a significant relationship between the study variables, regression analysis was used to determine predictor strength, effect forecast, and trend forecast.

Study Population

The study population comprised teachers, deputies, and head teachers working in selected secondary schools in Buikwe District and were knowledgeable about library and laboratory resources and students' academic performance in Biology. According to the ministry of education and sports, each A-level secondary school is expected to have a minimum number of two A-level Biology teachers and 02 school administrators, of which one is the head teacher, and the other is the deputy head teacher. This gave a total population of

approximately 140 people. Using the Krejcie and Morgan table (1970), the sample size from a population of 140 units is equivalent to 105 sample size.

Data Analysis

Spearman's rho coefficient of correlation was used to analyze the data to understand how instructional resource availability affects students' academic performance in Biology.

Results

Respondents Characteristics

The study surveyed the respondent's profiles in terms of gender, age, education level, marital status, and work experience.

Table 1 Respondents' Profile

	Frequency	Percent
Sex		
Male	54	52.9
Female	48	47.1
Education level		
Diploma	26	25.5
Bachelor	54	52.9
Postgraduate	22	21.6
Marital status		
Single	14	13.7
Married	65	63.7
Divorced	19	18.6
Widowed	4	3.9
Working experience		
1-5 years	13	12.7
6-10 years	40	39.2
11 and above years	49	48.0
	Mean	Std. Deviation
Age	43.3725	5.24437

n=102

Sex

Concerning gender, findings from Table 1 show that the majority, 54(52.9%) of the respondents, were male teachers compared to 48(47.1%) female teachers. This implies that the study contains more views of males, although those of females are substantively represented. In addition, this portrays the reality on the ground, whereby there are more male administrators than females.

Education level

On the issue of education level, the majority, 54 (52.9%) of the respondents, had attained a degree, while 26(25.5%) had attained a diploma and 22 (21.6%) had a postgraduate.

This implies that the majority of the respondents had a bachelor's degree, although other categories are substantively represented.

Marital Status

From Table 1, it was found that the majority, 65 (63.7%) of the respondents, were married, followed by 19 (18.6%) who were divorced, 14 (13.7%) who were singles, and 4 (3.9%) who were widowed. Hence the study contains more views of respondents who were married, although other categories are substantively represented.

Working experience

Regarding working experience majority, 49(48%) of the respondents, had worked for 11 and above years, followed by 40(39.2%) who had worked 6-10 years and 13(12.7%) who had worked 1-5 years. This implies that there were more views of those who had worked for 11 and above years, although other categories were substantively represented.

Age

On the age of the respondents, it was found that there was an average age of 43.4 years among the respondents who participated in the study. This means that, on average, the respondents were 43 years.

Instructional Resources and Students' Academic Performance

The aim was to establish the relationship between instructional resource availability and students' academic performance in Biology at an advanced level in Buikwe District. Data were analyzed using a Spearman's rho to analyze the findings, which are presented in Table 2 below.

Table 2 *Instructional Resources and Students' Academic Performance*

		Students' Biology Academic Performance
Spearman's rho	Laboratory Instructional materials	Correlation Coefficient .026
		Sig. (2-tailed) .798
	Library Instructional materials	Correlation Coefficient .240*
		Sig. (2-tailed) .015
		N 102

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Laboratory instructional materials

Findings from Table 2 show that there was no significant laboratory instructional materials availability and students' academic performance in Biology, as shown by Spearman's rho Correlation coefficient = 0.026 and *r*. value 0.798. This implies that laboratory instructional materials availability does not influence students' academic performance in

Biology. Therefore, laboratory instructional resources do not significantly influence the way students perform in Biology subject.

The findings are in line with the (Pareek, 2019) that there was no assessment of science laboratory practical activities; these activities did not contribute directly to measuring students' academic performance in science.

This, however, is contrary to Hajia et al., (2018), who found that laboratory instructional materials had a significant influence on academic performance in Biology among public secondary school students in Kwara State. Therefore, school laboratories and students' academic performance had a relationship. However, in the current study, the relationship does not exist.

Library Instructional resources

From Table 2, it was found out that there is a library instructional resources availability and students' academic performance in Biology with Spearman's rho Correlation coefficient = 0.240 and *r.* value 0.015. This implies that library instructional resources availability influences students' academic performance in Biology. The library instructional resources positively influence students' academic performance, and the reserve is true. In this case, the available library resources those students can access for Biology positively promote students' academic performance.

In light of the findings, Kachel (2013) notes that a practical school library should have a librarian, up-to-date reading materials, and information technology equipment to support reading and literacy skills. About the above scholars, it can be concluded, therefore, that effective libraries support students to develop literacy skills and reading culture and offer opportunities for students to learn at an individual level of inquiry outside their given program.

Table 3 *Relationship between Instructional Resources Availability and Students' Academic Performance in Biology*

			Students' Biology Academic Performance
Spearman's rho	Instructional resources availability	Correlation Coefficient	.276**
		Sig. (2-tailed)	.005
		N	102

** . Correlation is significant at the 0.01 level (2-tailed).

Table 3 presents the overall findings on the relationship among the study variables, whereby there was a significant relationship between instructional resources and students' academic performance in Biology. In computing the scores using Spearman's rho Correlation Coefficient, the study found a significant at 0.01 level (2-tailed) with Spearman's rho Correlation coefficient = 0.276, *r.* = 0.005. The implication is that there is a weak significant relationship between instructional resources availability and students' academic performance in Biology. Therefore, based on *r.* = 0.005, which is less than 0.05, the null hypothesis is rejected, and the alternative hypothesis is accepted that there is a significant relationship between instructional resource availability and students' academic performance in Biology at

the advanced secondary level in Buikwe District. The Coefficient of determination is 0.276×0.276 , which is 0.076176×100 or 7.62%. This means that if all other factors are held constant, instructional resource availability can only account for 7.6% of students' performance. The rest should be accounted for by other factors that this study did not handle.

Instructional materials positively influence students' academic performance in Biology. The more instructional resources are available such as the library and laboratory, the higher probability of positively influencing students' academic performance in Biology.

The findings are in line with Nghambi (2014) revealed some factors that affect students' academic performance. One of the factors is how students learn or intend to learn and what teachers teach. In his view, other factors -like shortage of books and materials, teaching, and teacher education affect students' academic performance. He adds that the type of teachers, their experience, professional qualifications, and commitment to work may contribute to the student's achievements. In addition to his findings, he insists on students' instruction time in actual learning activities.

In a nutshell, there is a weak significant relationship between instructional resources availability and students' academic performance in Biology. This may explain the poor performance in Biology over the years in Buikwe District. The decline in academic performance in Biology subjects results in a reduction in the number of students opting for Biology at the A level.

Recommendations

- Teachers can become frustrated if they need more resources to teach their subjects. It is, therefore, imperative to provide adequate and relevant materials (for the laboratory and library) for teaching and studying Biology in the secondary school curriculum for the Advanced level.
- Since there was a significant relationship between instructional resources and Student academic performance in Biology at the advanced secondary level in the Buikwe district, therefore, school administrators should work hand in hand with the government, parents, and other stakeholders to ensure that there is the availability of both laboratory and library resources that can enhance and support effective teaching of Biology in order to ensure high performance in the subject at UACE.

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