Attitudes of teachers toward the use of computer 3D animation in teaching biology

[1]Hassan Bob Rogers,   [2]Mary Nasibi
[1]Master of Science Education Student (Department of Educational Communication & Technology, School of Education, Kenyatta University)
[2]Lecturer Department of Educational Communication & Technology, Kenyatta University
Email: [1]rogershassanb@gmail.com, [2]NASIBI.MARY@ku.ac.ke

Abstract: *The objective of this study was to establish teachers' attitudes toward the use of computer 3D animation in teach biology. The study lasted about four weeks, involving 136 Form 2 (Grade 10) students and 13 biology teachers. Computerized 3D animations of the mammalian circulatory system and questionnaires were the instruments used for data gathering. During data collection, the 3D animations were projected unto a white-board to Form 2 students. The study was carried out using a mixed-methods approach. The study's findings established that biology teachers displayed favourable attitudes toward Computer 3D (C3D) animations during the course of the study. It was observed that the vast majority (100%) of respondents concurred that C3D animation improved their biology teaching abilities and methods. This may be due to the fact that the majority of respondents (teachers) concurred that using C3D animation to teach biology made the subject more engaging and helped to focus students' attentions while instruction was taking place. This improved the conceptual comprehension of students and the content delivery abilities of teachers. The views of biology teachers about the use of C3D animation did not appear to be negatively impacted by the teachers' ages as reported by previous studies. The majority of respondents (teachers) said they are willing to utilize C3D animation to teach biology, even though it takes more time and resources to plan C3D animation classes. Students' positive attitudes toward C3D animation were likely influenced by their teachers' positive attitudes, which makes it easier for students to learn difficult or abstract biological topics and concepts through visual 3D animation representations.*

Keywords: *Teacher Attitude, Perception, Computer 3D (C3D) Animation, Academic Performance.*

1. INTRODUCTION :

Teachers' attitudes with regard to the teaching profession demonstrate that a teacher attitude is a strong predictor of instructional efficiency (Bhargava & Pathy, 2014). A teacher's attitude, whether conscious or unconscious, has a significant impact on learners' academic performance and interest in learning. If a teacher does not appear to be engaged, concerned, or concerned about a specific approach, strategy, subject, or student, he or she will be unable to build an interactive learning environment. This means that teachers' attitudes toward their students, as well as teaching in general, are critical to students' academic performance (Omolara & Adebukola, 2015).

In the modern technological era, teaching and learning procedures have surpassed traditional approaches to education. Biology education and learning are considered to benefit greatly from and to a large extent require the usage of 3D animation content (Bhatti et al., 2017). Numerous intricate biological phenomena can be simplified and effectively described and taught with the use of multimedia learning. According to Cakiroglu and Yilmaz (2020) if teachers have ICT skills and the right content knowledge, then 3D animation can be applicable and effective in: enhancing visual elements that are pleasing to the eyes and convey a powerful and clear message quickly, allowing teachers and students to view biological processes that are abstract and cannot be experimented in elementary school, an efficient method of using amusement to convey complex ideas or knowledge, ensuring that students can easily retain what they have learned and sustain their long-term memory, and encouraging and keeping pupils' attention throughout instruction.

2. Objective of the study :

The objective of the study was to establish attitudes of teachers toward the use of computer 3D animation in teaching biology.

2.1 Research question

What is the attitude of teachers toward the use of computer 3D animation in teaching biology?

3. LITERATURE REVIEW :

Teachers Attitudes towards the Used of computer animation in Teaching Biology

An investigation was carried out by Parsons and MacCallum (2020) to probe the attitudes and perceptions specific to in-service teachers about the learning potential related to the use of simulation reality or augmented reality tools in teaching. The study was conducted in a workshop session with 85 teachers. In a workshop setting, teachers were given the opportunity to try out a variety of low-cost technological options. After trying out several simulations and augmented reality activities on computers and mobile devices that used free tools, the participants had the chance to make a simulation lesson a reality experience for teaching. The results showed that 27% of teachers had a favourable outlook on using simulations in the classroom. About 73% of teachers gave a negative or lukewarm response when asked about their perceptions on incorporating simulations into the classroom, saying things like: they don't like it; they are not sure how beneficial it would be; they don't think it's appropriate for high schoolers; they don't think students would benefit from it; they don't have the necessary ICT skills to make simulations work; it is too expensive to maintain. Seventy-three percent (73%) of teachers, who responded negatively to the use of simulation in education, do so because of deficit in ICT skills or proficiency. When all educators have been given the opportunity to learn how to utilize technology meaningfully in classrooms, simulation will likely be, widely accepted as a tool for instructing students of all ages and abilities.

A teacher's attitude is his or her behavior or actions as he or she goes about doing what is expected of a teacher, especially those actions that have to do with guiding and directing students' learning (Mondal, 2020). Now a day, smart phones are common among secondary students in our schools. Schools' administrator can put regulations to guide teachers and students to use smart phones in schools for ICT instruction to support animations for conceptual understanding in the sciences in learning environments where laboratory demonstrations are serious challenge.

A study was done to determine biology teachers' attitudes in high schools about using computer animation (augmented reality) to teach biology. An exploratory research approach was taken for the design of the study. The discussions were semi structure employed by researcher to collect information. The finding of the study reveal that many teacher participants had limited background knowledge of Simulation Reality (SR) and could not even imagine what such an application might look like. Negative conclusions can be drawn from the data collected about teachers' attitudes and perspectives on the implementation of SRs in teaching which include the following: SRs demands a lot of time and energy (50% said SR incredibly makes them busy and that they actually do not have the space/time to work on a new technology or idea and to use it in their lessons), it is because students are not used to such approach, it is not working in many schools, or it takes too much of the teachers' time whilst the students become nothing wiser, schools do not promote innovative learning or use of technology in learning, as administrators considered such approach cost-effective, lack of ICT facilities and unfamiliar with SRS, and skeptical or conservative colleagues (Jansen, 2020). According to these findings, teachers would rather stick with the traditional teaching approach they have always used rather than adopt the more cutting-edge strategies recommended by the SRs. These findings can provide some insight into the reasons why teachers, particularly in rural school settings, possessed little to no interest in the use of scientific research in their classrooms. In this current study conducted, the researcher investigated factors challenging teachers to adopt teaching biology using computer animation which was a gap found in the reviewed study.

Biology teachers in Siberia Education setting perspectives on the application of computer 3D models relating towards the mindsets of teaching staff and four distinct factors in teaching biology: age, teaching experience, and the ability of teaching staff to use contemporary teaching tools. Fifty-four biology teachers participated in the study. Using questionnaire forms as primary data gathering tool. The results showed that instructors had favourable attitudes to computer 3D in biology education. Moreover, the researcher proffer in their findings there is a substantial connection with variable listed above plus instructor attitudes toward 3D animation. Furthermore, the findings also showed that 87% of biology teachers have a positive attitude (ranging from a moderately positive attitude to a strong positive attitude) for 3D animation, while the remaining 13% categorized as having a reasonably unfavorable tendency were teachers. No

instructor had a very unfavorable views against 3D animation in teaching biology. The obtained results for Age and teaching experience posited that as teachers' age and teaching experience grew, instructors' attitudes changed toward computer animation implementation was less favourable. Teacher's competence in using modern teaching aids: 81.48% of biology teachers clarified that they had been either completely incompetent or just generally incapable of using modern technology while teaching biology. The remaining 18.52% stated they were knowledgeable in using fewer aid such as PowerPoint and Photoshop which are limited in CS when teaching biological processes or phenomena (Županec et al., 2014). The gap found in this study is geographical. The current study was carried out in Kenya to fill in the geographical gap and findings be compared with previous study for discussion and generalization.

In a survey study conducted by Pasalidou and Fachantidis (2021) involving 206 Greek primary school teachers to investigate teachers' perceptions and attitudes about educational application of cell phone augmented reality simulation in teaching contents from the curriculum that involve actual society scenarios through the use of gadgets. Teaching staff were educated about the implementation and asked for their thoughts on smartphones through the utilization of mobile devices simulation the actuality of said teaching methods succeeding experimenting with the smart phone simulation. The researchers in their findings reported that instructors' intentions to utilize a smartphone simulation were welcoming and considered the mobile simulation useful and easy to use in teaching their students. Sixty-seven percent (67%) of teacher reported not been familiar with simulation apps used for academic achievement in the past. Moreover, 98% of teachers showed positive attitudes for the mobile simulation in teaching by stating that it improved the efficiency, success, and productivity of their instructions. The research's summary of findings entails that when instructors become familiarized instructing with computer simulation and acquired the skills in operating simulation application for teaching purposes they will demonstrated positive attitudes in implementing simulation teaching in their classrooms.
The gaps found in the reviewed literature under this theme is sampled participants-primary teachers. This gap was targeted and filled by conducting this current study with secondary biology teachers. Findings from this study was compared to previous studies review to confirm and generalize its findings.

4. MATERIALS AND METHOD :
The instruments utilized for data collection were questionnaires and computer 3D animations pertaining the mammalian circulatory system. The 3D animations were presented to Form 2 students (grade 10 students) during data collection. The questionnaires were presented to biology teachers after presentations of C3D animations. The questionnaires presented to biology teachers had two sections. Section A consisted of questions for collecting data on teachers' backgrounds, which included years of teaching experience, age, gender, and qualification(s). Section B consisted of statements related to teachers' attitudes toward the use of computer 3D animation in teaching biology.
A mixed method approach was employed to conduct the study. According to Dawadi et al. (2021) a mixed method research approach is appropriate when an investigator wishes to interpret a phenomenon or notion in detail for a sampled group while also generalizing the findings to the general group. Data were collected qualitatively through questionnaires and quantitatively analyzed using frequencies, percentages and bar graphs to determine the participants' (teachers') attitude towards the use of 3D computer animations in biology teaching. Thirteen biology teachers and one hundred and sixty second graders (10th grade students) participated in the study.

5. DATA COLLECTION ABD ANALYSIS :
Teachers were informed that the information in the questions were intended to gather information on teachers' attitudes and perceptions towards the use of computer 3D animation in teaching content in biology related to diagrams. Teachers were informed that the data they provided will be handled with confidence and for educational purposes only. With the aid of a 5-Point Likert scale, data collected from the questionnaire filled in by teachers indicated their responses and choices which best indicated their attitudes toward computer 3D animation. For simplicity and ease of data analysis and presentation, the following: Strongly Disagree = SD, Disagree = D, Not Sure = NS, Agree = A, Strongly Agree = SA, were condensed into the following: Agree and Strongly Agree into Agree (A), Strongly Disagree and Disagree into Disagree (D) and Not Sure (NS) remain constant. The data were coded and entered in to SPSS (Statistical Package for Social Sciences) Version 20.00. Bar graph, percentages, and frequencies were employed for data presentations and analysis.

6. FINDINGS :
Table 1 displayed the gender, age, educational levels, and years of teaching experiences of respondents (biology teachers).

Table 1: Demographic Data of Respondents (Biology Teachers)

Gender	Frequency	Percent (%)
Male	6	46.2
Female	7	53.8
Total	**13**	**100.0**
Age Range (in Years)	**Frequency**	**Percent(%)**
20 – 30	5	38.5
31 – 40	4	30.7
41 – 50	2	15.4
51 – 60	2	15.4
Total	**13**	**100.0**
Highest Level of Education	**Frequency**	**Percent(%)**
Bachelor	12	92.3
Master	1	7.7
Total	**13**	**100.0**
Years of Teaching	**Frequency**	**Percent(%)**
1 – 10	8	61.5
11 – 20	2	15.4
21 – 30	1	7.7
31 – 40	2	15.4
Total	**13**	**100.0**

Table 2 summarized the responses indicated by biology teachers gathered from the questionnaires, which is presented in frequencies and percent.

Table 2: Teachers' Attitudes Toward the Use of C3D Animation

Types of Response			
D = Disagree NS = Not Sure	A = Agree F = Frequency		
	D	NS	A
No	**Statements**	**F(%)**	**F(%)**	**F(%)**

No	Statements	F(%) D	F(%) NS	F(%) A
1	I use computer 3D animation in teaching biology	4(30.8)	2(15.4)	7(53.8)
2	There is no support from the administration to help me implement computer 3D animation in teaching biology	12(92.3)	0 (0)	1(7.7)
3	Computer 3D animations can make learning biology more interesting	0 (0)	0 (0)	13(100)
4	Computer 3D animations can improve my teaching skills	0 (0)	0 (0)	13(100)
5	I am confident when it comes to working with computer 3D animation in teaching biology	1 (7.7)	3(23.1)	9(69.2)
6	The application of computer 3D animation in teaching biology requires administrative support	1(7.6)	2(15.4)	10(77.0)
7	The use of 3D animations in teaching biology help to capture students' attentions	0 (0)	0 (0)	13(100.0)
8	Computer 3D animations allow easier understanding of biology than teaching without them	0 (0)	1(7.7)	12(92.3)

7. DISCUSSION OF FINDINGS :

Based on the responses given and summarized in Table 1 the overall attitudes of teachers toward C3D animation was positive. It was observed that majority (100%) respondents agreed that C3D animation improved their teaching skills/practice in biology. This may stem from the fact that majority of the respondents (teachers) agreed that teaching biology using C3D animation made learning biology more interesting and captured and focus students' attentions during instructional time. This resulted in enhancing students' conceptual understanding and thereby enhancing teachers content delivery skills. Moreover, majority of the respondents agreed that when C3D animation is employed in teaching biology, it enhances understanding of content (lessons) presented by teachers than teaching without C3D animation. However, to have these outcomes achievable, teachers need administration supports at all levels. Slightly more than three-quarters (77.0%) of teachers asserted to this. Sourcing and maintaining these resources are costly to be done by teachers solely. With administration support, these hurdles can be minimized, allowing teachers to achieve their objectives.

In addition, approximately more than half (53.8%) of respondents agreed that they employed C3D animation in teaching biology, whereas a combine percent of 46.2% respondents indicated they do not teach biology using C3D animation. Teachers not employing C3D animation in teaching biology might be due to those teachers lacking the confidence and basic skills needed to solve technical problems in C3D animation. This deficit can be solved by administrators helping teachers to gain such skill and confident by offering needed ICT training. A small percent of 7.7% of respondents agreed that there is no support from administration to aid them employ C3D animation in teaching biology while 92.3% indicated that administration do support them. It was also observed that a combined percent of 30.8% respondents lack the confidence and were not sure they were able to employ C3D animation to teach biology while 69.2% indicated they were able to do so.

Teachers demonstrated positive attitudes toward C3D animation for enhancing conceptual understanding of students in teaching and learning biology. During the study majority of the respondents agreed that teaching biology involving C3D animation made learning biology more interesting, did capture students' attentions during instructional time, allowed easier understanding of content (lesson) presented by teachers, and enhanced teachers teaching skills in content delivery (which is usually abstract) in biology. Pasalidou and Fachantidis (2021) reported similar findings in their study involving Greek primary teachers by stating that 98% of teachers reported computer animations that it improved the efficiency, success, and productivity of their instructions.

Age and years of teaching experiences were two of the many factors reported by Županec et al. (2014) to negatively affect teachers attitudes toward computer animation in teaching biology. They further stated that, as teachers' aged, their attitudes changed toward the use of computer animation became less desirable (negative). Županec et al attributted this egative attitude to teachers' advance age (teachers approaching retirement) stating that C3D animation require lot of time and energy inplanning and demonstration, and make students reliant on teachers for information. Contrary to Županec et al. findings, the researcher did not find age and years of teaching experiences to negatively affect teachers' attitudes toward C3D animations, as majority of the teachers supported C3D animation intervention.

8. RESULTS :

In addition, the question to be answered in this section from the data collected was: what are the attitudes teachers have toward the use of computer 3D animation in teaching biology? Majority of teachers (92.3%) expressed favourable attitudes toward C3D animation for improving students' conceptual understanding in teaching and learning of concepts considered challenging or abstract in biology. Majority of the teachers demonstrated that C3D animation improved their teaching skills in biology contents delivery. Furthermore, teachers' age did not appear to have a detrimental impact on biology teachers' attitudes toward the usage of C3D.animation. Despite the fact that planning C3D animation lessons requires more time and resources, the majority of respondents (teachers) stated that they are willing to use C3D animation in teaching biology. The favourable attitudes of teachers toward C3D animation undoubtedly generate favourable attitudes in students toward C3D animation, allowing them to understand challenging concepts in biology with ease through visual representation.

9. CONCLUSION :

The study's findings showed that most teachers displayed a positive attitude toward C3D animation, and were eager to use C3D animation in their lessons to help students understand biological processes that were difficult for students to grasp when taught using conventional methods. Based on the findings of the study it can be concluded that computer

3D is more effective in enhancing students' conceptual understanding of the mammalian circulatory system than the traditional mode of teaching. In addition, biology teachers and students were motivated by the 3D animation demonstration of the mammalian circulatory system. Moreover, biology teachers also considered incorporating biological 3D animation into their classrooms as a teaching aid in order to enhance their content delivery skills as well as students' conceptual understandings of abstract concepts in biology.

10. RECOMMENDATIONS :
The following recommendations were made based on the findings of the study for further research.
- Teachers training institutions see the need for biology teacher and students of biology education presentations skills with C3D animations be enhanced to teach biology.
- Further study need to be done to investigate how schools' administrators would help source 3D animation teaching and learning resources for biology teachers to help ease the challenges teachers encounter when sourcing 3D animation.

REFERENCES :
1. Bhargava, A., & Pathy, M. K. (2014). Attitude of Student Teachers. *Turkish Online Journal of Distance Education-TOJDE*, *15*(3), 27–36.
2. Bhatti, Z., Abro, A., Gillal, A. R., & Karbasi, M. (2017). Be-educated : Multimedia learning through 3D animation. *International Journal of Computer Science and Emerging Technologies*, *1*(1), 13–22.
3. Cakiroglu, U., & Yilmaz, H. (2020). Using videos and 3D animations for conceptual learning in basic computer units. *Contemporary Educational Technology*, *8*(4), 390–405. https://doi.org/10.30935/cedtech/6207
4. Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-Methods Research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*, *2*(2), 25–36. https://doi.org/10.46809/jpse.v2i2.20
5. Jansen, C. J. (2020). Exploring attitudes towards augmented or virtual veality for biology and mathematics teachers in Dutch secondary education. *Journal of Science Education and Technology*, *11*(8), 133–1338. https://dspace.library.uu.nl/handle/1874/397610
6. Mondal, A. (2020). Simulated teaching – Modification for teacher behaviour. *Teacher Educatio*, *4*(4), 1–6.
7. Omolara, S. R., & Adebukola, O. R. (2015). Teachers' attitudes: A great influence on teaching and learning of social studies. *Journal of Law, Policy and Globalization*, *42*, 131–137. https://bit.ly/2YGnqCo
8. Parsons, D., & MacCallum, K. (2020). Comparing the attitudes of in-service teachers to the learning potential of low-cost mobile augmented and virtual reality tools. *World Conference on Mobile and Contextual Learning*, *7*(15), 33–40.
9. Pasalidou, C., & Fachantidis, N. (2021). *Teachers' perceptions towards the use of mobile augmented reality: The case of Greek educators* [Master thesis,University of Macedonia]. https://doi.org/10.1007/978-3-030-49932-7_97
10. Županec, V., Miljanović, T., & Parezanović-Ristić, S. (2014). Biology teachers' attitudes toward computer assisted learning. *Archives of Biological Sciences*, *66*(3), 1281–1289. https://doi.org/10.2298/ABS1403281Z