Novelty Journals

ISSN 2394-9686

International Journal of Novel Research in Education and Learning
Vol. 6, Issue 6, pp: (5-11), Month: November - December 2019, Available at: www.noveltyjournals.com

Effectiveness of animated video on Secondary School students' Conceptualization of Electronics in Kakamega-County of Kenya

[1]Esokomi Solomon Nuni, [2]Prof Francis Indoshi, [3]Dr. Joseph Rabari, [4]Dr Maurine Kangahi

[1]PhD Candidate, School of Education Maseno University, Maseno, Kenya.

[2]School of Education Maseno University, Maseno Kenya

[3]School of Education Maseno University, Maseno, Kenya

[4]School of Education Maseno University, Maseno, Kenya

Abstract: **The era of Information Communication and Technology (ICT) is characterized by unprecedented pace of technological development witnessed in the current society. Electronics, a branch of Physics, forms the basic block for the development of technologies of smart phones, projectors, interactive boards, computers, radio, television, remote controls and autopilot systems. However, according to Kenya National Examination Council reports (2014 and 2016) the topic electronics, is difficult to a majority of candidates at the Kenya Certificate of Secondary Education (KCSE) Physics Examinations, with many candidates performing poorly throughout the nation on the topic. The reports attribute the dismal performance of students in topic due to lack of apparatus in secondary school laboratories. Furthermore, research studies reviewed indicate that Physics teaching in secondary schools in Kenya in done through chalk and talk as opposed to experiments. Therefore, there was need to seek alternative teaching materials, which enable learners in secondary schools to conceptualize the electronic content. An animated Electronic video downloaded from *YouTube* and titled "Transistors, How do they work" and is an open source found at https://www.youtube.com/watch?v=7ukDKVHnac4. The video package is one such alternative resource which can be used to teach the topic electronic. Animations in the video illustrate abstract concepts of band theory, doping, depletion layer and biasing of diode which are essential to understanding of the topic electronic. The objective of this study was to establish whether student achievement was affected by use of the animated electronic video. This research employed Solomon Four quasi-experimental non-equivalent group pre-test post-test randomized control group design. A sample of 160 Form 4 (Grade 12) learners from four schools was involved in the study. The research tool used was Electronic Achievement Test (EAT) which measured students' performance on electronics at secondary school in Kenya during pre-test and post-test for both the experimental and control groups involved in the study. Cronbach's alpha (α) coefficient was used to determine reliability of the tool. Data were analyzed using t-test and analysis of variance (ANOVA). The t-test was used to test the difference in the mean scores of the pre-test while ANOVA was used to establish the differences between the experimental and control groups on the post-test mean scores. Statistical Package for Social Science version was used to analyze the data. Hypothesis was tested at coefficient alpha significance level of .05. Pretest-posttest analysis indicated a significant difference between the students taught with conventional instructional materials and those taught with the animated electronic video ($F_{(3, 158)} = 15.71$; $p = .000$). The researcher concluded that the animated electronic video is an effective resource for teaching electronics and teachers should be encouraged to employ it in their teaching of Physics and teacher trainers should make it part of the teacher training curriculum.**

Keywords: **Conceptualization of electronic concepts, Animated Electronic Video, ICT integration in education.**

International Journal of Novel Research in Education and Learning
Vol. 6, Issue 6, pp: (5-11), Month: November - December 2019, Available at: www.noveltyjournals.com

1. INTRODUCTION

The Ministry of Education Science and Technology (MoEST) Kenya and other education stakeholders in Kenya have made significant investment in computer-based information technology to support teaching and learning process in both Primary and Secondary schools. The Ministry of Education Science and Technology is investing in ICTs because the devices can be utilized in teaching and learning in areas of simulations, computer data acquisitions, animations and internet search. According to Ambikairajoh, Sheng, Celler and Che (2005) ICT utilization enables students to participate actively and pay maximum attention and their interest is a roused rapidly during the learning process. Ilonanusi and Osuagwu (2011) noted that ICTs help in lesson delivery and make education and information accessible to whoever needs it. Further, Iloanusi *et al* (2011) observe that ICTs enable teachers to have a greater control over their lesson presentations and delivery, through the use of simulations software, teachers try to make abstract concepts more concrete for students understanding. Iloanusi *et al* note that ICT helps self-paced learning through various tools such as assignments, tutorials and research which address different learning styles and continuous assessment of student's progress. ICT also removes inequalities of gender, colour, race, country and religion among students.

Student Performance in Physics

Physics education in Kenya is plagued with many problems; top on the list is dismal performance by learners in national examination despite all efforts by teachers, education officers and other stakeholders in education. According to Njoroge, Changeywo and Ndirangu (2014) the overall students' performance in Physics at Kenya Certificate of Secondary Education (KCSE) is poor coupled with low student enrolment. Njoroge *et al.(*2014) attributes this sorrow state to use of expository teaching methods which are ineffective in inculcating content knowledge, conceptual knowledge and science process skills that make up quality Physics teaching. Reacting to 1999 performance in Kenya Certificate of Secondary Education (KCSE), Ndirangu (2003) argued that secondary schools graduates showed little mastery of the Physics subject. According to Wambugu and Changeiywo (2008) Physics subject is classified as difficult subject, not popular, avoided by many students and with poor performance in Kenya. Students' performance in Physics national examination and especially topic electronic has remained poor and students' performance in the topic electronic is generally low as compared to other topics of the Physics syllabus. For instance results for the period 2014 to 2016 indicated that the average national mean score in the subject remained below 30 per cent. This demonstrates that the level of competency in Physics by a majority of graduates at secondary schools in Kenya was low.

Applications of ICT in Physics Classroom:

According to Reja (2016), ICT refers to a range of electronic tools for storing, displaying and exchanging information and for communicating. UNESCO defines ICT as, the combination of informatics technology with related technologies, especially communication technology. As such the three words, information, communication and technology, used together, have required special meaning in the field of education and have become an integral part of modern teaching and learning process. ICT is therefore facilitating information, dissemination and communication in all areas of education and training. According to UNESCO, integrating technology into education can help to bring quality education to everyone, everywhere which is key goal of education. The citizens of the future must be equipped with sufficient knowledge to keep up with technological advances. Besides, ICT is also being used in facilitating distance learning. It is enabling online designing of courses, online delivery of course, computer-aided teaching, online assessment, management and networking of a large number of educational institutions. According to Reja (2016) ICT has revolutionized the entire concept of education, learning and research by offering new opportunities and challenges in creation and dissemination of information via Web TV's, Net PC's and Web-based education independent of time, pace and location of the learners. The term ICT further includes any communication devices like CD Rom, the internet, Television and Radio, Image capturing devices including video cameras, mobile phone, sensing, data logging control application, e-content, e-book and multimedia representations. Therefore, handling of ICT in the classroom by teachers will definitely change the very nature of instructional processes. If teachers use technology in the classroom effectively it is likely to reinforce higher order cognitive skills among the learners. The teachers must realize that to enhance the teaching methods they must blend technology with pedagogy in order to gain student attention. Thus ICT can improve the quality of education by improving students' motivation, personalizing student learning, enhancing student critical thinking, giving feedback, enhancing quality of presentation, improving teacher education, improving the efficiency of education planning, policy making and management organization of schools. Peeraer & Petergem (2011) concur by noting the following ICT benefits to schools

in several ways: enhancing learning in classroom; improves management (in terms timetabling, record storage, secretarial work like typing of meeting minutes, examinations and letters); improves accountability; efficiency and effectiveness in school activities and use of PowerPoint presentations and internet search. Literature further shows that if ICT is well-utilized in schools it has the potential to enhance the teaching and learning process in many ways, such as engaging students in learning since it is generally learner centered. Research further shows that students are motivated when learning activities are challenging, authentic, multi-sensorial and multi-disciplinary. Dozidonu (2010) established that students report higher attendance, motivation and academic accomplishment as result of ICT programs in schools. Hennessey (2010) takes a cautionary view by stating that putting ICT infrastructure in schools does not itself create a stimulating learning environment that is about shifting the culture of classroom teaching and the ethos of schools. Computer can be put to different uses in the Physics classroom. According to Aina (2013), computers a can be used in the teaching Physics in the following ways simulation, computer data acquisition, animations, internet search and many more. For instance educational software can be used to teach difficult concepts or observe difficult skills in Physics. Aina still observes that teaching of electric motor in Physics can be done with the aid of Encarta Educational software. The rotation of the coil in the magnetic field will best be appreciated by students when seeing it demonstrated through the software. Most Physics teachers cannot explain the mechanism of either electric motor or generator to the students properly because its complexity, when demonstrated in a computer through the software the problem of complexity will be over and students' learning enhanced.

Video in Teaching

The usefulness of teaching using videos in classes has been shown in a wide range of subjects including social studies, science, mathematics, English/languages arts and reading (Bell & Bull, 2010). Showing a video does a number of things to help the instruction of class: reinforces the concept, helps visual learners, and gives the students a break from listening to the teacher talk. Today's students' are more visually oriented than the previous generations (Tucker & Courts, 2010). Chicago's public schools (Gillepie, 2007) and Philadelphia's college of Medicine (DiLullo, Coughlin *et al*. 2006) have shown an improvement in students test score with use of in-class videos. These types of in-class videos have been found to provide additional clarity and guidelines to beyond traditional classroom (Lachs, 2002). One reason for this observed improvement is that the videos and other multimedia provide an opportunity to visualize the concepts. The advert of free, streaming media has drastically increased the availability of instructional media for classroom use. Streaming videos off the website, such as YouTube, has been shown to be beneficial for educational purpose by (Timar & Karpati, 2011). Yusuf (1997) found that there was no significant difference between the high and medium achievement level, and between students of medium and low achievement levels when taught social studies using video instruction. This was supported by Yusuf (2004) who revealed that the achievement levels had no influence on academic performance of learners. However, other studies revealed that high ability students do perform better than low ability students (Aluko, 2004: Fajola 2002). According to Brekke and Hogstad (2010) video is another resource that can be used in teaching and learning Physics. Brekke and Hogstad (2010) note the SimVideo are interactive learning tools integrated with SimReal which contains video-lecturers, video-simulations, interactive simulations, task review and application for opportunities for continuous exchange between different elements without losing the focus in the temporarily abandoned item. What is not reported in the literature reviewed is the use of video in teaching topic electronics in secondary schools hence this study was conceptualized.

Challenges of ICT integration in Schools:

Reja (2016) notes the following as some of problems and challenges faced when integrating ICT in education: lack of sound National ICT and Educational policy, a huge percentage of teachers are illiterate ICT, teacher training institutions are not fully equipped to train teachers in ICT and lack of connection between ICT policy makers and the education sector. According to Farrell (2007) the government of Kenya placed considerable emphasis on the importance of ICT in schools. The Ministry of Education Science and Technology has taken steps to support the implementation of the strategy either by direct actions or through various organizations and agencies it works with. There are also other institutions and organizations that continue to be active in the implementing and supporting projects in public schools like Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) and the Teachers Service Commission (TSC). A study by Kwake and Adigun (2008) noted that the Kenya government was working towards establishing a master plan for e-government and e-commerce strategies to make public institutions efficient, accountable, transparent and more democratic in their operations. The study revealed that the government planned to spend US $ 5.84 billion (Ksh. 497.25

billion) by 2015 to connect rural areas on the power grid and fixed telephone lines. These are efforts directed at enabling the large rural population to excess ICT and in particular primary and secondary schools. According to Laaria (2013) implementation of ICT in Kenyan schools has remained elusive since most schools are not connected to electricity grid, have no capacity to buy the required infrastructure and school leaders and teachers are either computer illiterate or technology ignorant, though the current global technology changes emphasis digitalization and modernization of the all sectors including school classrooms. Despite the apparent benefits of the use of ICT in classrooms for teaching and learning , research shows that many teachers are not implementing it, thus depriving learners and the school community access to the potential of ICT in the instructional process especial the use of the video (Manduku, *et al*. 2010). It is with this background that this study set out to establish the effectiveness of animated video on the conceptualization of electronic concepts at secondary school in Kenya.

2. MATERIALS AND METHODS

This study was carried out to determine the comparative effect of use of animated electronic video and conventional instructional materials on secondary students' conceptualization of the topic electronic in Kakamega County, Kenya. The study was conducted during the first term of the academic 2018 in Kakamega Central sub-county. The primary purpose of this study was to undertake a comparative analysis of the effectiveness of an electronic animated video and conventional instructional materials used in secondary schools to teach the topic electronic at form four (4) level.

Research Question

The following research question was raised to guide this study:

- What is the difference in the achievement of students taught electronic concepts using the conventional materials and those taught using the electronic animated video.

Research Hypothesis

The following null hypothesis was formulated from the research question and tested at $p = .05$ so as to obtain answer the question of this study:

- There is no statistically significant difference in mean achievements in the topic electronic between students taught using an electronic animated video and those taught using conventional instructional materials

3. RESEARCH DESIGN

The research design was Solomon Four design employing quasi-experimental design, the pretest-post non-randomized control group design, carried out in four secondary schools in Kakamega, Central Sub-county of Kakamega County of Kenya.

Sample and Population:

The population comprised fifteen (15) secondary schools in Kakamega Central Sub-county, Kakamega County. Four secondary schools from the sub-county were randomly sampled and assigned to the experimental groups of the study. Intact classes of secondary students at Form 4 (Grade 12) formed the experimental and control groups of the research design. The Form 4 students in the sampled schools were made to belong to one group to avoid inter-group contaminations. The independent variable in this study was the use of conventional materials and electronic animated video in teaching topic electronic at secondary school. The dependent variable was the students' score obtained from research designed Electronic Achievement Test (EAT). The assigning of sampled school to the treatment groups is shown in Table 1.

Table 1: Experimental design

Group	Pre-Test	Treatment	Post-Test
E1	O_1	X (Electronic Animated Video)	O_2
C1	O_3	C (Conventional Materials)	O_4
E2		X (Electronic Animated Video)	O_5
C3		C (Conventional Materials)	O_6

Research Instrument:

The instrument used in this study was researcher designed-designed Electronic Achievement Test (EAT). The Electronic Achievement Test consisted of twenty (20) structured questions from the topic electronic taught at Form Four (4) level in Kenyan education system. The students were required to answers all the questions on the test in the spaces that were provided and were allowed to complete the test in one hour. The student score on the EAT was used to measure the achievement of the student in both pre-test and post-test. Intervening extraneous variables of the study like teacher effect, group interaction were controlled by random assignment of the groups to control and experiment as well as the presence of the researcher and the Physics subject teachers in the respective schools sampled.

Validation of Research Instruments:

The instrument was subjected to face and content validation using test blue print and item specific table analysis. The items were carefully drawn to ensure that they fell within the scope and depth of the form four Physics syllabus and the specific electronic area selected for this study. The items were also referred to experts in science education for criticisms and their input influenced modifications of the entire test.

Data Analysis:

The mean, standard deviation, t-test and ANOVA statistical analysis were used in this study. Scores of the different groups were computed and used in testing the study hypotheses. The significance adopted for the analysis was p = 0.05. The level of significance formed the basis for or rejecting each of the hypotheses formulated.

4. RESULTS

The research question raised in this study was formulated into a null hypothesis which was tested to provide the answer to the research question of the study. Analysis of the pretest and posttest data collected from means of the students taught with the conventional materials and students taught with the animated electronic video were used to test the research hypothesis. Means, standard deviations, t-test and ANOVA were employed in analyzing the pretest and posttest scores from EAT.

Table 2: The t-test of the Pre-test Scores from EAT

Pre-Test	N	Mean X	SD	df	t-value	p-value
E1	40	13.60	6.86	39	.981	.467
C1	40	9.14	7.10			

A pre-test was administered to both the experiment group E1 and control group C1. Table 2 indicates that the means scores were different, however the t-test indicated no significant difference between E1 and control group C1 which were subjected to the pretest prior to the start of the experiment treatment thus indicating the two groups achievement on the pre-test were equivalent.

Table 3: Post-test means obtained by students on EAT

Treatment Group	N	Mean Score
Group E1	40	18.96
Group E2	40	20.68
Group C1	40	15.43
Group C2	40	9.90

Table 3 shows that the experimental groups E1 and E2 had higher post-test scores on EAT as compared to the control groups C1 and C2. This implied that the two experimental groups exposed to the animated electronic video outperformed the groups that were not exposed to the video.

Table 4: Analysis of Variance (ANOVA) of the Post-test Scores on EAT

Source	Sum of Squares	*df*	Mean Square	F	p-value
Between Groups	1781.37	3	593.79	15.71	.000
Within Groups	5933.41	158	37.79		
Total	54532.00	161			

$P^{*} < 5\%$ $F_{critic} = 2.68$

Analysis of variance in Table 7 indicated there was a statistical significant difference between the four means scores on post-test from Electronic Achievement Test (EAT) (F_{calcu} (3,158, = 15.21 ≥ = 2.68). This signifies that the animated electronic video impacted positively on student conceptualization of electronic concepts at secondary school as compared to the conventional teaching materials.

5. DISCUSSION

It has therefore, been revealed that use of animated electronic video effectively improved students' conceptualization of electronic phenomena at secondary school by illustrating the concepts more vividly as compared to the conventional teaching materials. Application of video enabled the teachers to easily illustrate abstract concepts of doping, forward biasing and energy band of material thus higher scores on Electronic Achievement Test (EAT) by students.

Aina (2013) notes that ICT is a powerful tool for presenting information in various ways such as text, picture, tables and motion which enables students visualize complex processes associated with physics concepts. Aina further notes that ICT attracts students and makes them lively in the class, promotes student interactions in the course of learning, increases the effectiveness of teaching and generally improves students' conceptualization of abstract concepts. Also in agreement with results is Isiaka *et al* (2013) who showed in study that use of cooperative video-based instructional package improved the performance of students in mathematics in particular geometry. The improvement in the student achievement was attributed to the effectiveness of the COOPVIP video package that was used in the study. Laaira (2013) notes that if ICT is well utilized in schools it has the potential to enhance the teaching and learning process in many ways, such as engaging students in learning since it is learner centered since it provides environment that challenging authentic, multisensory, and multi-disciplinary which are appealing to learners. According to Reja (2016) the traditional methods of teaching and learning can be made more effective and interesting when a teacher can apply audio, video or power point presentation in the classroom which makes the students more attentive about the content being presented.

6. CONCLUSIONS

This study evaluated various literatures of the effectiveness of animated video on secondary students' conceptualization of the electronic concepts. The study showed that the use of animated video instructional package improved the students' performance in the topic electronic at form four in the Kenya secondary school curriculum. The better performance by the experiment group in electronics could be attributed to the effectiveness of the animated electronic video.

7. RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made. Video-based instruction should used in teaching physics subject to bridge learning gaps among secondary school students occasioned by inadequate apparatus and equipped laboratories. Also, instructional media such as computer simulations and animations should be provided and adequately programmed with variety of video-based instructional packages. Teachers at secondary schools and teacher trainees in universities and colleges should be trained on implementations of video teaching in their classroom to improve performance in Physics subject.

REFERENCES

[1] Aina, J.K.(2013). Integration of ICT into Physics learning students' achievement: Problems solutions. *Open Journal of Education. 1(4): 117-121*

[2] Aluko, K.O. (2004). Effects of comparative learning and individualistic instructional strategies on students' problem solving abilities in secondary school chemistry in Ilesa. Unpublished PhD thesis, department of curriculum studies and educational technology, University of Ilorin, Nigeria

[3] Bell, L.& Bull, G.L.(2010). Digital Video and Teaching. *Contemporary Issues in Technology and Teacher Education*. 10(1): 1-6

[4] DiLullo, C.& Coughlin, P. (2006). Anatomy in New Curriculum: Facilitating the Learning of Gross Anatomy using Web Access Streaming Dissection Videos. *Journal of Visual Communication in Medicine*. 29(3): 311-322

[5] Fajola, O.O. (2000). Effects of three modes of computer based instructional strategies on students learning outcomes in biology. Unpublished PhD thesis, University of Ibadan, Ibadan Nigeria.

[6] Gillespie, D. (2007). On-Demand Video System Enhances Visual Learning. District Administration 43(9): 25-26

[7] Kenya National Examination Council (KNEC). Report 2014. Nairobi, Kenya National Examination Council

[8] Kenya National Examination Council (KNEC). Report 2015. Nairobi, Kenya National Examination Council

[9] Kenya National Examination Council (KNEC). Report 2016. Nairobi, Kenya National Examination Council

[10] Hennessy, S. (2010). Developing the use of Information Communication Technology to enhance teaching and learning in East African schools: Review of the Literature. Aga Khan University, Nairobi Kenya.

[11] Isiaka, A.G., James, M. & Olumorin, C.O.(2013). Effectiveness of Video-based cooperative learning strategy on high, medium and low academic achievers. *The African Symposium: An online journal of the African Educational Research Network*

[12] Lashs, V. (2002). Book Review: Making Multimedia in the Classroom: A teachers' guide. *Interactive Learning Environment* 10(3): 293

[13] Manduku, J., Kosgey, A. & Sang, H. (2012). Adoption and use of ICT in enhancing management of public secondary schools: A survey of Kesses secondary schools in Wareng District of Wasin Gishu County, Kenya

[14] Njoroge, G.N, Changeywo, J.M,& Ndirangu,M (2014). Effects of Inquiry-based Teaching Approach on Secondary School Students' Achievement and Motivation in Physics in Nyeri County, Kenya. *International Journal of Academic Research in Education and Review Vol. 2(1), pp. 1-16*

[15] Peeraer, J.& Petergem, P. (2011). ICT in teacher education in an emerging developing country: Vietnam's baseline situation at the start of the year of ICT. *Journal of Computers & Education 56 (2011) 974-982*. http://dx.doi.org/ 10.1016/j.compedu.2010.11.015.

[16] Reja, A.M.P. (2016). Impact of Information Communication Technology in the Teaching-Learning Process. Scholars Journal of Arts and Humanities and Social Sciences. 4(8): 851-855. Available Online: http://saspjournal. com/sjahss

[17] Timar, S. & Karpati, A.(2011). Teaching with YouTube: Quality Assessment of English and Hungarian Videos on Physical Education. *European Journal of Open, Distance and E- Learning*.

[18] Tucker, J. & Courts, B.(2010). Utilizing the Internet to Facilitate Classroom Learning. *Journal of College of Teaching and Learning* 7(7): 37-44.

[19] Wambugu, P.W. & Changeiywo, J.M (2008). Effect of mastery learning approach on Secondary school students' physics achievement. *Eurasia Journal of mathematics, Science & technology education, 4(3), 293-302*

[20] Yusuf, A. (1997). Effects of videotape and slide-tape instructions on junior students' performance in social studies. Unpublished PhD thesis, curriculum studies and technology, University of Ilorin Nigeria

[21] Yusuf, M. (2004). Effect of cooperative and competitive instructional strategies on junior secondary school students' performance in social studies, Ilorin, Nigeria. Unpublished PhD thesis, curriculum studies and educational technology, University of Ilorin, Niger