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Audio-Visual Aids Utilization Frequency and its Effects on Biology Academic Performance among Secondary Schools in Nandi East Sub-County, Kenya

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Abstract
Audio-visual aids use in the teaching and learning process make it interesting and easy for learners to concretize information leading to a better understanding of Biology concepts. It raises curiosity as it appeals to the mind through multiple visual and auditory senses and provides learners with realistic experiences which in turn capture their attention throughout the lesson. This paper aimed to find out the frequency of utilizing audio-visual aids in teaching Biology in relation to academic performance among secondary school students of Nandi East Sub-County, Kenya. The study adopted a descriptive research design with a mixed methods approach where guided by Krejcie and Morgan sampling table of 1970, 28 schools were sampled from 30 secondary in the study location. Respondents were 383, comprising 317 Form 2 Biology students, 28 Biology teachers, 28 Lab technicians and 10 Heads of the Science Department. Stratified, purposive, and random sampling techniques were used in sampling. Data collection instruments were interview, questionnaires, and observation schedules. Pilot testing of both student and teacher questionnaires yielded reliable Cronbach Alpha Coefficients of 0.906 and 0.897, respectively, thus the instruments were acceptable. Data was analyzed using Statistical Package for Social Sciences, described in words (qualitatively) and numerically (quantitatively) then presented with the help of frequency tables and pie charts. The study limited itself to utilization of audio-visual teaching aids and their effects on academic performance. The findings of the study established that there was minimal use of audio-visual aids in teaching Biology with the most rarely used being smart Television. Furthermore, results also show that usage of audio-visual learning aids can make difficult ideas easily understood thus this leads to improved outcome.

Introduction
In the recent society, tutelage has gone through many changes with several innovations in teaching pedagogy. In indigenous system of education, a learner was a passive listener while the teacher could lecture since it was believed that the teacher knows what, how and why to teach. Such teaching methodology when used, learners were on the receiving end (Mohan et. al., 2010).

In the present-day education policy, the use of variety of teaching approaches has been recommended including utilization of instructional resources like audio (utilizes sense of hearing), visual (utilizes sense of sight) and audio-visual aids (makes use of the sense of sight and hearing) (Kumar et al., 2020). Visual aids utilize sense of sight while Audio-visual aids makes use of the two sensory organs; ears for hearing and eyes for sight (Shabiralyani et al., 2015). Instructional aids are objects such as models, charts, film strips, projectors, radios, televisions, and maps. Utilization of instructional media in teaching is believed to have begun way back when pictures was used in teaching by Amos Comenius (1592-1670. According to Ojelade (2020), audio-visual aids existed from long ago, but its use was rare only until 1970s when they were made to be part of the library collections. In the United States of America, audio-visual aids were incorporated in teaching as early as 1920s (Wandera, 2019).

Science education is important for any developing country. Biology aims at equipping the learner with the knowledge, attitudes and skills necessary for controlling and preserving the environment. It enables the learner to have a sense of responsibility and appreciate other human beings as part of the broader community of living organisms. It is also a precursor of biotechnology, which is a tool for industrial and technological development. In order to change the teaching methods in science education in Africa, a meeting on reform of science curriculum which included better teaching methods was discussed in the year 1968 conference which was sponsored by UNESCO (Fensham, 2008).

The challenge of dismal performance in sciences in Africa necessitated for introduction of capacity building of teachers through initiation of a program for teachers of Science and Mathematics called In Servicing and Training (INSET). This led to the roll out of Strengthening Mathematics and Sciences in Secondary School Education (SMASSE) program among countries found in East, West, South and Central Africa coordinated from Kenyan capital city, Nairobi. Biology being one of the science subjects under SMASSE have realized infusion of Instructional Technology during teaching and learning process. One of such ways included but not limited to using audio-visual aids in day-to-day learning Biology by students of high schools.

According to Jamila (2021), the nature of science knowledge keeps changing every ten years. Teaching strategies initially employed by teachers of Biology like lecture method or use of audio teaching aids alone has become irrelevant today since science has evolved a lot as observed by Diana et al. (2022). Using both visual and auditory aids can greatly enhance learning in science subjects. This combination leverages the power of sight and sound, which are two of the most impactful senses, making the educational experience more effective (Shabiralyani et al., 2015). Since they give a reasonable visual portrayal and work with learning, powerful learning materials can help with beating some language hindrance issues (Jamila, 2021).

For teachers and learners to achieve Education goals, text books have to be supplemented with audio-visual aids such as videos, filmstrips, smart television and slides. Agyeiku (2021) opined that, books are not the only source of information to the public and therefore there is need to equip libraries with audio-visual materials too. Learning can be reinforced remarkably by utilization of audio-visual instructional aids which tremendously stimulate learners' interest and keep them motivated throughout the lesson (Olu-Ajayi, 2016). Jadal (2011) seconds this idea by adding that audio-visual teaching and learning aids make education more enjoyable and noteworthy encounter to both learners and teachers by focusing attention of a student to the topic under study.

It is a fact that, an individual can learn faster and in an easy manner through audio-visual instructional aids than by oral explanations only (Eze et al., 2020). Kunari (2006) suggested that, students must be given extra ways to process instructional information easily through utilizing audio-visual aids. According to Diana et al. (2022), if teachers make use of instructional media with other teaching methods and techniques, most of their learners would be able to learn with a lot of ease and improve on their performance. Utilization of audio-visual aids presumably makes students participate effectively during teaching and learning process, a practice which makes them good Educationists thus enabling them fit in the current society with changing technological knowledge globally (Wandera, 2019).

The use of audio-visual aids can help make ideas and concepts clear to the student. They can make learning more interesting and vivid. According to Rono & Wanyonyi, (2012), teachers agree that frequent usage of audio-visual instructional aids during classroom instruction process prompts learners towards working independently. It also enhances teamwork among students as they work on problems beyond the usual curriculum.

Although the pros of using audio-visual aids supersedes its cons, it is unfortunate that many teachers do not employ them while teaching as cited by Eshiwani (1983) that most teachers use text books while teaching. Mutwiri et al. (2012) did a research study in Imenti North District to investigate the availability and application of electronic media in teaching Biology and he found out that about 73.53% of classroom teachers do not utilize video and Digital versatile Disc (DVD) while instructing biology students despite the fact that they have proved to catch and bring realism into the classroom. According to research done in Sokoto Metropolis, Nigeria, insufficient or improper use of instructional media may be to blame for students' poor academic achievement (Onyebuchi & Ibrahim, 2017).

The use of audio-visual aids teaching tools during the teaching and learning process helps students perform well. Research by Lin and Atkinson (2011) investigated the effects of using multimedia presentations in biology instruction. They found that students who received instruction through multimedia presentations, which included audio narration and visual aids, had significantly higher achievement scores compared to those who received traditional instruction. As a result, teachers should successfully utilize audio-visual learning aids to meet the needs of their learners in connection to the desired aims and objectives. Teachers need to be resourceful while choosing the best teaching tools. Only if they assist learners in achieving the goal are learning aids, said to be appropriate and effective (Jamila, 2021).

Experience has shown that lecturing alone while teaching is insufficient and ineffective in producing desired learning outcomes in any learning institution. Due to abstract nature of Biology concepts, most students find it hard to comprehend. Students' academic performance in a subject is important to all stakeholders in the education sector. As a result, several studies have been conducted to assess performance. However, there are inadequate materials or literature to explain the effect of utilizing audio-visual materials in teaching on performance of subjects (Kasilia, 2018). The need to learn through technology today is inevitable.

Unfortunately, in Kenyan secondary schools, audio-visual aids employment in classrooms by teachers is extremely wanting (Muriithi, 2005). For this reason, therefore, teachers must employ ways of increasing retention rate thus enhancing learning which in turn will boost academic performance of students when they are evaluated using internal tests and even the summative examination of Kenya

Certificate of Secondary Education (KCSE) usually done after four years in secondary schools. One way of increasing retention of subject matter is by utilizing audio-visual aids in teaching Biology. This is furthermore necessitated by the fact that a combination of audio and visual teaching aids calls for the use of sense of sight and hearing. This method of teaching increases the retention rate of Biology concepts among students and in the long run, this will go a long way into improving performance of students in any examination done. Audio-visual aids provide the students with accurate information, retaining their interest and assisting in the comprehension of the wonders of antiquity, this can be perfectly seen in Biology Topic of Evolution.

At the time of this research, Education system in Kenyan secondary school was that, students sit for formative examination regularly throughout their four-year course before promotion to next class. At the end of four years, all candidates are then subjected to a common summative examination called Kenya Certificate of Secondary Education (KCSE) to test the amount of learning then grade them in readiness to join tertiary institutions to pursue their career choices. KNEC is an independent body mandated to set test items, mark and analyze results of KCSE. The body will then give a report on the general performance in all examinable subjects and in it state the probable cause of performance in any particular year. Notably, it is unfortunate that the performance in Biology subject has been for a long time fluctuating and below average as seen in Table 1 below.

Table 1: National Biology KCSE results from 2017 – 2022

Year / Paper	2017	2018	2019	2020	2021	2022
1	13.74	15.81	18.00	16.03	19.58	24.04
2	16.43	11.92	18.00	19.83	21.73	19.87
3	7.68	13.62	16.00	16.59	15.72	13.47

Source: KNEC, 2022 Report

One of the factors attributed to this unsatisfactory performance according to Kenya National Examination Council report (KNEC, 2007) was insufficient resources and inappropriate utilization of resources available in schools.

This makes most of them fail to attain their career choice and end up falling for any other course available. In the year 2017, CEMASTEA with support of the ministry of Education began a program to popularize Science oriented subjects like Biology, Chemistry, Physics, Engineering, Mathematics and Science and Technology in schools to bridge existing gap between opportunities in the job market and the number of graduates in Science, Technology, Engineering and Mathematics (STEM) related fields. Biology being an integral subject of STEM has to be well learnt by students for them to fit in the competitive job market after going through the Education system.

Dismal performance in Biology has been reported by KNEC for the past five years in KCSE as seen in Table 1 above (KNEC 2022). The predominant cause of dreary performance in Biology could be insufficient and improper use of available resources. Despite efforts by the Ministry of Education to address the issue through provision of text books and increasing the number biology teachers, the problem has been persistent.

Based on the Kenya National Examination Council report (KNEC 2000 and 2007), there was unsatisfactory performance in KCSE Biology results and one factor attributed to it was inadequate resources and improper utilization of available resources in secondary schools. Furthermore, it was

observed that in the year 2017, KCSE Biology performance was the lowest as seen in the KNEC report of 2018 (KNEC, VOL 2, 2018). Based on this report of KCSE analysis, it was noted that nationally, Biology performance was at 30%, which is way below the average mean mark of 50%. The poor performance is replicated in Nandi East sub-county secondary schools.

Studies conducted by other researchers on how effective audio-visual instructional aids can be in teaching and learning of various subjects in other regions provides solid grounds to conduct similar research to ascertain the frequency of audio-visual aids use in Nandi East sub-county secondary schools because it has not been so far conducted in study area of Nandi East sub-county, Kenya. Due to these facts, the researcher found it prudent to sample 28 public secondary schools in Nandi East Sub-County to ascertain the use of audio-visual aids while imparting Biology knowledge and skills by teachers to their learners**.**

The lack of cognizance of other conceivable hitches which leads to dismal performance is as a result of absence of sufficient literature which left the subject to remain persistently static. The approaches implemented to improve Biology performance have not succeeded in making it grasp its potential. Consequently, it is against this problem that the study sought to fill the information gap on the utilization of audio-visual aids in teaching and learning of Biology on impacting Biology academic performance among secondary school students in Nandi-East Sub-County, Kenya.

This research adopted Cognitive theory of Multimedia fronted by Richard Mayer (2005). According to him, more learning occurs when words and pictures are combined than when words only are used. The theory indicates that multimedia supports the way of a human being works. This therefore insinuates that students achieve, perform and learn more if audio-visual aids are used. For meaningful learning to take place, students' brain should select, organize and integrate received information consisting of text and images. Richard Mayer elucidates that brain takes in information and interprets it in various channels depending on how it is presented whether auditory or visually. The theory further indicates that learning is enhanced when multiple senses of a human being are stimulated concurrently. It further delves into how information from the two sense organs; the eye and the ear are selected, organized and integrated in the brain before storing it in the long-term memory.

Methodology

The study adopted descriptive research design because it best suited the study's objectives which was carried out on individuals found in institutions, methods of teaching and materials used while teaching in order to illustrate, compare and contrast information. By focusing on describing phenomena rather than establishing causal relationships, descriptive research lays the groundwork for further inquiry and informs decision-making in various fields. The choice of this design was further informed by the fact that the researcher was on fact finding on existing condition of the phenomenon under research. Mixed methods approach was used to collect qualitative and quantitative data concurrently. According to Klassen and Creswell (2012), mixed research approach increases the chances of mitigating weaknesses associated to a single method. Educational institutions, being social environments, encounter diverse and intricate challenges that require solutions. These challenges are effectively tackled through research endeavors employing quantitative plus qualitative research methodologies (Clabo, 2010).

Target population consisted of 1800 form two Biology students, 30 Laboratory technicians and 30 teachers of Biology in 30 secondary schools of Nandi-East Sub- County. The research used finite population therefore estimation method to adopt was that which was proposed and tabulated by

Krejcie and Morgan (Krejcie & Morgan, 1970). Purposive sampling was employed to choose 28 biology teachers, 10 Heads of science Departments (HODs), and 28 laboratory technicians. Conversely, the selection of 317 form two Biology students was conducted through simple random sampling.

During collection of qualitative data, the investigator made use of unstructured questionnaires, observation checklist and structured interviews whereas for quantitative data collection, structured questionnaires was used. The quantitative data gathered was coded and processed through SPSS for analysis. Subsequently, it was presented in frequencies, mean scores, and standard deviation, followed by visualization on tables and pie charts. Qualitative data was described using texts then triangulation of quantitative and qualitative data findings done to ensure overall validity and reliability of the study.

Frequency of Audio-Visual Aids Utilization

The researcher sought to determine the frequency of using audio- visual aids in Biology tutelage in Biology classes in Nandi East Sub-County, Kenya. A number of statements were given to learners to respond to. The findings are summarized in table 2 below;

Findings from Student's Questionnaire

Table 2: Frequency of AVA Utilization According to Students

Statement	N	Min	Max	Mean	SD
Over Head Projector and transparencies are used in teaching biology by the teacher	292	1.00	5.00	2.02	1.22
Videos are used in teaching biology	292	1.00	5.00	2.50	1.28
Slides are used by biology teachers in the school	292	1.00	5.00	2.40	1.14
Films are used by biology teachers in the school in teaching biology	292	1.00	5.00	2.45	1.17

On the statement that "Over Head Projector with transparencies are used in teaching biology by the teacher," a mean of 2.02 with the SD of 1.22 was registered, the findings intimated that the said AVA were hardly used in teaching biology by the teacher. "Videos are used in teaching biology" registered a mean of 2.50 and SD of 1.28, this finding implied videos were rarely used in teaching biology. "Slides are used by biology teachers in the school" recorded a mean of 2.40 and SD of 1.14 and "films are used by biology teachers in the school in teaching biology" registered a mean of 2.45 with a SD of 1.17. Findings of studies implied both slides and films were hardly used by biology teachers in selected schools respectively.

Findings from teachers

In order to find out frequency of use of available AVA in selected secondary schools, Questionnaire was issued to teachers handling form two Biology and the findings summarized in Table 3 below.

Table 3: Frequency of Teacher' Usage of Audio-Visual Aids According to Teachers

Statement	N	Min	Max	Mean	SD
I smart Television when teaching Biology	24	1.00	5.00	2.20	1.10
I use the projector and transparencies when teaching Biology	24	1.00	5.00	2.45	0.93
I use video when teaching Biology	24	1.00	5.00	2.50	1.10
I use slides when teaching Biology	24	1.00	5.00	2.50	1.10
I use the films when teaching Biology	24	1.00	5.00	2.41	1.06

In table 3 above, a summary on the rate at which teachers use audio-visual aids is given. The statement "I use smart Television when teaching Biology" registered mean of 2.20 and SD of 1.10, which implies teachers rarely used smart television when teaching Biology. The second statement "I use the projector with transparencies when teaching Biology" registered a mean of 2.45 and SD of 0.93 which the findings imply teachers hardly used the projector and transparencies when teaching Biology. "I use slides and videos when teaching Biology" both scored a mean of 2.50 with a SD of 1.10, signifying that only a few teachers utilized slides and videos in Biology instruction. Moreover, "I use the films when teaching Biology" recorded a mean of 2.41 and SD of 1.06, the findings from the study implied few teachers used films when teaching Biology. In summary, a handful of teachers utilize AVA during lessons, these findings support that of Eshiwani (1983), where he alluded that many teachers do not use AVA although it is of great importance.

From the findings on the extent to which audio- visual aids in teaching and learning of Biology are used in secondary schools of Nandi East Sub-County, Kenya, the results indicate minimal use with the most rarely used being smart TV as reported by interviewed Lab Technicians. The results are summarized in Table 4 below.

Table 4: Frequency of Teacher' Usage of Audio-Visual Aids According to Lab Technicians

AVA	Daily	weekly	monthly	rarely
Projectors	2	2	4	4
Smart TV	0	1	2	1
Computer and slides	2	4	7	9
DVD player	1	3	4	7

It was also noted that most aged teachers were rigid to embracing information communication technology integration as compared to young teachers who were eager to use audio visual aids. Although majority of respondents are aware of the immense benefits of usage of audio-visual aids, the study found out that most teachers in sub-county schools do not utilize it due to either lack of the aids or reluctance of the teacher. The reluctance by teachers indicates a failure by them to be resourceful in choosing the best teaching methods hence corroborates with the assertion by Jamila (2021) that teachers need to be resourceful while choosing the best teaching tools. Only if they assist learners in achieving the goal are learning aids, said to be appropriate and effective.

Most respondents agreed that however much audio-visual aids enhance students' academic performance by motivating them and increasing concentration during lessons, most teachers are reluctant to use it during learning process. 70% of the interviewed HODs attributed this to lack of electricity, teachers' heavy workloads or teachers' unwillingness to prepare or use media because they are time-consuming, inadequate training on the use of various instruction media, scarcity of funds for the acquisition of some media, teachers focusing on making students achievement in exam rather than refining their instruction method and finally, the training teachers underwent was more theoretical therefore they assumed that is the norm in the instruction practices. This finding is supported by the assertion by Muriithi (2005) that in Kenyan secondary schools, audio-visual aids employment in classrooms by teachers is extremely wanting. It also supports the works of Mutwiri et al. (2012) on the availability and application of electronic media in teaching Biology. He found out that about 73.53% of classroom teachers do not utilize video and Digital versatile Disc (DVD) while instructing biology students despite the fact that they have proved to catch and bring realism into the classroom. It further corroborates with research done in Sokoto Metropolis, Nigeria, where it indicated that insufficient or

improper use of instructional media may be to blame for students' poor academic achievement (Onyebuchi & Ibrahim, 2017).

Conclusion

The following conclusion was drawn based on the study findings; there was minimal use of available audio-visual aids in teaching biology in secondary schools of Nandi East sub-county, Kenya. Data revealed that there was a generally favorable presence of teaching and learning materials in the schools under review, with visual aids being particularly abundant. However, there remains room for enhancement, notably in the availability of audio-visual resources, which are found in less than half of the surveyed schools. Ensuring access to a wider array of resources, including audio-visual materials, can contribute to the creation of more engaging and effective learning environments that accommodate various learning styles and preferences. Schools might contemplate investing in additional audio-visual equipment and materials to further enrich the teaching and learning experiences for their students.

Research revealed discrepancies in the availability of audio-visual aids (AVA) among different categories of schools. Typically, higher-tier institutions such as extra-county schools demonstrate superior access to a diverse array of AVA, encompassing resources like computers, DVD players, overhead projectors with transparencies, and smart TVs, in contrast to lower-tier establishments like sub-county schools. Rectifying these discrepancies and guaranteeing fair access to AVA can foster more inclusive and efficient learning environments that cater to the needs of all students equally. Moreover, it was revealed that certain educators incorporate specific audio-visual aids (AVA) into their instructional methods more consistently, while others employ them less often. Elements like resource accessibility, technological familiarity, perceived efficacy, and personal teaching approaches can impact how teachers utilize AVA. Overcoming obstacles and offering assistance and training opportunities can empower educators to better utilize AVA, thereby enriching classroom teaching and learning experiences.

The research revealed minimal utilization of AVA, with smart TV being the least frequently used. According to student feedback, there are varying levels of AVA usage in teaching biology, with videos, slides, and films being moderately employed, while overhead projectors and transparencies are less commonly utilized. These findings indicate an opportunity for educators to diversify and improve their incorporation of AVA to create more stimulating and effective learning environments in biology classrooms. Enhancing the frequency of AVA usage can accommodate diverse learning preferences, reinforce concepts, and promote deeper comprehension among students.

According to teachers' feedback, there are differing levels of frequency in the utilization of audio-visual aids (AVA) during biology instruction. While some AVA options, like video and slide presentations, are used moderately, others, such as smart television and films, are less frequently employed. These results indicate potential areas for teachers to explore and integrate a wider array of AVA into their teaching methodologies, aiming to improve student engagement, understanding, and memory retention. Boosting the regularity of AVA usage has the potential to cultivate more lively and effective learning atmospheres in biology classrooms.

Based on research findings recommendation were given for the Ministry of Education to review the utilization and financing of audio-visual aids in schools, prospectus should be planned such that there are options to activity-based learning through audio-visual aids. In addition, government to fund purchase audio-visual aids in schools, Moreover, heads of schools ought to ensure financial budget

set aside for the acquisition of audio-visual aids materials is adequately spent in the purchase of required items in order to address instances of unavailability of the resource in many schools. There is also the need for the provision of in-service training to Biology teachers so as to acquire necessary skills and confidence in using audio-visual aids.

Arising from the study, there is need for further research so as to determine the most appropriate audio-visual aids for improve the academic performance of Biology in secondary schools. Secondly, similar studies be carried out in other Sub-Counties or entire Nandi County to find out if similar outcomes are obtainable so as to help to inform in policy making.

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