

**EFFECT OF DIGITAL LEARNING PROGRAM ON THE ACADEMIC PERFORMANCE
IN PUBLIC PRIMARY SCHOOLS IN KENYA
(THE CASE OF KIAMBU COUNTY)**

^{1*} **Edward Kariuki Njambi**
ekariuki@jkuat.ac.ke

^{2**} **Dr. Oluoch Oluoch**
joluoch@jkuat.ac.ke

^{1*} *Master Of Science In Business Information Technology, Jomo Kenyatta University Of Agriculture And Technology*

^{2**} *Lecturer, Jomo Kenyatta University Of Agriculture And Technology, Kenya*

Abstract: *Computing was being introduced into the curriculum in Kenya. Teachers' perspectives enabled us to discover what challenges they presented, and also the strategies teachers claimed to be using successfully in teaching the subject across primary education. The study described in this project report was carried out in Kenya, Kiambu County in 2017 where teachers were prepared for the mandatory inclusion of Computing into the curriculum.*

Methodology: *A survey was conducted with teachers who were currently teaching computing to elicit their perspectives on challenges and strategies with the objective of getting to know the effect of the Digital Learning Program on academic performance in public primary schools in Kenya. Data was analyzed to identify both extrinsic and intrinsic challenges for both teachers and students.*

Significance: *The findings of this study will benefit the instructors and practitioners to gain a deeper understanding on how to integrate ICT meaningfully to Leverage time better, spread knowledge widely, engage a worldwide audience, and build learning modules quickly and also to Improve instructional techniques.*

Scope: *The research targeted primary schools in Kenya, specifically the teachers in public primary schools. The coverage area was Central region, Kiambu County as covering all the other Counties was not feasible due to geographical vastness and large population size.*

Keywords: *ICT, Motivation, Training and Development*

1. INTRODUCTION

The impact of ICT on learning is currently in relation to use of digital media, primarily computers and internet to facilitate teaching and learning. ICTs are the technologies used in conveying, manipulation and storage of data by electronic means, they provide an array of powerful tools that may help in transforming the present isolated teacher-centered and text-bound classrooms into rich, student-focused, interactive knowledge environments. To meet these challenges, learning institutions must embrace the new technologies and appropriate ICT tools for learning. The relationship between the use of ICT and student performance in higher education is not clear, and there are contradictory results in the literature. Earlier economic research (Greenan and Mairesse, 2004) has failed to provide a clear consensus concerning the effect on students' achievement.

The integration of technology in primary education is a significant issue especially across the diverse contexts of Kenya, where only 32% of all school-age children attend primary school (Ministry of Education, 2012; Ngware, Onsomu, Muthaka, & Manda, 2006), with challenges ranging from a lack of electricity, infrastructure, connectivity and finances, to those with respect to the capacity building of all the stakeholders (Hennessy et al., 2010). Based on this review, the Kenyan government and donor agencies tend to seek infrastructural investments as a panacea for the needs of schools without having a plan for how they will be utilised, why they want technological devices or what existing deficits the technology will address. As a result, the actual use of technology in teaching and learning processes remains restricted despite considerable growth in the numbers of computers acquired by schools in Kenya (Ford, 2007; Ogembo et al., 2012).

Kenya and Kiambu County

Kiambu County is a county in the former Central Province of Kenya. Its capital is Kiambu and its largest town is Thika. The county is adjacent to the northern border of Nairobi County and has a population of 1,623,282. The county is 40% rural and 60% urban owing to Nairobi's consistent growth Northwards.

In 2007, Kiambu District was subdivided in two: Kiambu East and Kiambu West. Kiambu West district took Limuru, Lari and Kikuyu divisions, with Limuru as its district capital.

Most primary schools have received the learning digital devices. The digital learning package which was issued to schools included a projector and an ICT teacher in each primary school has been trained on digital presentation of the curriculum in class one.

Statement Of The Problem

Based on the extended usage of ICTs in education the need appears to unravel the myth that surrounds the use of information and communication technology (ICT) as an aid to teaching and learning, and the impact it has on students' academic performance in Kiambu county.

The application of ICT in primary education has revolutionized teaching and learning. Teacher trainees with diverse learning styles are able to maximize their learning potential when instructors use ICT to support their pedagogical practices. An important consequence of ICT is enabling the learners to be more independent, reflective and self-regulated in their learning process. In addition, ICT makes it possible to deliver virtual instruction to students outside the classroom. There are two broad aims for this study which are: (a) to gain a deeper understanding of how ICT affects academic performance of teacher trainees, and (b) to investigate the effects of ICT on academic performance based on gender, type of teacher education program and type of learner. This study is significant in terms of improving teacher education programs by embracing ICT as a mean to provide and increase the quality of the teaching and learning process. The results of the study is expected to highlight significant effects of ICT on students' academic performance and issues related to further improvement in teacher education programs.

Objectives Of The Study

The general objective was to study the effect of digital learning program on the academic performance in public primary schools in Kenya. The specific objectives are;

1. To evaluate the effect of digital learning program hardware / devices on the academic performance in public primary schools in Kenya.

2. To establish the effect on usage of digital learning program content on the academic performance in public primary schools in Kenya.
3. To find out the effect of digital learning program technical support on the academic performance in public primary schools in Kenya.
4. To ascertain the effect of digital learning program device ergonomics on the academic performance in public primary schools in Kenya.

2. THEORETICAL REVIEW

Several theories and arguments have been proposed by other researchers, scholars and managers on the effect of digital learning on the academic performance, and the possible effects that these aspects could have in public primary schools. This study was pegged on; **Behaviorism theory, Technology Integration theory, Schools Organisation theory.**

3. RESEARCH METHODOLOGY

A survey was conducted with teachers who were currently teaching computing to elicit their perspectives on challenges and strategies with the objective of getting to know the effect of the Digital Learning Program on academic performance in public primary schools in Kenya. Data was analyzed to identify both extrinsic and intrinsic challenges for both teachers and students. Secondary data as well as primary data was used. Primary data was used to collect and analyse data from the questionnaires’ closed ended questions on a Likert scale to generate frequency distribution tables, data entry sums and averages. Data collected was analysed using SPSS statistical software and tested using T test statistics at 95% confidence level. Further investigation could support which strategies can alleviate the challenges of teaching and learning of Computing for students and teachers. In particular developing student resilience in Computing was seen as a challenge while not many strategies were suggested. F test was used to compare statistical models that have been fitted to the data sets, in order to identify the model that best fits the population from which the data were sampled.

4. RESEARH RESULTS

Findings on the impact of DLP hardware devices in the schools

Hardware devices is one of the independent variables considered to influence academic performance in the schools. The study sought to determine which devices were issued to the schools and their use in delivery of the materials, the effect of this devices and which ones were more desired by teachers and reasons for this.

Table 1. Impact of Devices on Academic performance

Opinion Statements	SA %	A %	N %	D %	SD %
Do you have a device when delivering content in your classroom	28.57	42.86	28.57	0	0
Do you use computers for preparing lessons	14.30	57.10	14.30	14.30	0
Do you often use computers in your school	0	14.29	57.14	28.57	0

Do you have access to the internet in the classroom	0	42.86	28.57	25.57	0
Do you have a student response system installed	42.86	42.86	14.28	0	0
Are students allowed personally owned devices in the classrooms	14.28	28.57	42.86	14.29	0

SA= Strongly Agree, A= Agree, N= Neither Agree nor Disagree, D= disagree, SD= Strongly Disagree

The study found that 71.43% of teachers agreed that the schools digital learning program hardware / devices had an effect on the academic performance while 28.57% neither agreed nor disagreed implying lack of interest in using this digital learning devices. 71.43 % of the teachers also agreed that the device’s had been implemented. Those who agreed that they often use computers for delivering content often were 14.29%. 57.14% of teachers felt that their teachers could use more training to better performance and handling of this digital devices. 42.86% of teachers also concurred that students should be allowed with personally owned devices in the classrooms while 14.29 disagreed.

Findings on the usage of content on the academic performance

The next independent variable in this study considered to affect the academic performance is the extent usage of digital learning program content.

Table 2: teacher’s views on usage of the digital learning content

Opinion Statements	SA %	A %	N %	D %	SD %
Does your school provide you with an email address	28.57	42.85	14.28	14.28	0
Do you use LMS in your school(learning management system)	14.29	57.14	28.57	0	0
Does your school advocate for the use of CMS(content management system)	0	42.86	28.57	28.57	0
Do you have an electronic register in your school	57.14	28.57	14.29	0	0
How would you rate the ease of use of the KICD(Kenya institute of curriculum development)	0	28.57	42.86	28.57	0
How would you rate the other contents against the above	28.57	42.86	14.28	14.28	0
Would you rate switching from one subject to the other as soon as you are done with a class very easy	14.29	28.57	42.86	14.28	0

SA= Strongly Agree, A= Agree, N= Neither Agree nor Disagree, D= disagree, SD= Strongly Disagree

The study found that 71.42% of teacher’s agreed that they were interested in the usage of the content provided by the government for delivery. However, only 42.86% agreed that performance was improved by the use of the learning management system with 28.57% agreeing that they had electronic registers in their schools, while 28.57% disagreed. The findings also revealed that 28.57% agreed that the KICD has greatly helped the in delivery by providing various contents like the msingi program. However only 42.86% disagreed with the rate of switching from one subject to the other as soon as you are done with a class was very easy.

Finding on effect of technical support on the academic performance

The third independent variable in this study was technical support. This research sought to find out how technical support is being used by the schools to boost the performance of the students the study sought to find out if the government initiative of employing a technical support package after delivery whether it was being implemented and how helpful it was in the various schools.

Table 3 Teachers views on technical support

Opinion Statements	SA	A	N	D	
	%	%	%	%	
Do you have someone providing support at your school	14.29	42.86	14.28	28.57	0
is the person in I above trained in ICT support	28.57	42.86	28.57	0	0
Do you often take advanced classes on ICT	14.29	42.86	14.28	28.57	0
Can the failure rate of the devices be classified as low	14.29	42.86	14.28	28.57	0
Is the time taken to repair devices classified as fast	0	57.14	14.29	28.57	0
Is the time taken to replace devices classified as fast	28.57	42.86	28.57	0	0

SA= Strongly Agree, A= Agree, N= Neither Agree nor Disagree, D= disagree, SD= Strongly Disagree

Teacher’s response on the attractiveness of the schools technical support system policy was 57.15% in agreement and 28.57% disagreement. 71.43% of them further agreed that the schools needed to further train the person tasked with maintenance. 57.14% of teachers agreed that the time taken to repair devices was fast and it’s a contributing factor towards the academic performance goals. 42.86% of teachers also agreed that the time taken to replace devices was fast and well-balanced between the collection day and replacement day.

Findings on Academic performance

Table 4 Teachers views on the pass rate

Opinion Statements	SA %	A %	N %	D %	SD %
Teachers turnover in your department is high	0	0	14.29	57.14	28.57
Teachers turnover has an impact on academic performance	28.57	42.8	28.57	0	0
The school considers teachers retention a priority significant effect on the academic performance of students	0	57.14	28.57	14.29	0
Increase the knowledge and appreciation of the subject content. DLP facilitates and enhances effective teaching and learning of social studies in secondary schools	0	24.2	45.5	27.3	3

SA= Strongly Agree, A= Agree, N= Neither Agree nor Disagree, D= disagree, SD= Strongly Disagree

The study found that 85.7% of teachers disagreed that the turnover was high in their departments. 71.43% of them however agreed that the turnover did have an impact on the schools performance. 42.86% of teachers agreed that the digital learning devices in the schools does have an effect on the academic performance while 14.29% disagreed. From these figures it is observed that management recognize the importance of DLP for theirs schools to perform.

Teachers considers their retention a priority significant effect on the academic performance of students at 57.14%, resignations at 28.57%.

The teachers in management also mentioned some of the steps they have taken to foster their teacher’s retention. These included schools-specific or trainings unique to the schools operations or activities, improved work-life balance by increasing leave days from 24 to 28.

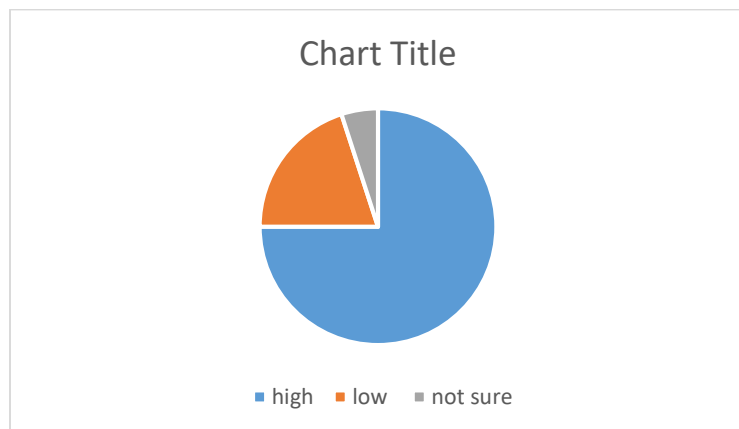


Figure 1: Teachers View on Performance Level

Correlation

Pearson Correlation tests were carried out on both teachers in management and in non-management questionnaire responses to determine if there was any significant correlation (at 95% significant level, $\alpha = 0.05$) in the responses given by each respondent. The correlation tests yielded a Pearson correlation coefficient and its corresponding p value.

The findings indicated that there was a positive relationship between the teacher's retention and Academic performance. The relationship was statistically significant ($r=0.887$, $p=0.008$). Most of those who felt that turnover was low or retention high also felt that schools performance was positively influenced by teachers choosing the mode of delivery to the student's. The teachers in management were of the view that the impact of DLP hardware devices had a positive relationship with academic performance.

Discussion

The correlations among the teachers in management responses are not as strong as those who are not in management suggesting that the variables do affect each other but there could be better utilization of the digital learning program devices to further influence the effect on academic performance.

The results show a significant effect on the introduction of digital learning program which indicates that students' academic performance increased as a result of the digital learning program. However, the effect of technology use on students is complex. Detecting spill-over effects on traditional subjects using school average as outcome variables would require an unambiguous effect for a sufficient share of students at a given school.

The limitations to the sampled data, might prevent us from detecting such changes. Technology, represented by the digital learning program, can affect students' academic performance through several channels. Firstly, it increases the access to information, for example, it becomes easier for students and teachers to do online research and teachers can provide course content to students digitally.

Secondly, it is likely to provide students with digital tools that can improve learning and performance. Examples are dictionaries, programs correcting grammar, calculators, and graphical mathematics tools.

Thirdly, it might increase opportunities to communicate and collaborate with other students and take advantage of each other's knowledge. All of the above will strengthen educational outcomes. However, students might also get distracted by the use of a digital device in school. The increased access to entertainment such as social media, games, and the World Wide Web creates a tempting and easily accessible online environment for the students during class.

The impact of technology use on a student's academic performance depends on various social factors. First, the academic motivation will be crucial for how the student benefits from the access to a laptop. While motivated students may achieve on average better grades, non-motivated students may achieve on average lower grades due to the easy access to distractions on laptops during class. In addition, the socioeconomic background might cause students to be affected differently. For example, some students can take advantage of previous knowledge with use of home computers, as well as the fact that parental monitoring and supervision might differ between students from different socioeconomic backgrounds.

The channels and social factors described above are pulling in different directions, and one could argue that the expected effect of the laptop program is ambiguous. Hence, concluding that there is a very huge significant effect of the digital learning program on students' academic performance in general could seem reasonable.

5. SUMMARY

The research successfully met the objectives of the study adequately drawing out the relationship between the independent and dependent variables. With an overall response rate of 88.9%, and conducting a census thereby involving the entire study population, the findings of the study are satisfactorily reliable. Of the received responses 17.5% were from the teachers in management and 82.5% were ordinary teaching staff.

Influence of hardware devices on academic performance

Hardware devices was considered as one of the variables influencing academic performance in this study. 71.5% of the teachers agreed it was correct to be using the devices on delivering the content. However, only 42.42% of the teachers still had an issue on using the devices. This indicates the need for further training of the teachers. The non-management employees however, generally agreed that trainings were done based on a training needs analysis hence were likely to impact positively on organization operations. Teachers not in management also rated inadequate work resources and workload as bigger hindrances to their performances than their skills inadequacy. They however still had an interest in training with 60.6% preferring to be offered the schools support for external training to advance academically and skill wise , while the remaining 39.4% preferring on the job training by updating knowledge on new work models, statutes and regulation to perform their jobs better. This indicated that teachers felt that the hardware training was a very effective strategy for effective delivery to the students and this could perhaps explain why management's strategy to offer organization-specific training on handling of the devices as academic performance strategy was bringing all employees on board.

Effect of content usage on the academic performance

Content usage was also considered as a key factor affecting the academic performance. The content usage spectrum involved parameters such the coverage of the syllabus and the ease of access in usage and navigating within the content. 71.42% of teachers in management considered the Content Management System (CMS) usage as a key interest in the matters affecting academics.

Both teachers in management and in non-management, seemed to have similar positive opinions on the syllabus coverage, an indication that there were efforts by teachers in management to motivate the others despite the ineffectiveness of some of the incentives but they had the biggest disparities in opinion regarding ease of access of the content where teachers in management rated the implementation or practice positively, while teachers in non-management rated them as being inadequately or negatively conducted

Effect of after sale support on the academic performance

After sale support was also considered as a factor in this study, with 67% of teachers admitting that the school's academic performance was dependent on the availability of machines on a regular meaning each child has the access to the laptop in a class. Faulty machines can cause a negative effect on the performance. The rest of the staff while they did not refute the existence of non-monetary rewards differed with management in general over the balance with 12% completely disagreeing that there was any attempt at providing a balance. The need for a more experienced / knowledgeable teacher was desired by 42.85% of most teacher and 24.24% of non-management preferred other school staff, Experts from outside the school and an online helpdesk, community or website while School ICT / technology coordinator was desired by 28.6% and 21% respectively.

Effect of the Ergonomics on the academic performance

Ergonomics was also considered as a factor in this study with 57% of teachers admitting that the pupils not being able to support their wrists when typing affected learning whereas only 33% of the teaching staff agreed. Teachers in management were largely of the view that the school offered a well-balanced combination of height and angle of the monitors, keyboards and adjustable chairs. The rest of the teaching staff did not refute the existence this equipment's with teachers in management in general over the balance with 12% completely disagreeing that there was any attempt at providing a balance. Appropriate footrests was desired by 42.85% of management and 24.24% of non-management while screen a minimum of 50 cm away was desired by 28.6% and 21% respectively.

Academic performance

Technology, represented by the laptop program, can affect students' academic performance through several channels. Firstly, it increases the access to information, for example, it becomes easier for students to do online research and teachers can provide course content to students digitally. Secondly, it is likely to provide students with digital tools that can improve learning and performance. Examples are dictionaries, programs correcting grammar, calculators, and graphical mathematics tools. Thirdly, it might increase opportunities to communicate and collaborate with other students and take advantage of each other's knowledge. All of the above will strengthen educational outcomes. However, students might also get distracted by the use of a laptop in school. The increased access to entertainment such as social media, games, and the World Wide Web creates a tempting and easily accessible online environment for the students during class.

The impact of technology use on a student's academic performance depends on various social factors. First, the academic motivation will be crucial for how the student benefits from the access to a laptop. While motivated students may achieve on average better grades, non-motivated students may achieve on average lower grades due to the easy access to distractions on laptops during class. In addition, the socioeconomic background might cause students to be affected differently. For example, some students can take advantage of previous knowledge with use of home computers, as well as the fact that parental monitoring and supervision might differ between students from different socioeconomic backgrounds

Conclusions

The laptop program which was flagged in 2015 contributed to making the lower primary education the most digitized among the EAC countries. To analyze whether the investments in technology in education are efficient use of public resources, we exploit the differences in the timing of the laptop program implementation across the country to estimate the causal effects on academic performance. For this purpose we use a generalized difference-in-difference approach and an event study specification. Performance is measured as an average grade at school level in the common core subjects of general studies in lower primary education: The sample consists of 84 public primary schools.

The results presented in this thesis indicate that the use of individual laptops in the lower primary education has a significant effect on academic performance. These findings are in line with previous literature in this field. It is therefore relevant to assume that the implementation of technology in the educational system in Kenya has greatly affected the academic performance, at least when it is quantified as average grades at school level in the common core subjects studied here. However, we suspect that a potential significant effect of the

laptop program can be masked by contradictory effects of laptop use due to differences in for example motivation and socioeconomic background for students in the same school.

This paper is limited to analyzing the short-term effects on the traditional subjects. However, the findings can inspire future research in obtaining knowledge on long-term effects of technology use on other educational outcomes. In addition, the field of study is especially important when designing educational policy to prepare students for the future labour market.

Recommendations

The schools are aware of the broader impacts of introducing digital devices in the curriculum However it needs to consider the parameters involved in proper implementation of these devices and identify those that they are not factoring or need to improve on and act accordingly. The schools also needs to look into what causes the varying opinions on outcome of the various performances. The schools therefore needs to determine whether the differences are as a result of miscommunication, insufficient training, device size and quality, content coverage and address the differences.

Teachers need to see the positive impact of their continuous training not just to the schools but to themselves. Their high skill improves the schools output but does not lead to career enhancement for them and this makes them seek other employment opportunities.

There is need for improving academic performance and therefore the schools need to establish opportunities and develop all round employees with job descriptions that also have some tasks that are long enduring even in the absence of a donor funded project to provide continuity for highly qualified staff. It is costly for the schools to have to recruit highly skilled labour afresh every time they receive funding only to lose them to competitors after equipping them with skills through further training, and experience.

The decision makers have to consider whether the investments devoted to the laptop program are more efficient than expenditure on other educational inputs. The Government has to be thorough when deciding how to spend its scarce resources. Analyzing the effects of current technology initiatives in education can have implications for how educational policy is designed in the future. The Government can choose to invest less money in technological equipment if studies show that it has little or no effect on students' academic performance, i.e. is economically inefficient. However, it is difficult to judge whether the laptop program has been successful or not without being able to measure the students' digital skills and associated spill-over effects at individual level. The importance of digital skills is underlined by the Knowledge Promotion, and it is difficult to fulfil this objective without directly investing in technological equipment for students Thus, a potential way of assessing the project's economic efficiency is to compare to other forms of technological investments such as computer rooms.

Areas for Further Research

This research studied effect of digital learning program on the academic performance in public primary schools in Kenya

Our study is limited to analyzing the short-term effects on the average grades in schools in the common core subjects hence, for further research it will be interesting to analyze other outcome variables and long-term effects. First and foremost, measures that capture digital literacy are of interest, but also variables on academic results in courses such as mathematics, other foreign languages, as well as subjects in social sciences including

history and religion. In addition, it would be interesting to examine whether there are more students that choose technology oriented study

fields as a result of being introduced to technology in upper primary school. If the students obtain high digital competence before choosing higher education, the share of students applying for more technological study programs is likely to increase.

Furthermore, studying the effects of similar initiatives on other populations, such as students in lower levels of education and in other countries, could be of interest. Measuring the effect of laptops on younger students and their long-run outcomes would be highly relevant as younger students might react differently to the introduction of technology in education. Additionally, the effect of a laptop program might have a positive effect in other, less digitized, countries.

However, the studies on less digitized countries presented in the Literature Review have similar findings to the ones presented in this paper.

Lastly, it would be interesting to study the effects of the laptop program at individual level.

This would make it possible to control for more determinants of academic performance and hence obtain more precise estimates. This could make it possible to study the long-term effects of technology use in education, and hence whether the initiative makes individuals more capable of handling the future labor market, by measuring labor market outcomes.

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