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Development of an Animation Package in Biology for Teaching Vertebrate, Anatomy, and Physiology

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A B S T R A C T S

Students learn faster at their best when they can the lesson is in concrete form as against the abstract. There is a need to design an instructional package in some science subjects like Biology. This study developed an animation package in biology for teaching vertebrates, anatomy, and physiology. The study employed the research and development research design. The animation package was developed with concepts of vertebrates, anatomy, and physiology.

A R T I C L E   I N F O

1. INTRODUCTION

Science and technology are closely related but not synonymous. While science tries to elucidate the natural world, technology dwells on the human-made world. Technology is a method of skillful utilization of ideas for the benefit of humanity. The practical application of scientific discoveries is applied in almost every aspect of human life. Technology is a body of knowledge that is devoted to creating tools and managing resources. People use technology to accomplish various tasks in life. This manifests in the types of food, clothes, shelter, and machines people use in daily life.

Information and Communication Technology (ICT) promotes innovations, increases productivity, and enriches the quality of life. The changes and services brought about by ICT have been quite transformative to the extent that even the socialization of the human species could be incomplete without being equipped with the necessary skills, knowledge, and motivation required to understand, cope with and benefit from the impact of ICT on all aspects of life (Babagana *et al.*, 2016). Technology is indispensable to human existence because it simplifies the way things are done. However, despite the benefits accorded to technology, it may be harmful if it is wrongly applied. There are lots of contributions as to how well technology can influence education. Technology is a powerful tool that supports and transforms education in many ways. Technology can be used by classroom teachers to construct instructional materials for teaching their students. Thus, in constructing instructional materials, a lot of creativity and ingenuity is required on the part of the teacher. The relevance of ICT in education and its contribution to all fields of knowledge had been investigated and proved by quite many researches. ICT offers access to a variety of data and digital information which the teacher can utilize for teaching and learning activities in the class. ICT also helps in understanding complex concepts that are abstract (Wambiri & Ndani, 2017). Thus, ICT is a tool and a way to enhance teaching pedagogy.

The teaching environment as viewed by Joshi (2022) does not necessarily present information that the student requires to know, but the environment enables the learner to make sense of the material presented. Given this development, Mayer (2002) stated that multimedia presentations motivate students' participation in active learning by mentally representing the educational materials in words and pictures and by making connections mentally between pictorial and verbal representations. The use of words alone may encourage low-ability students to engage in superficial learning that does not require the connection of words with other knowledge (Aloraini, 2022). Thus, the need for the development of the Animation package is empirical.

Animation is the manipulation of electronic illustration to create an illusion of moving images with the assistance of a computer. Animation is a rapid display of images to create an illusion of movement using a computer device. Research in educational technology revealed that when learning is associated with fun, students tend to understand better (Hanna *et al.*, 2021; Iida & Khalid, 2020). This has been scientifically proven that retention of information is higher when it is communicated using both visual and verbal communication (Moreno *et al.*, 2001). The combination of illustration, caption, narration and even sound gives an animation a unique status in advancing the level of education. The use of animated media for instruction can significantly enhance students' learning if properly planned and executed Wahyu & Sakti (2023).

Several kinds of research had been conducted concerning the application of computer animation in teaching-learning Biology. However, the most closely related study to the present work was those of Polk who investigated the effects of animation and static cartoons

on content retention in teaching cellular transport, protein synthesis, and mitosis as concepts in Biology. The findings of this study showed an overwhelming interest in the continued utilization of computer animation as a medium of instruction. Westhoff also examined the effects of computer animations on high school students' performance and engagement in Biology. Their findings revealed that computer animations accompanied by traditional teaching increase the performance of high school Biology students and should be recommended to aid the teaching of biological concepts. However, the two studies focused on animation applications and their implication on students' academic performance. But none of the studies focused on its implication on the college of education students' performance in vertebrate anatomy and physiology, which is the focus of this research.

Biology is one of the branches of science that deals with the study of living things. The discipline of biology is concerned with all the varied aspects of living organisms (Abimbola & Abidoye, 2013). Biology holds a great position in the school curriculum and is a focal point for many science-related disciplines. Biology is not just a body of scientific discoveries related to living organisms, but a continuing activity in which man tries to find the solution to his multifaceted problems in life. Thus, Biology is a rapidly changing and interesting discipline among students who have the desire to further their education in biology-related disciplines after completing their Secondary Education, Diploma, and or the Nigeria Certificate in Education (NCE).

Vertebrate, Anatomy and Physiology deals with the study of the structure and functions of animals with backbones, hence the name vertebrate column. Dent in his reaction to what constitutes difficulty in understanding the concepts in vertebrate anatomy and physiology asserts that the concepts involved memorization and lots of abstract thinking. This is because students were not able to link biological concepts to real-life situations. In support of this view, Yusuf and Afolabi (2010) claims that students' poor performance in Biology is because Biology classes are too large and vary in term of ability levels.

This study investigated the development of an animation package for teaching biology in Nigeria. Specifically, the study developed an animation package in Biology for teaching Vertebrate, Anatomy, and Physiology in colleges of education in Bauchi State, Nigeria;

This study provided answers to the following research questions: What are the processes involved in the development of an animation package in Biology for teaching Vertebrate, Anatomy, and Physiology in colleges of education in Bauchi State, Nigeria?.

2. METHODS

The study adopted the research and development design.

3. RESULTS AND DISCUSSION

As explained above, research question one was focused on the processes involved in the development of an Animation-package for teaching Vertebrate, Anatomy, and Physiology in colleges of education, Bauchi State, Nigeria. The research question was asked to ascertain the processes involved in the development of an Animation-package for teaching Vertebrate, Anatomy, and Physiology. The processes involved in the development of the Animation-package for teaching the selected concept in Biology were broken down into nine stages:

(i) Development of instructional objectives/content. Instructional objectives and instructional content have been developed in line with the NCCE minimum standard (2012) edition, which was later used by the researcher in the production of scriptwriting/storyboards.

(ii)   Scriptwriting, Storyboarding, and Narration. The process began with coming up with the idea and later proceeded to scriptwriting with a narration (voice recording), searching for relevant illustrations and other information that are considered paramount to the researcher in animation production. The scriptwriting helped the researcher in developing a storyboard of a visual representation of each scene in form of a comic strip with relevant illustrations and captions beneath each illustration. With the use of adobe audition software, which was part of the adobe creative suite, a microphone, and a personal computer, the already created script was read and recorded in wav form into the computer hard drive and formed the narration (voice recording). Following the narration of the instructional content as contained in the scriptwriting/storyboard, the following was achieved.

(iii)   3D Model: Layout and model sheets processes were skipped as the animation was meant for instructional purposes. Therefore, the storyboard was converted to a 3D model to produce good-looking animations. This was achieved using Blender software. Blender is a free and open-source 3D creation suite, specifically for 3D pipelines including modeling, rigging, animation, simulation, rendering, compositing, motion tracking, and video editing.

(iv)   Texturing and Shading: The next step was texturing and shading using image editing software, such as Photoshop. The models created were textured to achieve what is called Photorealistic qualities with the use of diffuse, specular, and bump/normal maps. Some of the shadier types used in this 3D animation were Lambert, Blinn/Phong, and Anisotropic.

(v)   Lighting and Rigging: The next stage was lighting and rigging. The created models were brought to life by placing light to illuminate them. Next to this was rigging, the process of adding a skeleton for the 3D models to be moved. This was simply done through "joint and skinning". The models were essentially given skeletons, which have various joints that allowed the bones to be animated. Thus, Adobe After Effects Software was used to add special effects such as lighting to the objects.

(vi)   Folder: A folder was created to move all the assets (six recordings; that is the narrations and the animated objects) for easy location while editing.

(vii)   Editing: The editing process began, this stage is very important, because all the assets created earlier were brought together meaningfully so that they adequately represent the script in a very visual and tangible form. The software used at this stage was Adobe Premiere Pro, another software from the adobe creative suite, which is mainly for video editing. While editing, all the assets in the already created folder were imported into the new project created in adobe premiere. The audio (that is the narration) was laid on the timeline first. The researcher carefully listened to the narration as each of the assets was placed in suitable areas so that the visual aligned with the narration. This process was followed until each of the episodes was completed. There are six episodes in the package.

(viii) Rendering: The next stage was rendering. This is a process whereby all the assets were fused into a given video format. In this case, the video format was rendered into H.264/Moving Picture Experts Group 4 (MPEG-4). This is a multimedia container format commonly used to store video and audio together. A total of 12 videos, each per episode. 1 main video and 1 video dedicated to the evaluation questions.

(ix)   Arranging into the interactive layout: In this stage, Adobe Flash, which is another software in the adobe creative suite was employed. Using codes and an artistic layout, all the videos were stitched together into a Small Web File (SWF) so that by clicking one

can navigate through the entire package to either watch, listen to the episode summary or take evaluation questions for each episode.

Some storyboards from the animation are shown in **Figures 1-24**.
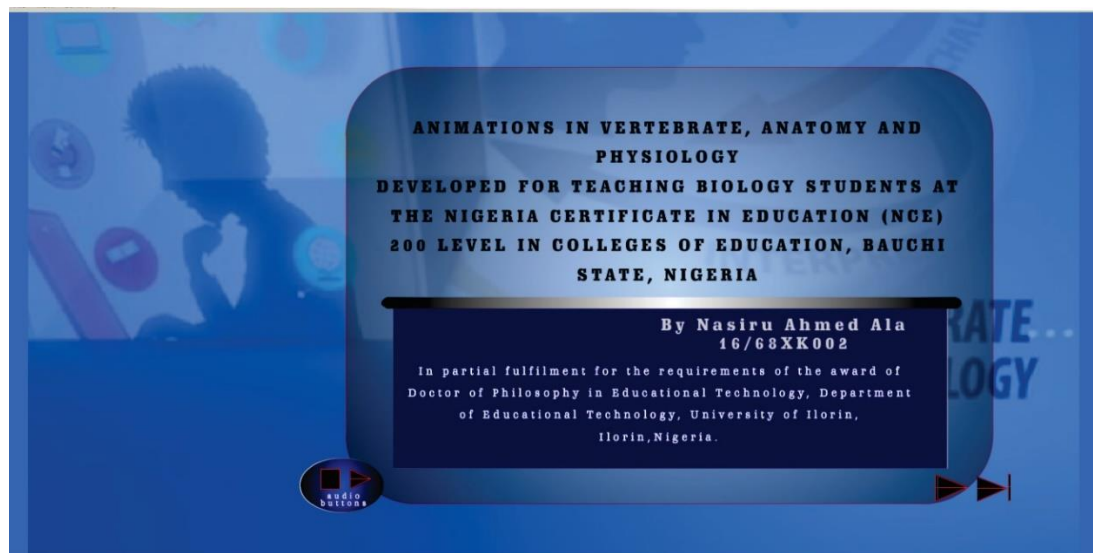
Figure 1. The appearance of storyboard 1.

Figure 2. The appearance of storyboard 2.

Figure 3. The appearance of storyboard 3.

Figure 4. The appearance of storyboard 4.
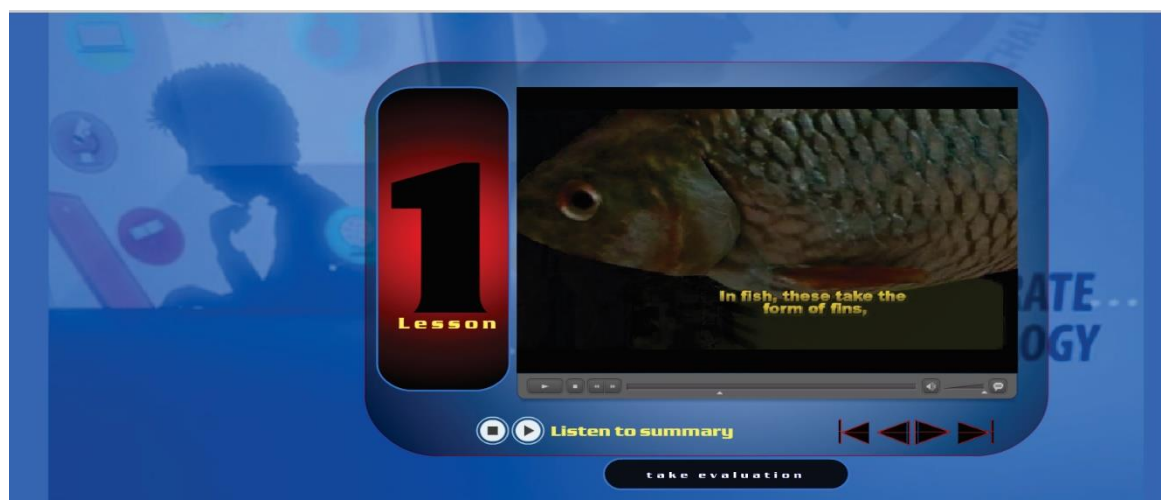

Figure 5. The appearance of storyboard 5.

Figure 6. The appearance of storyboard 6.

Figure 7. The appearance of storyboard 7.

Figure 8. The appearance of storyboard 8.

Figure 9. The appearance of storyboard 9.

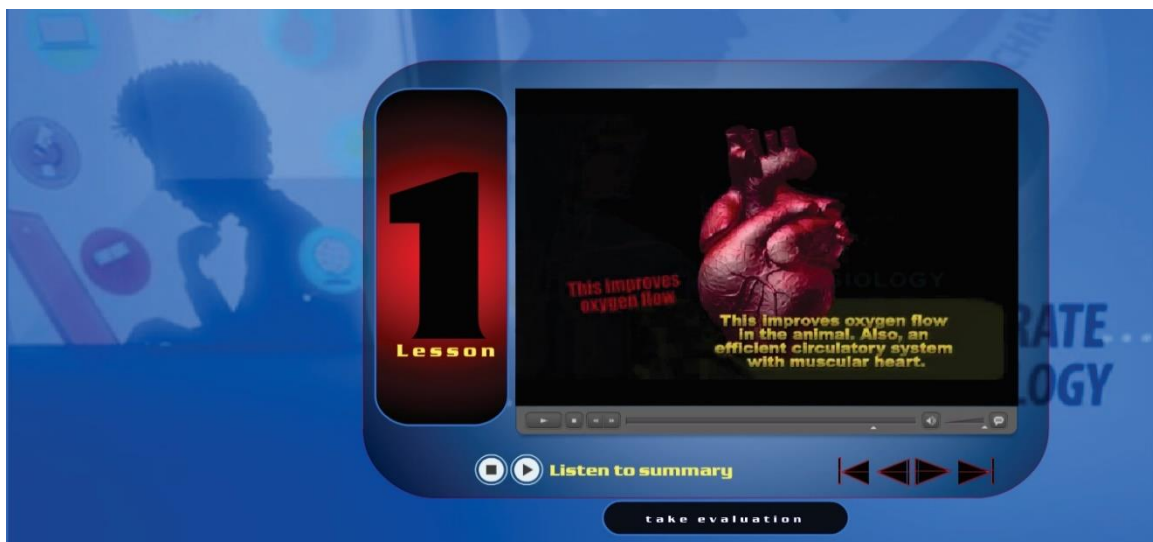**Figure 10.** The appearance of storyboard 10.

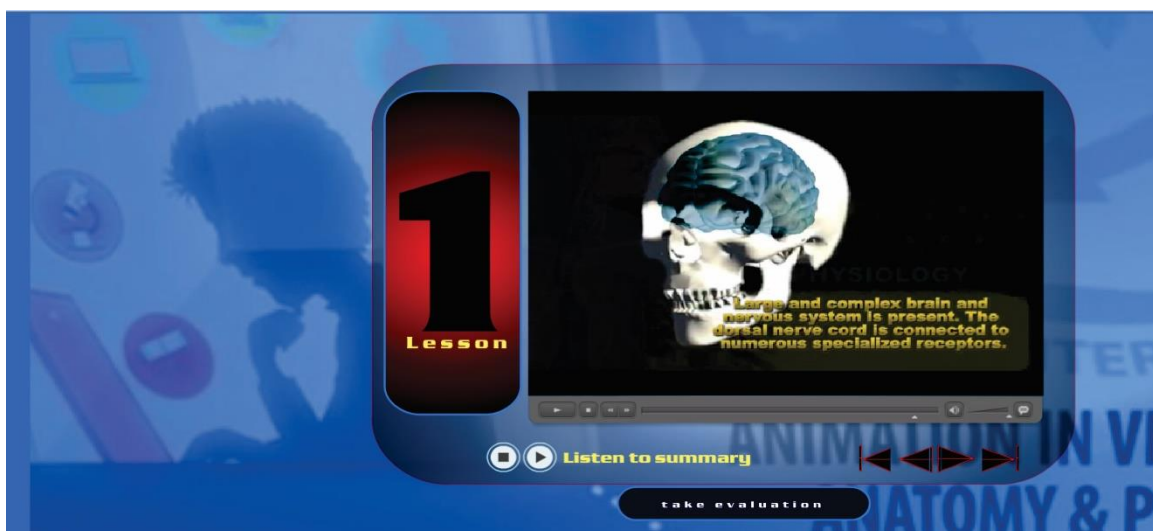**Figure 11.** The appearance of storyboard 11.

Figure 12. The appearance of storyboard 12.

Figure 13. The appearance of storyboard 13.

Figure 14. The appearance of storyboard 14.

Figure 15. The appearance of storyboard 15.

Figure 16. The appearance of storyboard 16.

Figure 17. The appearance of storyboard 17.
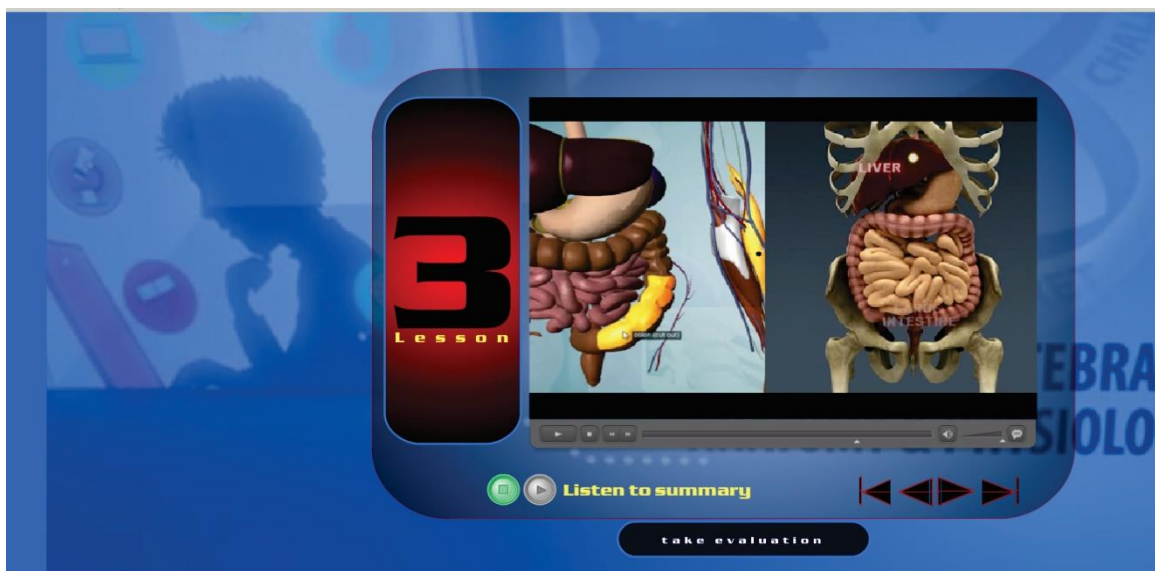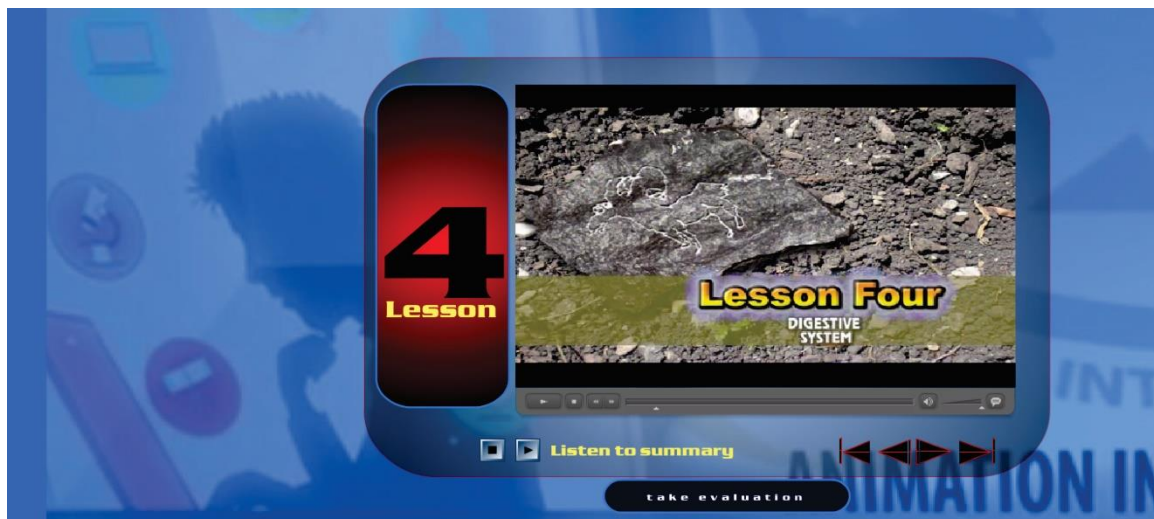

Figure 19. The appearance of storyboard 19.

Figure 20. The appearance of storyboard 20.

Figure 21. The appearance of storyboard 21.

Figure 22. The appearance of storyboard 22.

Figure 23. The appearance of storyboard 23.

Figure 24. The appearance of storyboard 24.

Figure 25. The appearance of storyboard 25.

One of the important attributes of the Animation-package is making learning real, permanent, and immediate. The results of the major findings indicated that students understand better when relevant and appropriate instructional media are used in teaching them. Animation-package is a step forward in this direction; it enables students to see and hear sound. This view is supported by Ayupratiwi *et al.* (2022) who made it clear that students

are more influenced by audio-visual stimuli than any other means of instructional delivery. Thus, the animation-package enhanced students' performance in Vertebrates, Anatomy, and Physiology in colleges of education in Bauchi State.

4. CONCLUSION

When a lesson is presented in tangible rather than abstract form, students learn more quickly and to the best of their abilities. In some science courses, such as biology, an instructional package needs to be developed. This project created a biology animation kit to teach students about vertebrates, anatomy, and physiology. The research and development research design were used in the study. Vertebrates, anatomy, and physiology concepts were used in the creation of the animation package.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Abimbola, I. O., and Abidoye, F. O. (2013). Views of Kwara State senior school biology teachers on the status of ecology teaching. *Journal of Curriculum and Instruction*, *8*(1), 1-10.

Aloraini, S. (2022). The impact of using multimedia on students' academic achievement in the college of education at King Saud University. *Journal of King Saud University-Languages and Translation, 24*, 75-82.

Ayupratiwi, T., Nandiyanto, A. B. D., Kurniawan, T., and Bilad, M. R. (2022). Online learning using audio-visual for elementary school students during the Covid-19 pandemic. *ASEAN Journal of Educational Research and Technology*, 1(2), 125-132.

Babagana, M., Idris, U. S. B., Chado, A. M., Ndagi, M., and Jibril, M. N. (2016). Biology teachers' perception of integrating mobile phones as instructional strategy in teaching senior secondary school students in Minna metropolis, Nigeria. *Benue State University Journal of Education (BSUJE), 16*(1), 66-74.

Hanna, H., Abdul, S. L., Cruz, A. D. B. D., Manalo, Z. T., Papna, F. M. L., and Falle, J. A. (2021). Game-based activity method: A case of grade 5 students. *Indonesian Journal of Teaching in Scienc*e, *1*(1), 13-16.

Iida, H., and Khalid, M. (2020). A paradigm shift from optimal play to mental comfort: A perspective from the game refinement theory. *International Journal of Informatics, Information System and Computer Engineering (INJIISCOM)*, *1*(1), 47-78.

Joshi, A. (2012). Multimedia: A technique in teaching process in the classrooms. *Current World Environment, 7*(1), 33-36.

Mayer, R. E. (2002). Multimedia learning. *Psychology of learning and motivation*, *41*, 27-29.

Moreno, R., Mayer, R. E., Spires, H. A., and Lester, J. C. (2001). The case for social agency in computer-based teaching: Do students learn more deeply when they interact with animated pedagogical agents?. *Cognition and instruction*, *19*(2), 177-213.

Wahyu, A. G. M., and Sakti, A. W. (2023). The effect of the implementation of animated learning videos on increasing students' motivation and learning outcomes in citizenship education during the covid 19 pandemic in junior high schools. *ASEAN Journal of Science and Engineering Education*, *3*(2), 139-148.

Wambiri, G., and Ndani, M. N. (2017). Kenya primary school teachers' preparation in ICT teaching: Teachers' beliefs, attitudes, self-efficacy, computer competence and age. *African Journal of Teacher Education (AJOTE), 5*(1), 1-15.

Yusuf, M. O., and Afolabi, A. O. (2010). Effects of computer assisted instruction (cai) on secondary school students' performance in biology. *Turkish Online Journal of Educational Technology-TOJET*, *9*(1), 62-69.