Innovation in Pedagogy: 2-D Animation as Information Communication Technology (ICT) Software for the Government's One-Laptop-per-Child (OLC) Project

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Abstract

While the Jubilee Coalition Government's Manifesto for Kenya (2013 – 2017) recognizes that Kenyan primary school classrooms have 'remained overcrowded, schools under-equipped and the entire education system underfunded,' it proposes an innovative approach to pedagogy that would 'provide each pupil with a solar-powered lap-top computer equipped with relevant content' as from January 2014 at an estimated annual cost of Kshs. 53.4 billion. This is amid growing skepticism over its prioritization in a sector that: lacks 80,000 skilled teachers; has an average teacher-pupil ratio of 1:100 and has high tuition costs. The One-Laptop-per-Child (OLC) project aims at achieving the Kenya Vision 2030 goals through providing equity in the school system and qualified skills for the labour market. Lessons on similar OLC initiatives in Kilgoris (Kenya), Rwanda, Nigeria, Peru, Nepal and Korea indicate that the dominant project costs are on hardware and software and on the Total Cost of Ownership (TCO) (distribution, maintenance, power infrastructure, teacher training, repair and replacement and curriculum integration.) To be able to meet its objectives, the Kenyan OLC project should utilize mediums that effectively communicate with the targeted pupils. The 2002 World Summit on Sustainable Development (WSSD) Conference, held in Johannesburg, committed, for instance, to the use of Information Communication Technology (ICT)-based solutions, such as animation, for effective communication of social development solutions in communities because animation has over time 'gained new and wider use, especially in situations where it is important to get the message through and have it internalized' (Ginman et al., 2003:69). This paper puts a case for the

utilization of 2-D animation as software on the Kenyan OLC by reporting a study that sought to establish its utilization and efficacy in Kenya. Professionals in animation were interviewed to determine the level of utilization of the technology as a medium of communication in Kenya. Criterion- referenced tests were then sat by pupils' in order to establish the software's efficacy in effective communication between source and receiver. Analyzed data showed that though animation was in average use in the country, the opportunities for growth far outweighed the challenges. The pupils who watched the animations and sat the tests also recorded significant mean score gains than those who had not. These results put a case for animation's inclusion as software on the Kenyan OLC.

Key words: Pedagogy; 2-D Animation, ICT Software, Effective Communication.

Introduction

Evidence from around the world shows that the single most significant means of improving the performance of national educational systems is through excellent teaching (Barber *et al* 2007.) Pedagogy is therefore firmly on the contemporary agenda. Polard (2010) defines pedagogy as both the means of enhancing student learning and the source of teachers' professional identity while Lovat, 2003:11 defines it as 'a highly complex blend of theoretical understanding and practical skill.' Existing literature indicates that Information Communication Technology (ICT) helps primary school teachers to be more effective in their teaching, especially if they are well resourced (Becta, 2001). ICT's have proven to be beneficial to pupils' attainment depending on the way the teacher selects the ICT resources, organizes and integrates them into other activities in the classroom and beyond. Cox *et al.,* (2004:4) aver that for teachers to effectively integrate ICT into teaching and learning they should 'use their subject expertise to select appropriate ICT resources, that include subject-specific software, which will help them meet the specific learning objectives,' Webb (2003) concurs and lists the capabilities of the type of selected software application as one of the two key elements required for ICT-based problem solving.

The choice of appropriate software application has also been emphasized in studies that focus on effective communication of social development solutions in communities. The 2002 World Summit on Sustainable Development (WSSD) Conference held in Johannesburg, South Africa, for instance, gave commitments to the use of ICT-based solutions as interventions for effective communication. Effective communication should lead to a significant increase in 'retention of information for longer periods' (Baker *et al.,* 2002:21), and eventually to a significant increase in acquisition of knowledge. Animation, a type of ICT-based technologies had been identified as one that could be utilized to achieve that

WSSD objective, (Gichuki *et al.,* 2007; WSSCC *et al.,* (2005:71); GoK,1976) since it has over the years, 'gained new and wider use, especially in situations where it is important to get the message through and have it internalized' (Ginman *et al.,* 2003:69).

This paper reports a study that sought to establish the level of utilization of animation as a medium of communication in Kenya. It analyzes scientific data that puts a case for the utilization of 2-D animation as software on the Kenyan One-Laptop-per-Child (OLC) project as effective communication between teachers and learners is paramount on the project that aims to achieve the Kenya Vision 2030 goals through providing equity in the school system and qualified skills for the labour market. That study is discussed hereafter.

Methodology

The first objective of the mentioned study was to establish the level of utilization of animation as a medium of communication in Kenya. Twenty-five (25) professionals in animation were interviewed to determine the utilization of the technology and the opportunities and challenges that faced its application in the country. The professionals were drawn from clusters that included: officials from the Animation Society of Kenya; media and advertising firm personnel, teachers of animation and professional animators.

To determine the efficacy of animation in effective communication between source and receiver, psychometrics were applied through criterion- referenced tests. The tests were attempted by pupils some of whom had been 'treated' with an animation that had been specifically developed for the study. Children were the focus of the study as 'being visual learners they get attracted to animations easily,' (Baker *et al.,* 2002:23). Further, for an in-depth study, only children in Standard Two (2) of age group between 7 and 9 years were targeted. The choice of Standard 2 was informed by the expectation of the Kenya Institute of Education (KIE) syllabus (2002) that good hygiene practice be taught to the children in class. Good hygiene practice had been found to be wanting in Githurai Location, Kiambu County, Kenya, a region 25km north of Nairobi, the capital city. This region became the focus of the study. A total of 320 pupils, drawn from private and public schools and equally from either gender, were involved in the study. The children were divided equally into control and experimental groups. A null research hypothesis, 'that there would be no significant difference by respondents' acquisition of knowledge on good hygiene practice after exposure to 2-D animation,' was proposed and a quasi-experimental research design utilized to test the hypothesis.

To be able to carry out the study, a 2-D animation was specifically developed for the study by a purposively selected professional animator. The animator was guided by a detailed brief developed by the researcher. The brief was based on the three themes of the KIE syllabus: caring for personal hygiene; cleaning the physical environment and proper use of latrines/washrooms. The animator collated supplementary information from the study area to use in the animation's production. Such information included: the personality of the target population; the social context of the study area; the desired duration of the animations; the language to use and the kind of voice-overs and sound jingles to be applied. The animator eventually capitalized on the technological capacity that 2-D animation affords to produce a flawless animation that communicated the intended messages on good hygiene practice to the target group. The Aestheic Value (AV) of the animation was verified by four (4) purposively selected art critics and animation professionals. The communication in the animation formed *Artist's Intention* (AI) of the study.

Criterion-referenced tests were used to quantify the reception of the communication from the animator by the pupils. The tests were based on five of the six skills spelt out in the Bloom's Taxonomy of Educational Objectives of the Cognitive Domain, namely Knowledge, Comprehension Application, Analysis, Synthesis and Evaluation. This measurement formed the *Audience Interpretation* (AIP) of the study and its procedure was as follows:

First, the pupils in the experimental and control groups were pre-tested. This was done during the second term of the calendar year after both groups had been through classroom teaching of the subject of hygiene in their first term. Prior teaching and learning of the subject ensured that all the pupils in the two groups had the same skills before the intervention was introduced. The groups in the experimental group were thereafter exposed to the developed animation. After a period of two weeks (Mugenda, 2008:78; McAlpine, 2002:12), both the experimental and control groups were again post-tested with the tests. This established any changes in the responses to the instrument after the respondents of the experimental group had been exposed to the animation.

Analysis of the test results, based on each of the five selected ranges of thinking skills in the Bloom's Taxonomy, was then done using the Statistical Package for Social Sciences (SPSS). An independent t-test at a set significance level of ($p < 0.05$) was finally used to measure the p-values, mean scores and standard deviations obtained by pupils.

Results

Information on the level of utilization of animation as a medium of communication in Kenya was descriptively presented then analysed quantitatively using frequencies and percentages. These are presented hereafter.

Utilization of Animation in Kenya

In order to make a case for the utilization of 2-D animation to communicate hygiene messages to children, it was necessary to establish its suitability for the said purpose. Data on the kind of ICTs in use in Kenya and the levels of usage was collected. Responses were elicited from identified users of ICT in the country. Figure 1.0 indicates the comparison of the tallied responses from the indicated interviews.

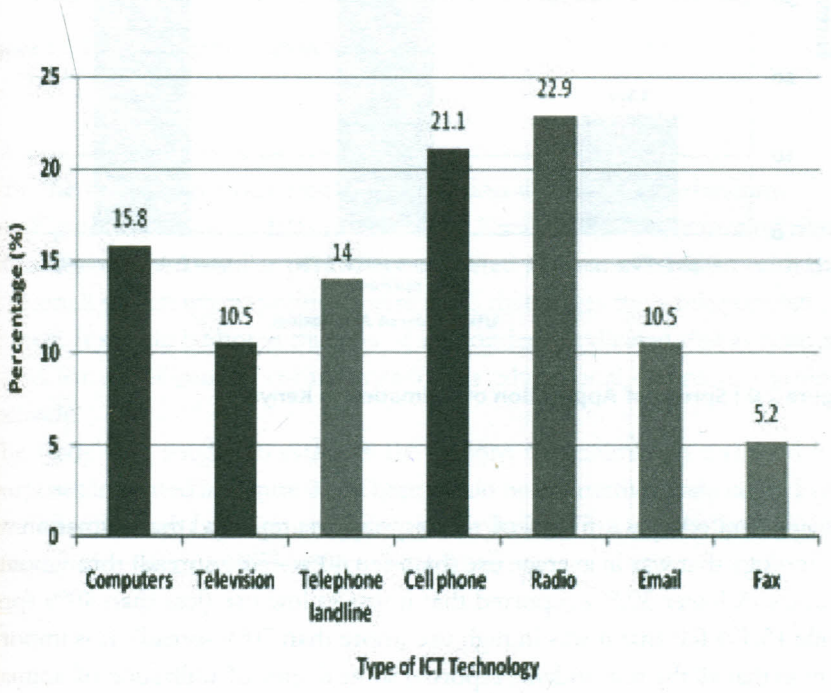


Figure 1.0 | Types of ICT Technology Used for Communication in Kenya

As shown in the above figure, out of 57 respondents, 22.9% of them reported that radio was the most common ICT technology in use in the country. A new technology, cell phone, followed closely with a 21.1% usage. Computers and Television, a concern for this study, was in average use in the country as reported by 15.8% and 10.5% respondents respectively. It was then necessary to determine the spread of animation, a form of ICT technology, in the country. The responses are shown in Figure 2.0.

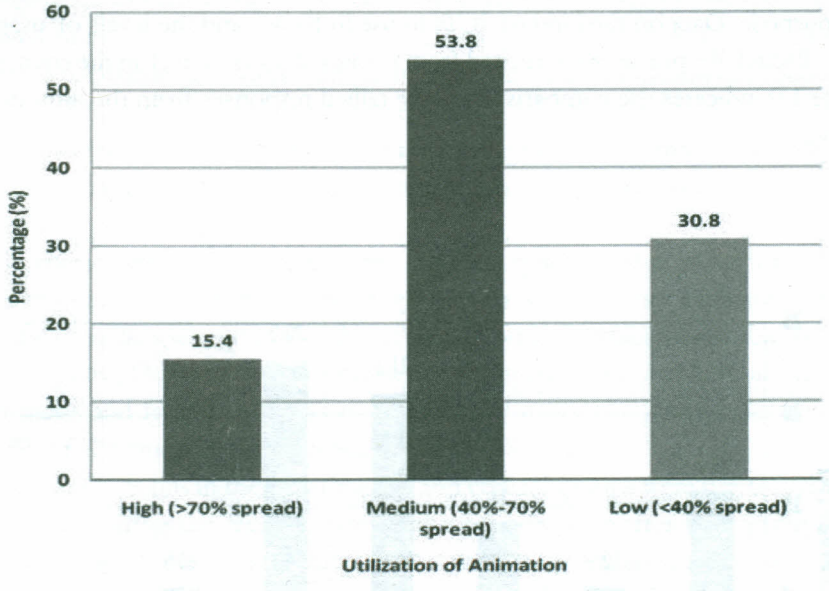


Figure 2.0 | Spread of Application of Animation in Kenya

As is illustrated above, 53.8% of the respondents reported that animation was a technology that was in average use (between 40% - 70% spread) throughout the country. A lower 30.8% reported that it was in low use (less than 40% spread) while 15.4% felt that it was in high use (more than 70% spread). It is important to note that all the respondents reported some degree of utilization of animation in the country.

Some of the uses animation is reported to have been put to include: edutainment; advertisement; political satire; motion film and documentaries; animated musical videos and education. These are presented in Figure 3.0.

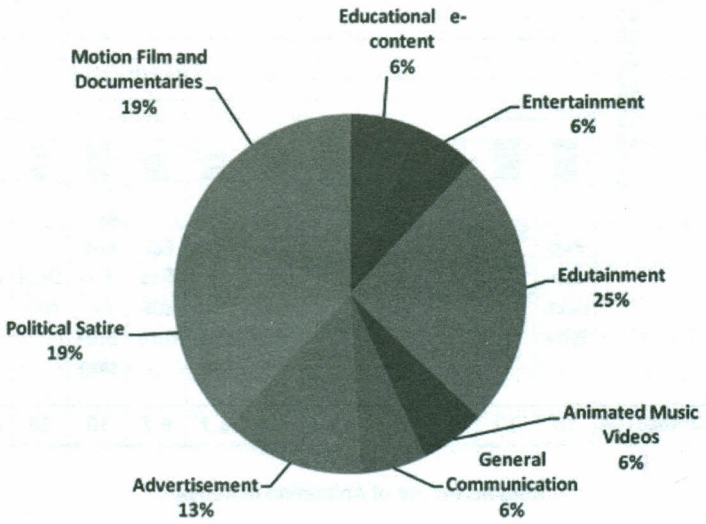


Figure 3.0 | Uses of Animation in Kenya

25% of the respondents reported that animation was used for edutainment in Kenya (Figure 4.3). Another 19% reported that it was being used in motion films and documentaries. A similar percentage reported animation's use on both the big and small screen where political satire films that target the adult population are shown. It should be noted that 6% of respondents indicated that animation was used for either general communication or educational e-content learning respectively.

The study then sought to establish the reasons why animation was used for the purposes indicated in Figure 3.0. These would be instructive in shedding light on animation's current and future application in the country, especially in regard to being a mode of communication with children.

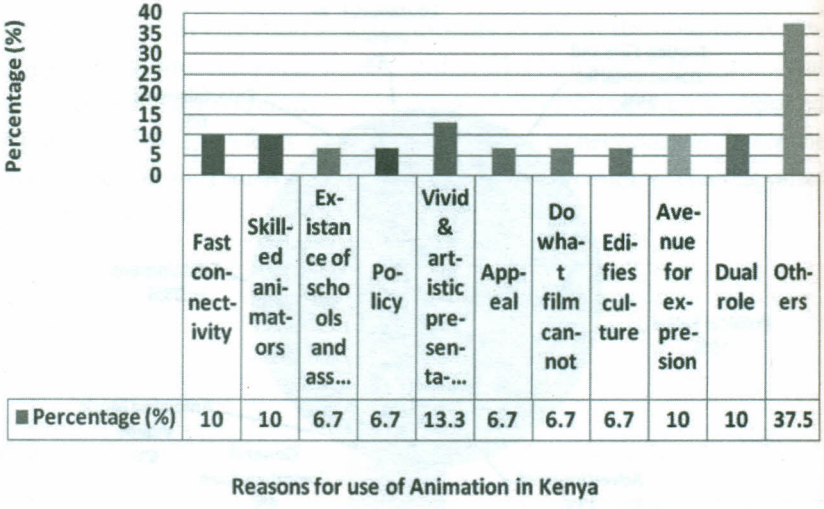


Figure 4.0 | Reasons Why Animation is Used in Kenya (2011)

Figure 4.0 summarizes the responses from the interviews with users of animation in the country. Of those interviewed, 13.3 % reported animation's ability to present stories more vividly and artistically. An equal 10% reported each of the following as reasons for animation's use: that it is an alternative avenue for expression; that it plays a dual role of appealing and teaching consecutively; that there existed skilled animators in the country who were on the cutting edge of animation technology with knowledge of it and the advent of fibre optic connectivity in the country that had necessitated faster connectivity of ICT and its related applications.

The figure also gives another set of mentioned reasons of animations use in Kenya. A tally of 6.7% usage was reported for: animation can 'do what film cannot' because of the higher capacity of imagination that can be integrated in it; animation edifies storytelling that is a cultural heritage in Kenya; the Kenyan government policy of 40% local content play on national media; the existence in the country of schools and associations of animation and animation's appeals to the viewer's imagination. Other reasons that were mentioned though in relatively lower percentages were: animation's relative cheapness in production as opposed to film; the advent of digital technology in the country; animation being felt to be a 'less intimidating' technology and the recent bullish growth of ICT technology that had offered new career choices in fields such as animation.

Further on, it was pertinent to determine what opportunities existed for increasing the utilization of animation in the country. This helped inform the recommendations drawn for the present study. Figure 5.0 illustrates the received responses and shows that out of a total 67 responses, 9.0% reported that growing interest from audiences/clients was the best indicator for the growing utilization of animation in Kenya. 6.0% reported on the utilization of the animator's human and technical skills by the public and private sectors. These skills had also been reported in Figure 4.0 as being a reason for animation's use in the country.

Other reported opportunities had to do with the growth of the ICT sector in Kenya. Examples of these are: the institutionalizing of a strong animation culture in the country; the inception of the digital technology; the spread of animation technology; the availability of skilled animators and the availability of fully set- up animation studios and schools (Figure 5.0).

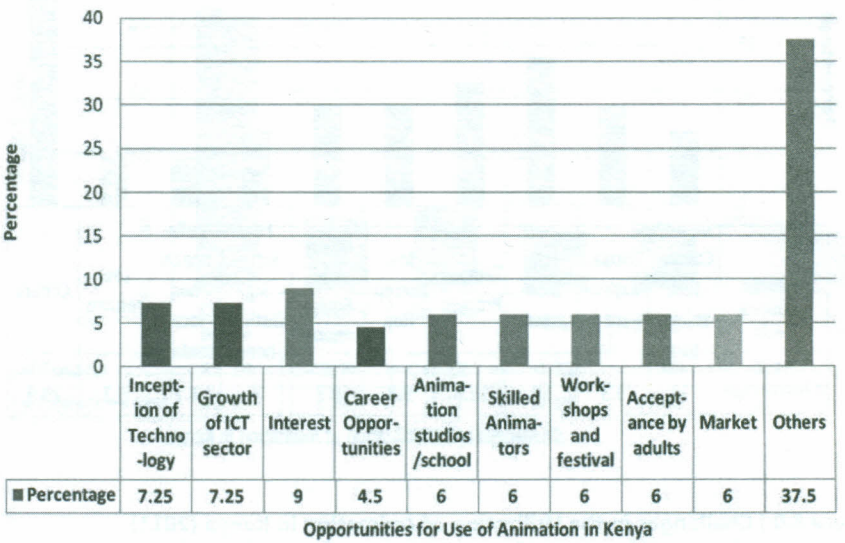


Figure 5.0 | Opportunities for Use of Animation in Kenya (2011)

Structures and policies put in place by the Kenyan Government to market the use of animation were also reported in Figure 5.0 as opportunities for animation's growth. Some of the mentioned structures and policies include: increased appreciation by adult Kenyan audiences of animation; the staging of animation workshops and festivals; surge in new career opportunities that are reliant on

multimedia (e.g. voice actors, script visualizers and editors); existence of thematic collaborative funded projects applying animation; application of government policy for 40% local content on local television stations; Kenya's superiority in animation in the region that has lead to relative lower costs of production of animations and the emergence of Associations of Animation artists in Kenya . Other factors are the increased interconnectivity of many establishments to the fibre optic cable and the greater application of creativity and originality in local multi-media content development.

Data on challenges faced with regard to the utilization of animation in Kenya was also gathered (Figure 6.0).

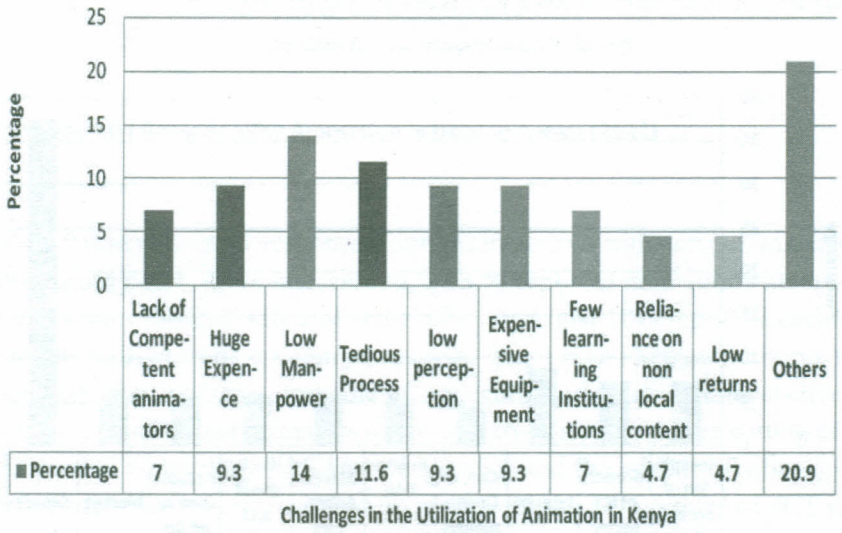


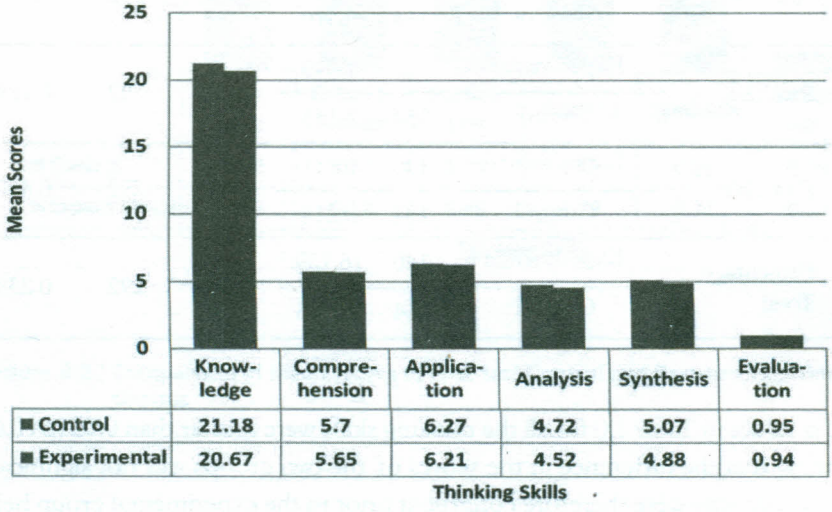
Figure 6.0 | Challenges in the Utilization of Animation in Kenya (2011)

The 43 respondents who polled reported lack of a sturdy and robust workforce as the biggest challenge to the utilization of animation in Kenya. The tedious and expensive cost in the development of animations was also reported. Other challenges included: the perception that animation was only for children/idlers/ low achievers; the existence of a low number of animators with higher academic qualifications partly due to the limited number of institutions of higher learning there are that teaching animation and over-reliance on foreign (to local) content

and the west and limited markets for the product were other challenges to the utilization of animation in Kenya.

Analysis of Pre-test Scores

To second objective of the study was to determine the efficacy of animation in effective communication between source and receiver. Pre-test results of pupils in the control and experimental schools were compared to determine the congruency of the experimental and control groups before treatment (Fraenkel *et al.*, 2009). The analysis of mean scores of the two groups indicated that the differences were negligible (Figure 7.0).



	Know-ledge	Compre-hension	Applica-tion	Analysis	Synthesis	Evalua-tion
Control	21.18	5.7	6.27	4.72	5.07	0.95
Experimental	20.67	5.65	6.21	4.52	4.88	0.94

Figure 7.0 | Comparison of Mean Scores of Pre-test Control and Pre-test Experimental Groups

To verify whether the differences in the mean scores mentioned in Figure 7.0 were significant, a t-test of the scores was done and the p-values and Standard Deviations (SD) calculated. The results are shown in Table 1.0.

Table 1.0 | T-test Scores of Pre-test Control and Pre-test Experimental Groups

	Thinking Skill	Group	N	SD	t-value	Df (N-2)	p-value
1.	Knowledge	Experimental	140	3.926	-1.182	292	0.238
		Control	154	3.462			
2.	Compre-hension	Experimental	140	1.587	-0.306	292	0.760
		Control	154	1.464			
3.	Application	Experimental	140	1.234	-0.412	292	0.681
		Control	154	1.023			
4.	Analysis	Experimental	140	0.995	-1.993	292	0.047
		Control	154	0.670			
5.	Synthesis	Experimental	140	1.399	-1.319	292	0.188
		Control	154	1.153			
6.	Evaluation	Experimental	140	0.241	-0.513	292	0.609
		Control	154	0.214			
7.	Percentage Total	Experimental	140	16.759	-1.180	292	0.239
		Control	154	13.505			

The p-values in Table 1.0 for all the thinking skills were greater than 0.05 ($p > 0.05$) meaning that the difference in the scores of the two groups was not significant. The two groups were therefore congruent prior to the experimental group being exposed to the animation.

Analysis of Post-test Scores

To determine the effectiveness of 2-D animation due to the classification of the schools, a comparison of the post-test scores of the experimental schools and of the control schools was done. It revealed that the mean scores for the control groups were lower than the mean scores for the post-test experimental groups in all thinking skills apart from 'evaluation' (Figure 8.0).

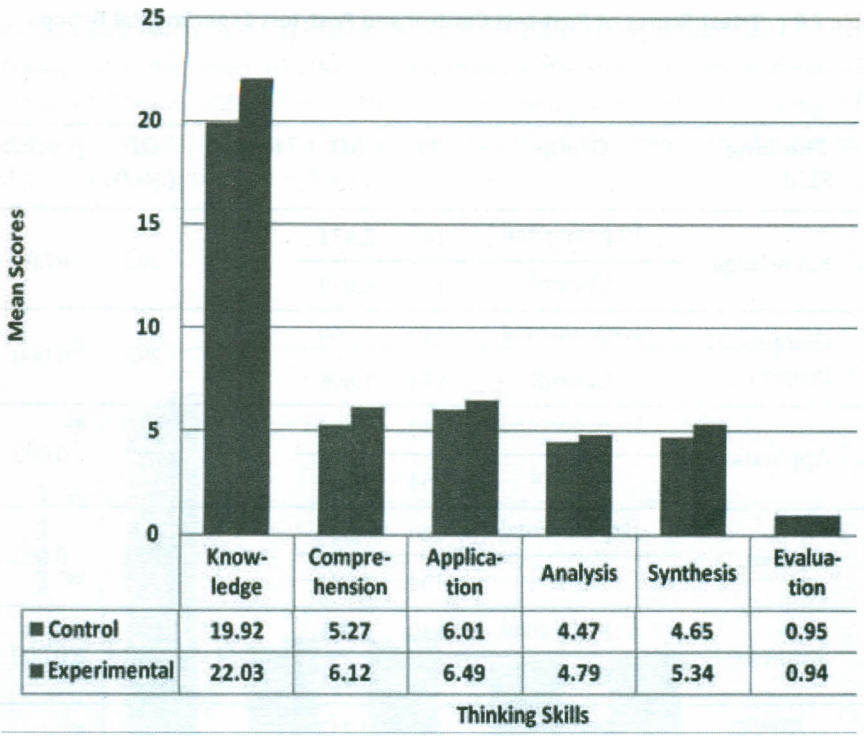


Figure 8.0 | Comparison of Mean scores of Post-test Control and Post-test Experimental Groups

Of all the thinking skills, 'knowledge' had the highest gain score indicated by (22.03-19.92 = 2.11) (Figure 4.17). The results also suggest that, overall, the experimental group scored better than the control group. To determine how significant the differences in scores were, the t-values and Standard Deviations (SD) of the test scores were compared and the results indicated in Table 2.0

Table 2.0 | T-test Scores of Post-test Control and Post-test Experimental Groups

	Thinking Skill	Group	N	SD	t-value	Df (N-2)	p-value
1.	Knowledge	Experimental	140	2.874	5.089	292	0.000
		Control	154	4.078			
2.	Compre-hension	Experimental	140	1.160	4.998	292	0.000
		Control	154	1.696			
3.	Application	Experimental	140	0.902	3.762	292	0.000
		Control	154	1.265			
4.	Analysis	Experimental	140	0.534	3.178	292	0.002
		Control	154	1.043			
5.	Synthesis	Experimental	140	1.001	4.744	292	0.000
		Control	154	1.421			
6.	Evaluation	Experimental	140	0.233	-0.195	292	0.845
		Control	154	0.233			
7.	Percentage Total	Experimental	140	11.697	5.031	292	0.000
		Control	154	16.866			

The above table indicates a significant t-test for equality of means ($t(292) = 5.031$, $p < 0.001$) for the total pupil percentage score between the post-test experimental and post-test control groups. This implies that the differences in scores between the post–test experimental group and the post-test control group were significant. There was also a significant t-test score difference in the mean scores of all the indicated thinking skills except 'evaluation'. It should also be noted that the Standard Deviations (SD) for 'knowledge' were highest in both the experimental (SD=2.874) and control (SD=4.078) groups and lowest for 'analysis' in both the experimental (SD=0.534) and control (SD=1.043) groups.

Analysis of Pre-test and Post-test Results of Experimental Schools

Having established that experimental schools performed better than control schools, it was necessary to establish the trend within the experimental schools themselves. This would further confirm the reported positive effect of using 2-D animation. Figure 4.18 illustrates the comparison of the means of the pre-test and post-test experimental schools.

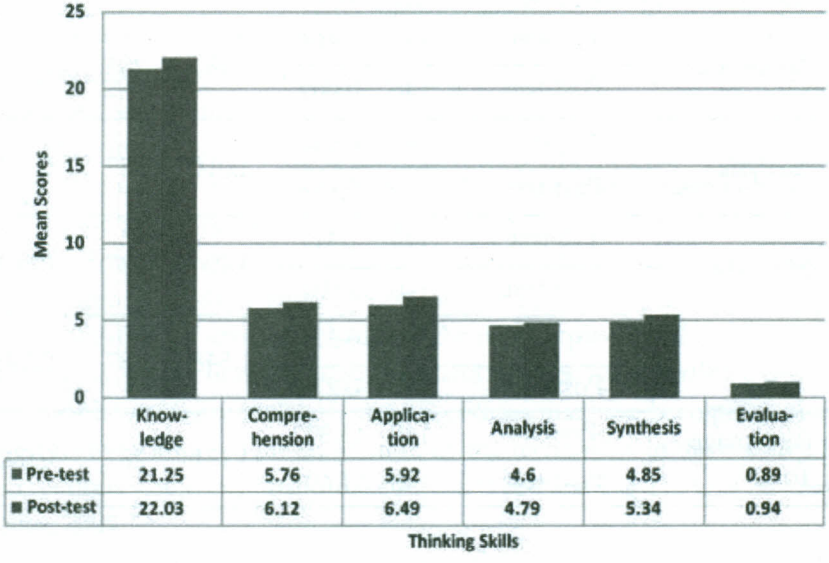


Figure 9.0 | Comparison of Mean Scores of Pre-test and Post-test Experimental Groups

Figure 9.0 indicates a positive gain in the mean scores of the pre-test and the post-test results of the experimental schools in all levels of thinking under study. To ascertain the level of significance of the differences of the mean scores registered in Figure 9.0, the t-values and Standard Deviations (SD) of the pre and post-test results were compared (Table 3.0).

Table 3.0 | T-test Scores of Pre-test and Post-test Experimental Groups

	Thinking Skill	Group	N	SD	t-value	Df (N-2)	p-value
1.	Knowledge	Pre-test	149	3.236	-2.162	287	0.031
		Post-test	140	2.874			
2..	Compre-hension	Pre-test	149	1.592	-2.204	287	0.028
		Post-test	140	1.160			
3.	Application	Pre-test	149	1.464	-3.980	287	0.000
		Post-test	140	0.902			
4.	Analysis	Pre-test	149	0.936	-2.010	287	0.045
		Post-test	140	0.534			
5.	Synthesis	Pre-test	149	1.317	-3.496	287	0.001
		Post-test	140	1.001			
6.	Evaluation	Pre-test	149	0.311	-1.548	287	0.123
		Post-test	140	0.233			
7.	Percentage Total	Pre-test	149	13.577	-3.171	287	0.002
		Post-test	140	11.697			

The p-values in the above table indicate a significant p-value for the total percentage score and for all the indicated thinking skills under study except evaluation. Table 3.0 also shows that within the levels of thinking, the Standard Deviations (SD) for 'knowledge' were highest in both the experimental (SD=3.236) and control (SD=2.874) groups and lowest for 'evaluation' in both the experimental (SD=0.311) and control (SD=0.233) groups.

The results in Table 3.0 are in tandem with earlier results that indicated that the post-test mean scores of experimental schools had significant p-values as compared with the pre-test scores of control schools in all thinking skills except evaluation. Both sets of results consequently reaffirm, on the basis of classification of pupil's schools, the positive effect the utilization of 2-D animation had on effective communication.

Discussion

Analysis of test results control and experimental schools (Figure 1.0) indicated that the two groups did not have significant differences in their mean scores (and in all the levels of thinking) before being exposed to the animation. This implied that the two groups were congruent before the treatment with the 2-D animation, and so all the results from subsequent tests involving the two groups were valid.

The finding that sought to establish the level of utilization of animation as a medium of communication in Kenya, was that animation was already in use in the country, particularly for general communication and educational e-content (Figure 3.0). It was also established that animation has local expertise that understand and apply it in a contextually relevant and appropriate manner. The technology's application in the country was found to be due to factors that include: its communicative potential due to its vivid and artistic presentations, the existing infrastructural capacity in the country and the technology's dual role for education and entertainment (Figure 4.0). Data presented also indicated that some of the following opportunities exist for the technology's utilization in the country: growing interest from audiences/clients, relative growth experienced in the ICT sector and the availability of skilled animators (Figure 5.0). Challenges to the utilization of animation included the tedious process of production, the high cost of production and equipment and the lack of expertise (Figure 6.0). The study however noted that there were policies that have been put in place by government to improve the application of the technology in the country. Such interventions would eventually make Kenya 'The Next Big Thing in Animation' (Callus, 2009:5.)

After the experimental group was 'treated' with the developed animation, the results obtained from the pupil's tests showed that there was a significant difference in performance between the experimental and control groups as recorded in Fig. 8.0. It was evident that the experimental group posted significantly better results than the control group. This was contrary to the null hypothesis of the study that 'there would be no significant improvement in the acquisition of knowledge on proper hygiene by children before and after interaction with 2-D animation.' The test results proved that animation did have a positive impact on the pupil's performance in all thinking skills except evaluation.

Knowledge posted the best results in both the pre and post tests. It also registered the greatest improvement in mean score after the treatment. This implies that knowledge as a skill is most impacted by animation perhaps because it is the lowest of the thinking skills in the Taxonomy and is therefore relevant to the level of children who took the test (Anderson et al., 2001). On the other

hand, the lack of significant gain in the skill of evaluation could be due to the fact that the skill is a more advanced thinking level for the level of children who took the test (ibid, 2001).

Recommendations

Arising from the obtained results, the following recommendations were drawn in as far as the utilization of 2-D Animation in Kenya and its efficacy is concerned:

- That there be consideration for animation's use as a software on the forthcoming Kenyan One-Laptop-per-Child (OLC) project. There should also be increased utilization of 2-D animation in programmes that offer practical solutions for social development and which target children, irrespective of their gender or aptitude. Such programmes could be of national importance like the Kenya Vision 2030 or of international significance like the United Nation's MDG's. The initiatives could be in all skills in the Bloom's Taxonomy of Educational Objectives of the Cognitive Domain except evaluation.

  This commendation is based on the recorded significant improvements in mean score gain arising from the use of the technology. Champoux (2001:80) writes that 'animated films are a rich teaching resource for use in organizational behavior and management courses.'

- A second recommendation is for 2-D animation to be in-cooperated as a strategy in teaching children in primary schools and other institutions. It had been reported that there was 0% usage of the technology in schools in the study area yet results of this study show there is a significant improvement in mean scores when the technology is utilized by teachers in all thinking skills except 'evaluation.'

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