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The effect of Teaching Aids on Students' Performance in Biology Subject in O'level Secondary Schools in Kayonza District

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Abstract: *The purpose of this study was to assess the effect of teaching aids on students' performance in Biology subject in O'level secondary schools in Kayonza District. Using convenient sampling, four schools were selected comprising a total population of 347 made by 4 Dean of Studies, 4 Biology teachers, and 339 students. Data were collected using both interviews, observation checklists, and tests. As a mixed study, data were analyzed using descriptive statistics, content analysis, and t-tests using SPSS 26 version as a tool to compare students who were taught using teaching aids and those who learned without teaching aids. The results showed that textbooks and charts were the most available teaching aids. The most challenge that hinders the effective use of teaching aids in biology teaching was found to be a lack of time to prepare teaching aids (n=4, 100%), and the teaching aids language barrier (n=4, 100%). The results revealed that there were significant differences between academic performance amongst the students who learned using teaching aids (M= 7.000) and those who learned without teaching aids (M=6.017) at a significant level of 0.000. The provision of instructional materials in schools, the organization of workshops for teachers about the use of instructional materials, the production of simple teaching aids through improvisation for students to practice what they study and the supervision of how the available instructional materials are effectively utilized will contribute to high performance in O'level Biology secondary schools in Kayonza District.*

Keywords: *Teaching aids, Performance, Biology, secondary schools, Kayonza district*

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1. Introduction

Teaching aids have been extensively used since the 17th Century. Amos Comenius (1592-1670) one of the earliest users of teaching aids, used pictures to assist the teaching process and drawings through his oeuvre *Orbis*

Sensualium, with about 150 drawings that facilitated the learning process, (Comenius, 1977) Jean Jacques Rousseau (1712-1788) and Pestalozzi (176-1827) regularly used visuals and they found that resources in the instructional process increase students' interest in subjects, hence stimulating self-activity that precedes in-depth learning (Lawrence Ong'amo et al., 2017a),

In the nineteenth century, according to (Grange, 2016), Biology appeared as a school subject in different countries in the world, including Britain and the USA as examples. Before that time, physics and chemistry were the principal subjects, followed by botany and zoology. Biology started to arise in the curriculum of some schools as botany weakened. Its development in schools was too slow due to the user and applied features of biology which remained undeveloped. Its development started around the Industrial Revolution, whereby in Britain Louis Pasteur did work developing a branch of medicine and biology (Bacteriology), and the study of marine life, agricultural biology, and so on while in the USA, Thomas Huxley fused botany and zoology into general biology to accentuate the importance of laboratory work. Moreover, most learners chose to study it as it is the subject that provides individual requirements like developing knowledge about defense against diseases (Grange, 2016).

Like other countries, the government of Rwanda accentuates the importance of providing teaching and learning materials with the syllabus to enable learning development. This is understandable as the curriculum being used is a competency-based one, there must be improvisation of adequate learning resources, qualified teachers, enough advanced laboratories, and so on, and this helps in active learning where everyone shows his/her own experience and knowledge into the learning process (Rwanda Education Board, 2015a).

In Rwanda, the influence of inadequate teaching materials and equipment is crowned in poor academic performance of students in continuous assessment scores, low semester examination scores, and very low practical skill acquisition (Ogbu, 2015).

Therefore, the low academic performance in secondary schools is much felt in some provinces and districts of Rwanda. Kayonza district is one of the districts which are badly affected by the low performance in secondary schools, and the low academic performance is the result of many factors related to pupil-teacher ratio, use of teaching aids, and school environment at large ('Gamariel, 2018).

It is against this background that this study, guided by the following research questions, investigated the effect of teaching aids on learners' performance in Biology subject.

1. What are the teaching aids used in teaching O'level Biology in secondary schools of Kayonza District?
2. What are the challenges hindering the use of teaching aids in teaching and learning O'level Biology in secondary schools of Kayonza District?
3. Is there any difference between the performance in O'level Biology in the students taught using teaching aids and students taught without aids in secondary schools in Kayonza District?

2. Literature Review

2.1 The conception of teaching aids in education

Teaching aids or materials are used to illustrate the teaching process and make instruction more comprehensive for the learner. Instructional aids are devices or pieces of equipment, graphics or sound representation, or illustrations that help pupils to learn.(Enohuean, 2015)

The involvement of learners in searching for teaching aids will make them more participative and engaged. This may include the collection of samples such as insects, plants, and other similar things, which will allow the learners to see, touch, smell, and handle things physically and that will contribute to their normal experience. Different types of teaching aids can be used in a teaching and learning process such as:

Visual materials: are teaching aids that make use of sight. Examples are charts, real objects, photographs, and maps….
Audio materials: are teaching aids that make use of hearing. Examples include cassettes, microphones, radios, and headsets….
Audio-visual materials: Teaching aids that make use of both sight and hearing means that they are multi-sensory materials. Examples include slides, projection, tapes, films, television, and digital video player ….

These teaching aids have different effects as they vary from simple locally made to complex and sophisticated materials like computers (Enohuean, 2015).

2.2 Teaching aids in teaching biology

The necessity of using equipment in education and teaching is also valid for Biology education. Biology education is essential for life. It has been determined that although teachers know the importance of Biology, students are not aware of this significance (Ibrahim & Abdullahi, 2019)

The field of Biology, which is of vital importance for life, needs to get more support in education in this sense. On the other hand, it has been revealed that students learned Biology course more easily by using computers and technology and that equipment-rich environments promote students' motivation and contributes to success (Lawrence Ong'amo et al., 2017b)

In Biology education, many pieces of equipment ranging from the simplest writing board to the most advanced electron microscope are provided as accessories to teaching. The more sense organs are involved in Biology education, the better and more permanent the learning will be. What we learn best is what we achieve by ourselves (Ibrahim & Abdullahi, 2019)

There are various methods and techniques employed at each stage of biology teaching that appeal to both hearing and seeing. These methods and techniques are extremely important in terms of students' associating their current knowledge with newly learned information through biology equipment, revealing the connections and transitions between concepts, in other words, appealing to visual memory. As one of the teaching equipment in Biology teaching, models play a key role in the interpretation of science and help to understand complex concepts easily. Besides, they support students in producing new and creative ideas. Models are the equipment that can be used the most effectively in biology teaching. The materials that teachers use in educational environments help them to establish communication with students. It is doubtless that the communication established by the teacher in learning is very important (Adalikwu & Iorkpilgh, 2013)

One of the most challenging phases in the Biology teaching process is the selection and design of teaching equipment. Equipment use has a wide range of utilization in Biology teaching. Selecting the most useful equipment for a specific subject is very important in biology education. Teaching Biology without equipment and not using the opportunities provided by the equipment seems almost impossible in Biology teaching (Effiong & Igiri, 2015).

2.3 Challenges of shortage of teaching aids

The lack of resources may impact students' achievement negatively or poorly due to many different reasons. For example, teachers may be incompetent or may lack training and skills in using such materials. This may affect the lesson-delivering session as well as the results from students. Some materials may be not enough once they are available, or the available ones may be used improperly due to the methodology used by teachers (Makori & Onderi, 2014). Students must be provided with enough guidance and assistance on the choice of the appropriate and developed materials to be used to enhance their performance. The outdoor laboratory is suitable, especially in rural areas because it does not cost anything to explore nature, while it is difficult and expensive to urban areas students to explore it. On the other hand, the indoor laboratory has some limitations such as insufficient apparatus; the multipurpose laboratory in some schools, instead of a specified laboratory for Biology; unqualified laboratory technologists, which are some challenges to be overcome (Sayan & Mertoğlu, 2020).

Improvisation is viewed as an alternative solution to the challenge of the lack of the lacking teaching aids. It is defined as the process or the ability to replace what is not sufficient or unavailable could be seen as improvisation. From this perspective, improvisation is any object or thing that is provided to replace insufficient or unavailable. The teacher initiates the production of them alternative resources, which are constructed by either the teacher or the local artisans e.g., carpenters, blacksmiths, etc. The teacher may use the students for improvising some of the needed materials or equipment (Ibrahim & Abdullahi, 2019)

3. Methodology

3.1 Research design

Both observational and quasi-experimental research designs were used in this research because the sequential exploratory mixed method approach was used in the study.

The observational research was used to collect qualitative data for the first two objectives using an observation checklist while the quantitative phase comprised the quasi-experimental research to answer the third research question.

This study also used a quasi-experiment research design that was used by a researcher to conduct a test on two selected groups from the existing classes to see whether there is a difference in performance between students taught using teaching aids and students taught without them. One group was the control group (class to be taught without using teaching aids) and another group was the experimental group (class to be taught using teaching aids). In this setup, four classes from four schools were picked as the control while the other four classes from the same four schools were selected as the experimental group. The model lesson was Types of Solutions found in Unit 3 called Passive Movement of Substances across a Cell Membrane;. The experimental group used beakers, balances, spatula (spoons), salts, sugars, water as well a student book as teaching materials which were used after a discussion between a teacher and a researcher. Beakers were used as containers of solutions where salts and water were mixed, they were also used to measure the quantity of solvent (water) used. Balance was used to measure the number of solutes (salts or sugar). Salts/sugar were used as solutes to be solved in the solvent (water). A spatula (spoon) was used to measure the number of solutes where there was no balance. Water as a universal solvent was used to dissolve those solutes (sugar & salts). While the control group learned under lecture methods without even students' books.

3.2. Target Population

The study was conducted in secondary schools, ordinary level in Biology in Kayonza district. The total number of secondary public, government-aided, and private schools in the Kayonza district was fifty-two schools in 2018.

3.3. Sampling techniques

Convenient sampling was used to select both districts and schools. The four selected schools were chosen conveniently because of the limited time, geographical factors, and the budget provided, regardless of the type of the school (private, public, or governmental school). As Kayonza has a small urban area compared to the rural ones, the researcher chose one school to represent other urban schools, while the remaining three schools were representing the rural area.

The researcher used one biology teacher and a Dean of Studies at each school, which means that the researcher worked with four biology teachers and four Dean of studies, but the number of students to be used in this research depended on the number of students the researcher found in classes from selected schools.

3.4. Location of the study

The research was conducted in selected secondary schools of Kayonza District in the Eastern Province of Rwanda. Kayonza District is one of the seven districts constituting the Eastern Province of Rwanda. It is located in the East of the Province and borders Gatsibo District in the North, Rwamagana in the East, Ngoma, and Kirehe in the South-East, and the Republic of Tanzania in the East. It covers an average area of 1954 km^2. Kayonza District was selected since it was convenient for the researcher's time and budget.

3.5. Data collection method and instruments

As a basis of the mixed research approach, both qualitative and quantitative methods of data collection were used. The researcher used interviews, observation, and tests as follows:

Interview

In this research, the interviewees were the Dean of studies as well as biology teachers. The interview guide was developed by the researcher and composed of different sections containing open-ended questions. The interviewee transfers information to the interviewer (Quad, 2016). The researcher delivered the questions to the interviewee and he/she answered them, for some who were not available, the researcher gave them the questionnaire so that they answer questions on their own.

To analyze the interview data, all answers were transcribed and this was followed by their analysis. This analysis was done by categorizing similar answers according to the question answered. Thereafter, the similarity of the responses was checked and the frequency of the similarity was estimated. Data are presented in tabular form.

Observation

This study employed a non-participatory observation. Non-participatory observation is the technique used when collecting qualitative data, and it is very important as it facilitates someone to observe and at the same time comment on something (Ciesielska et al., 2018). This was chosen because it helped to obtain information that cannot be obtained using any other tools for collecting data. To conduct this study, the researcher prepared the observation checklist. This checklist comprised possible teaching aids which can be found in secondary schools according to the

literature. The researcher during data collection used it to mark the presence or absence of the material. Both interview and observation were used to see the complementarity between teaching aids observed by the researcher herself, and others said by the teacher during the interview.

Test

The students who were exposed to the lesson delivery "Types of Solutions", either using teaching aids or not, were given the same test to measure their performance regardless of the conditions in which they were taught. A class test was used to collect information relating to the third research question.

3.6. Validity and reliability of the instrument

The validity of instruments was determined through content validity determined by experts from the University of Rwanda, College of Education. The reliability of the test was ensured by determining the Cronbach Alpha, which was found to be 0.63. It is stated that Cronbach alpha values above 0.6 are considered moderate but acceptable (Ursachi, 2015)

3.7. Data analysis methods

The data collected were analyzed both quantitatively and qualitatively. In quantitative analysis, descriptive statistics such as frequencies and inferential statistics such as t-test and effect size were used. Whereas Qualitative analysis involved content analysis followed by using the frequency of similarities between interview data. All these analyses were done using SPSS 26 software.

3.8. Ethical considerations

The study approval was demanded from the College of Education/ Research Unit, and a research authorization document was distributed to the concerned parties: The District's Education Unit, the Sector Education Officer, and the Representatives of schools. The contributors were knowledgeable and guaranteed the secrecy of the questions and the right to take them out at a slight step. They were cognizant that the interview guide was saved privately until the termination of the study. They were guaranteed that the product of the exploration was mutual with them after the finalization of the research. The research was funded by the ACEITLMS after applying for ethical clearance and research financial support. In that application, conditions and terms were provided.

4. Results and discussion

The objective of this research was to investigate the effect of teaching aids on students' performance in Biology subjects in O'level secondary schools in the Kayonza district.

The study findings are based on the following variables: the demographic characteristics of respondents, types of teaching aids, commonly used teaching methods, challenges hindering the use of Teaching aids in teaching and learning Biology as well as the difference between the academic performance of students taught using teaching aids and those taught without using teaching aids. The findings are presented as frequencies and percentages in the tables. For analytical statistics, Mean, Standard Deviation, and t-tests were used where appropriate. Significance was set at $p<0.05$.* 95 Confidence Interval.

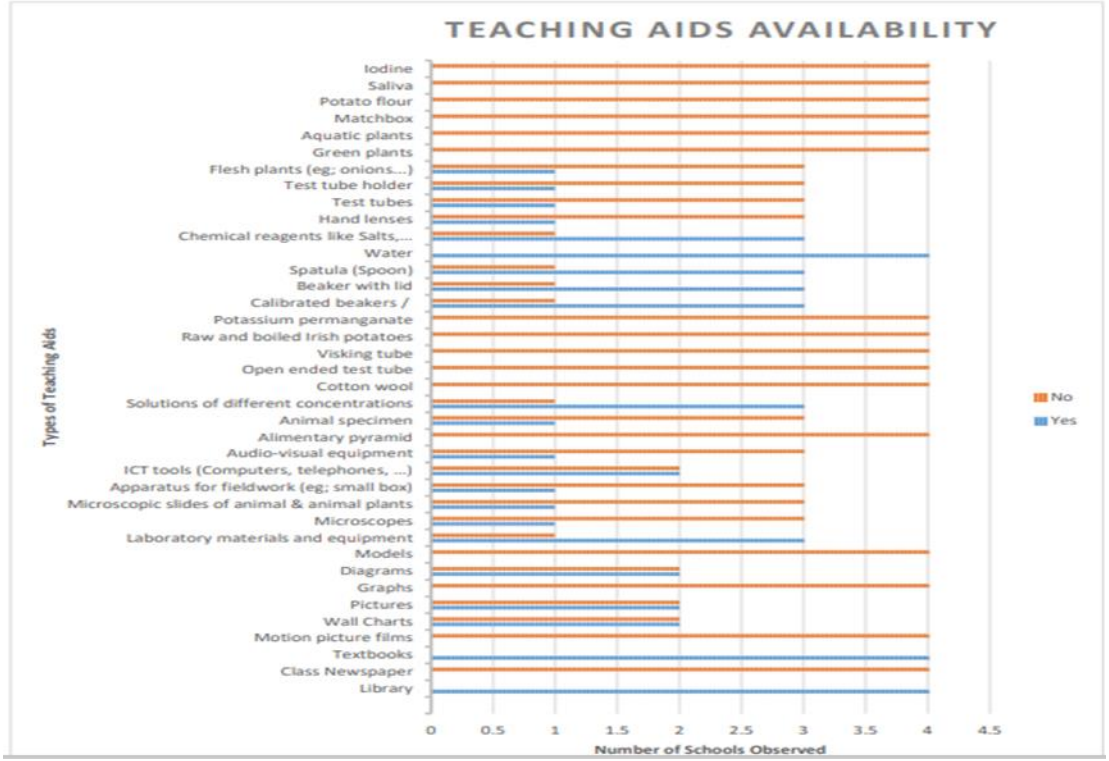

Figure 1: types of teaching aids available in selected secondary schools in Kayonza District. (Wasswa et al., 2017)

According to the data presented in the figure above, the most available teaching aids at all schools are textbooks, and wall charts while some schools have ICT tools and some laboratory materials.

Textbooks are of a paramount importance in teaching and learning Biology. The importance of reading texts in biology and other science subjects has been widely acknowledged. For example, (Joseph Oba, 2015) believed that reading science textbook is an important activity in science academic endeavour. Teachers and parents should be more concerned with the amount of learning a student is able to achieve when reading a biology textbook. It could be mentioned therefore that what a reader is able to comprehend while reading a particular science text depends on some variables. These include reader factors and text factors. Among the text factors are the prints, the familiarity of the subject-matter, and familiarity of the sentence types, vocabularies, diction, and illustrations and so on. Reader factors are language competence, background, and prior knowledge, purpose for reading, interest and meta-cognition However, materials such as models, graphs, and laboratory chemicals were available (Joseph Oba, 2015).

Wallcharts and other tools are needed in teaching Biology. A lack of essential facilities, apparatus, resources and instruments for teaching science is another major contributing factor of poor achievement of students in Biology. Some of these include lack of teachers, lack of educational amenities like laboratories, poor attitude and lack of interest on the part of the students. Despite the fact that many educationists believe that effective use of instructional aids has influence on children's performance in school, considering the fact that teaching require effective use of instructional aids that will facilitate meaningful learning, not much empirical studies have been carried out in recent times to support this assertion. Besides, much of the data available on this topic are theories and opinions of individuals. It is also not certain that such studies have been carried out in biology (Rafiu Ademola Olatoye, 2017).

Table 1: Challenges hindering the use of teaching aids in teaching and learning Biology in O'level secondary schools in Kayonza District

Challenges	Frequency
Some units are hard to find teaching aids	1
A larger number of students	3
Language barriers	4
Lack of time to prepare teaching aids	4
Unavailability of Teaching aids	3

The major challenges biology teachers face while thinking and using teaching aids are the lack of enough time to prepare teaching aids and language barriers. On this issue of language barriers, teachers reported that most of the students want to know scientific names in their mother tongue and the accent of the English used in Audio-visual materials mostly downloaded from the internet which seems to be difficult to understand.

Table 2: Opinions to overcome challenges of using teaching aids in teaching Biology

Opinions	Frequency
Improvisation	3
Increasing the number of science teachers	1
Purchasing many teaching aids	4
Creation of ICT based Teaching aids and smart classroom	4
Increase the number of CPDs related to the use of Teaching aids	2

The table above shows that purchasing enough materials is one of the strategies to overcome the problem of a lack of teaching aids. Improvisation, the creation of ICT-based Teaching aids, and smart classrooms are the factors that may help in overcoming the challenges of using teaching aids in teaching Biology. Teachers reiterated that increasing the number of CPDs may contribute a lot to this challenge. The curriculum stipulates the use of ICT tools including computers in classroom instruction, especially when no teaching materials are available or to foster students' understanding (Rwanda Education Board, 2015b).

Table 3: Comparison of students' academic performance in terms of the use of teaching aids

	Descriptive statistics		t-Test				
	Mean		T	Sig.	Mean Difference	95% Confidence Interval of the Difference	
	Std. Deviation					Lower	Upper
Control group	6.017	2.00000	31.000	.000	6.01765	5.000	6.0000
Experimental group	7.000	2.00000	36.000	.000	7.00000	6.000	7.0000

The mean score of the experimental group (the students who learned with teaching aids such as beakers, water, and balance) was 7.0000, which was compared to the mean score of the control group of 6.0176 with the t-test. The results show that the experimental group's means score is higher than the control mean score with a t-test of 31.000 and a p-value of 0.000 which is below 0.05, therefore the difference between the two groups is statistically significant. The effect size is 0.96, which is considered to be a large effect size.

The performance difference between the two groups was due to the fact that each instructional material provided different learning experiences and that one instructional material may provide more learning experiences than another instructional material, for example real objects provide more learning experiences than videos and charts. Making a classroom interesting is a fundamental way for teacher to encourage and make students learn without forcing them. Real specimens and videos enable students to be more creative and active in learning. This agrees with findings of Gambari and (Clara & Carmen, 2021) who found that students taught with multimedia acquired better knowledge, and improved comprehension skills than other groups. They also introduced the cone of experiences as a "pictorial device" for showing the progression of learning experiences from direct firsthand participation to pictorial representation and on to purely abstract, symbolic expression. He arranged the learning experiences from the point of view of learners in order of increasing abstractness or decreasing concreteness.

5. Conclusion and Recommendations

5.1Conclusion

This study assessed the effect of teaching aids on students' performance in Biology subject in O'level secondary schools in Kayonza District. According to the first objective, the study showed that the most available teaching aids at all schools are textbooks and wall charts while some schools have ICT tools and some laboratory materials.

The use of instructional materials impacts the teaching and learning of students in biology, it influences the academic achievement of students in biology. Based on the study findings it was found that instructional materials play a vital role in students' academic performance in senior secondary two students in biology. Proper presentation of good instructional materials and the methodology employed by the teacher will enhance a good understanding of the subject matter.

For the second objective, the major challenge biology teachers face while thinking and using teaching aids is the lack of enough time to prepare teaching aids and language barriers. On this issue of language barriers, teachers reported that most of the students want to know scientific names in their mother tongue and the accent of the English used in Audio-visual materials mostly downloaded from the internet which seems to be difficult to understand.

For the third objective, the mean score of the experimental group (the students who learned with teaching aids such as beaker, water, and balance) was 7.0000, which was compared to the mean score of the control group of 6.0176 with the t-test. The results show that the experimental group means the score is higher than the control mean score with a t-test of 31.000 and a p-value of 0.000 which is below 0.05. Therefore, the difference between the two groups is statistically significant. The effect size is 0.96, which is considered to be a large effect size.

The findings derived from the study include: The use of instructional materials impacts the teaching and learning of students in biology. The use of teaching aids makes learning real and permanent. Biology teachers do not always make use of available teaching aids during instruction. Teaching aids available for the teaching of biology are grossly inadequate and this negatively affects effective teaching and learning.

The use of instructional materials promotes retention. The use of teaching aids influences the academic achievement of students in biology. Based on these findings it was found that instructional materials play a vital role in student's academic performance in senior secondary two students in biology. Proper presentation of good instructional materials and the methodology employed by the teacher will enhance a good understanding of the subject matter.

5.2 Recommendation

The recommendations from this study were aimed at paving the way for secondary schools in Kayonza District, in particular, to improve more on the creation and use of instructional materials in all the secondary schools. Doing so will help the students carry out their learning activities with a lot of interest to ensure their good academic achievement at the end of their senior school examinations in Biology.

It is therefore recommended in this research that:

1. The government should provide instructional materials like textbooks in schools to enable teachers to use them in instruction.
2. There should be workshops, seminars, conferences, and mentorship activities for teachers to enable them to update their knowledge on new developments in the use of instructional materials.
3. Teachers should try hands-on the production of simple aids so that students can see what they are talking about in the lessons.
4. School heads should supervise their teachers more closely to ensure that the available instructional materials are effectively utilized.

It is therefore hoped that if the above recommendations are properly carried out, it will help to improve the performance of students in senior secondary school biology in the Kayonza district at large.

References

Adalikwu, S. A., & Iorkpilgh, I. T. (2013). The Influence of Instructional Materials on Academic Performance of Senior Secondary School Students in Chemistry in Cross River State. Global *Journal of Educational Research*, *12*, 39–45.

Ciesielska, M., Boström, K. W., & Öhlander, M. (2018). Observation Methods.

Clara F., & Carmen M. (2021). *Student Perceptions of Academic Engagement and Student-Teacher Relationships in Problem-Based Learning*. *6*, 45–46.

Comenius, A. J. (1977). *Orbis Sensualium Pictus*.

Effiong, O. E., & Igiri, C. E. (2015). Impact of Instructional Materials in Teaching and Learning of Biology in Senior Secondary Schools in Yakurr LG A. *International Letters of Social and Humanistic Sciences*, *63*(2005), 27–33.

Enohuean, V. O. (2015). *Effects of Instructional Materials on Achievement and Retention of Biology Concepts Among Secondary School Students in Delta State, Nigeria.*

Gamariel, M. (2018). Challenges facing nine years basic education schools on students' performance in Kayonza district, Rwanda. *International Journal of Social Science and Humanities Research*, *6*(2).

Grange, L. (2016). Southern African Review of Education. *Comparative Education and History of Education*, *14*.

Ibrahim, S. A., & Abdullahi, S. A. (2019). *Improvisation in Teaching and Learning Biology in Senior Secondary Schools : Prospects and Challenges*. *5*(11), 33–36.

Joseph Oba. (2015). Readability of Biology textbooks and students' academic performance in senior secondary schools in Ekiti state Nigeria. *European Journal of Research and Reflection in Educational Sciences*, *3*(3), 45–46.

Lawrence Ong'amo, B., Rosana Ondigi, S., & Omariba, A. (2017a). Effect of Utilization of Biology Teaching and Learning Resources on Students' academic performance in Secondary schools in Siaya district-Kenya. *Education and Research*, *5*.

Lawrence Ong'amo, B., Rosana Ondigi, S., & Omariba, A. (2017b). Utilization of Biology Teaching and Learning Resources on Students' academic performance in Secondary schools in Siaya district-Kenya. *Education and Research*, *5*.

Makori, A., & Onderi, H. (2014). Examining the teaching and learning resources related challenges facing small and medium-sized public secondary schools in Kenya: A comparative analysis. *African Educational Research Journal*, *2*(2), 72–84.

Ogbu, J. E. (2015). *Influences of Inadequate Instructional Materials and Facilities in Teaching and Learning of Electrical / Electronics Technology Education Courses*. *6*(33), 39–46.

Quad, A. (2016). *Research Tools Interiews & Questionnaires – Research Methodology in Education.*

Rafiu Ademola Olatoye. (2017). *EFFECT OF TEACHING USING CHARTS, REAL SPECIMENS AND VIDEOS ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MAMMALIAN SKELETAL SYSTEM CONCEPTS*.

Rwanda Education Board. (2015a). *Advanced Level Biology Syllabus*.

Rwanda Education Board. (2015b). *Advanced Level Biology Syllabus*.

Sayan, H., & Mertoğlu, H. (2020). Equipment Use in Biology Teaching. *Journal of Educational Issues*, *6*(1).

Ursachi, G. (2015). How reliable are measurement scales ? External factors with indirect influence on reliability estimators. *Procedia Economics and Finance*, *20*(15), 679–686.

Wasswa, G., Mugarura, B., & Ndiwa, S. (2017). Biology and Health Sciences. *Longhorn Publishers Ltd*.