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IMPACT OF MODELLING TECHNOLOGY INTEGRATION FOR OUT-OF-SCHOOL TIME LEARNING ON ACADEMIC ACHIEVEMENT

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ABSTRACT

This paper determines the impact of modelling technology integration for of out-of-school (OST) learning on academic achievement in primary schools. The research was conducted in Arusha Region, specifically in Meru District. The paper adopted the experimental design, involving experimental and control groups. Each of the two groups comprised three (3) schools, making a total of six (6) schools. The experiment was conducted using Digital Video Disks (DVDs), mobile phones, notebooks and home assignment booklets. The tools were further supplemented by a list of perceived best practices, and examination papers. The findings reveal a statistically significant difference in mean scores between the control and experimental groups as confirmed by 95% confidence level whereby, F (1, 180) = 28.63, p*=0. Based on the findings, null hypothesis was rejected, leading to the conclusion that the proposed model for OST technology integration is attributed to significant improvements in academic achievement for primary school OST learners. The implication of these findings is for researchers, and other educational stakeholders, including the government to invest in devising contextually relevant model, and mobilizing parents, teachers and learners with a view to hastening technology integration in order to improve academic achievements for primary school pupils. There is also a need for studies that further explore technology integration opportunities, and associated challenges in a bid to addressing poor academic performance among primary school pupils.*

INTRODUCTION

This paper subscribes to the view that learning is a ubiquitous and life-long process. This implies that learning can occur across time and space especially when mediated by educational technology. To achieve this, technology adoption is necessary; and according to Hultman (2004), this is simply a decision to accept or reject the use of technology. Adoption of technology depends on the extent to which potential adopters are influenced through effective channels of communication. In the context of OST, and in the view of Ashleigh and Jacinta (2010), a communication tool and prerequisite for enticing the academic use of ICT by primary school pupils may entail establishment of guidelines and models of technology adoption.

It has been established that learners' participation in appropriate OST programmes positively correlates with improved school attendance, better interpersonal, higher aspirations for college, and more positive attitudes towards school work finer work habits (Posner &Vandell, 1994, 1999; Schinke, 1999; U.S. Department of Education, 1998). It is further correlated with reduced drop-out rates, reduced teen pregnancy and improved grades, higher quality homework completion, and also less time spent in unhealthy behaviors (Clark, 1988; Hamilton and Klein, 1998; Huang et al, 2000; McLaughlin, 2000). Researchers have also found that learners see the link between what they learn at school and what they learn after school such that full enjoyment afterschool learning begins

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with effective school attendance (Metlife foundation, 2011).

There exist different approaches to making pupils learn during OST; and different approaches suit different socio-cultural contexts. For example, although the United States of America is considered the pioneer of community-based OST programmes, financial obligations and geographical diversity between schools, homes and the programme centres determine the efficiency of many programmes (miller, 1995). It has also been established that several middle and low income countries place children in private tuitions. On the one hand, some private tuition have been found to help learners to do better in examination; on the other hand, however, it has been indicated that negative consequences of private tutoring overshadow the accrued benefits (Mark, 2003). In Tanzania, private tutoring has been overruled; however, some practitioners are still active at both primary and secondary school levels (Amon et al., 2003).

In Africa, the Nokia Mobile Mathematics (Momaths) project has been supporting OST programmes. This project supports the teaching and learning of mathematics with the aid of mobile devices (UNESCO, 2014). In Tanzania, the Tanzanian Commission for Science and Technology (COSTECH) launched the Momaths project in 2014 (Ippmedia October 19, 2014*)*. OST learning has also been supported by use of mobile text messages. For instance, ELIMU Community Light (ECOLI) uses mobile technology to send text messages to guide, remind, and inform stakeholders (teachers, parents, and family members) about skills and best approaches to mediating learners' learning at school and out of the school environment (Center for Education Innovations, n.d). Moreover, since it is not bound by fixed class times, thereby enabling learning across time and space, ECOLI has devised social networks, public dialogue, and information sharing among ECD teachers, parents, and community members. Another OST learning initiative is presented by the Ubongo Kids project (Communication Initiative Network, 2014). Accordingly, Ubongo Kids is designed to mediate children's learning of mathematics and science in the form of songs, fun and local stories. The Ubongo Kids programme complements learning at school especially with regard to topics that seem difficult and essential for pupils. Given the local demands, the Ubongo Kids programme can inspire the use of technology in education in Tanzania. However, more and different educational programmes could join the Ubongo Kids programmes in order to complement the efforts.

Although there have been efforts to integrate ICT in OST learning different parts of the world, learners do not seem to have been enticed to fully and sufficiently exploit the opportunities associated with use of educational technology (Adomi and Kpangban, 2010; Swart and Wachira 2010). The Chalk Board Project (2008) and Terzian, et al. (2009) maintain that the availability of learning technology is not sufficient to guarantee better academic performance; the availability has to be accompanied by a model that comprises strategies that make learners interested by developing positive perceptions towards the use of the developed technology.

Many studies around the world seem to pay much attention on teaching and learning models that are classroom-based, and thus less is known about teaching and learning experiences in OST settings (Georgia et al., 2004). This determines the impact of modelling technology integration for OST learning on academic achievement based on the model advanced by Kiwango (2018). The model proposed joints endeavours of parents, learners and schools throughout the process of technology integration as a driver of hastening technology adoption in OST learning, consequently improving academic performance of primary school pupils in Tanzania. The paper draws from a Thesis authored by Kiwango (2018) for award of a doctoral degree of the University of Dodoma. The Thesis was on a model to hasten technology integration for OST learning for primary school pupils in Tanzania.

LITERATURE REVIEW

Theory of Constructivism

According to constructivists, learners construct meaning through active participation which makes them develop cognitive representation of their experiences (Juniu, 2006). This is further supported by the observation that children learn by thinking and doing, and thinking is the aftermath of participating in an activity (Jonassen, Peck, & Wilson, 1999). In a class based on constructivism, therefore, learners interact with the surroundings and create their own understanding of the world; as opposed to merely receiving information from the mentor (Jonassen, 2000). Therefore, active learning calls for occasionally minimal guidance to improve learning and motivation of learners so that they can transfer what they learn new situations encountered elsewhere (Kirschner et al., 2006). Constructivists think that OST learning is an important supplement to learners' school experience (Maddux, 2001).

The application of constructivist thinking in teaching and learning as mediated by technology offers more learning opportunities that make learners self-motivated and committed to thinking critically (Juniu,

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2006). The term techno-constructivist has been coined to denote teaching and learning practices that integrate technology into the school curriculum thereby complementing classroom instruction and redefining the same (McKenzie, 2000). According to Rakes, et al., (1999) "technology can provide the vehicle for accomplishing constructivist teaching practices". The scholars are of the observation that the use of constructivist methods in the teaching and learning are directly related to the amount of the available technology, the level of technology skills that tutors possess and the use of technology. Collins (1991) opines that technology-rich learning makes the learner more autonomous while at the same time allowing individualized instruction and active engagement. This theory suits the present context since it capitalizes on the need to make technology integration sensitive to the learning environment.

Harvard Family Research Project (HFRP) Logic model for OST

According to Kellogg Foundation (2000), a logic model explains the manner in which a programme is expected to work as related to activities, resources and the intended outcomes of the programme. Watson (2000) outlines six components of a logic model, which include programme desired results; programme motivating conditions and causes; programme strategies; programme activities, outcomes performance measures and outcomes indicators. According to Hamilton (2007), logic models are powerful tools for designing, planning, implementing and evaluating OST learning programmes. In implementing and measuring OST programmes, HFRP (1999), customizes the logic model into four components; which are inputs, activities, outputs, and outcomes. Whereas inputs pertain to plans or resources involved in the evolution of the programme, activities have to do with the components that define the main tasks and activities to be carried out during the implementation of the envisaged programme. As regards outputs, some programme aspects are expected to change instantaneously following the implementation of the programme. On the other hand, outcomes entail changes in the performance of individuals or community as a whole. This study supports the HFRP model because it insists on the need of evaluating the achievement of OST learning, which is the focus of this paper.

Out-of-school time learning technology integration model

Kiwango (2018) came up with a model for OST technology integration that comprises three main constructs, namely the OST technology integration strategies, hastened technology integration and improved academic achievement. As regards the OST technology integration strategies, the model is designed in a way that the operation of each activity relates to the participation of stakeholders as the two jointly form the strategies for integration of OST technology. The model comprises six strategies, which are the assessment of stakeholders' perceptions, validation of stakeholders' perceptions and partnership contracting. The other strategies include capacity building, technology acquisition, technology deployment, and participant evaluation. Whereas technology integration strategies are implemented in a manner that hastens technology integration, they are also implemented linearly; beginning with assessment of stakeholders' perception and ending with participant evaluation.

Hastened technology integration is measured by intensity of technology use, timeliness of technology use and use of other technologies. Hastened technology is determined by the OST technology integration strategies, and in turn influences the academic achievement. On the other hand, improved academic achievement gauges the degree to which the use of new model and the associated technology impact on the learners' academic performance. This paper adapted the out-of-school time learning technology integration model by Kiwango (2018) with a focus on the academic achievement construct.

The Concept of Out-of-School Time (OST) Learning

The Afterschool Coalition of Indianapolis (2002) views OST learning as a range of activities that are learned before school, after school, including weekends, holidays and vacations. Recently, there has been the urge to come up with a more expansive definition of learning to include all the means by which young learners can have access and make use of educational opportunities. This is opposed to the traditional school model, and instead includes afterschool activities, time spent with the family, and more and more, interaction with the digital media (Sarah *et al.*, 2012). Studies have attributed participation of learners in OST learning programmes to better school attendance and more positive attitudes towards school work. The practice is also linked with finer work habits, higher aspirations for college, reduced drop-out rates and better interpersonal skills (Clark, 1988; Hamilton and Klein, 1998). Other benefits include higher quality homework completion, less time spent in unhealthy behaviors, improved grades and reduced teen pregnancy (Huang *et al.*, 2000; McLaughlin, 2000).

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METHODOLOGY

Research design and approach

Data resulted from an experiment which involved experimental and control groups; while quantitative analysis of data was adopted.

Research location

Data was collected in Meru District, located in Arusha, one of the cities in Tanzania and whose population was found to have sufficient access to technological digital devices such as decoders and television sets (Lamudi, 2015; TCRA, 2013). This made the population more aware of educational technology, and better positioned to participate in the study. This is coupled with the fact that urban and peri-urban population is more advanced in the use of technologies than rural population (Kelly, 2013). Therefore, being peri-urban, Meru District was thought to be a moderate representation of majority of Tanzanians culturally and economically.

Participants in the experiment

A quasi-experiment was mounted in the study site; involving six (6) schools in the experimental and control groups. Class 6 pupils whose families own a DVD player device specifically a television qualified for the experiment. Class 6 pupils were assumed to be more mature, as compared to those in lower classes and therefore in a better position to respond to the study. Class seven was not involved because they were expecting to sit for the National examination and hence it would not be wise to interfere the busy schedule that they had with their teachers. There were 99 and 83 participants who responded to the study in the experimental and control group respectively. Given that the experiment was meant to determine the effectiveness of the new model in the context of OST learning, day scholars were preferred instead of boarding scholars.

Schools were selected with consideration of the learning contexts of Tanzanian primary school pupils. To that end, criterion sampling was used so as to involve public schools since they mostly use the curriculum maintained by the National Examinations Council of Tanzania (NECTA), and which also use Kiswahili as a medium of instruction. Since all of the schools were Government-owned, the selected schools followed the same curriculum and had similar recruitment modalities. The schools were also guided by similar procedures as guided by schemes of work, while they also shared criteria for enrolment of pupils.

Another important consideration was physical accessibility; as the experiment involved six schools while requiring several examinations, distribution and supervision of tests, returning the marked test papers as well as distribution of DVDs. Since also these movements depended wholly on public surface transport, the experiment was arranged in a manner that eased movements. This dictated the selection of schools from geographically friendly settings. With reference to the geographical orientation of Meru District, the transport was mainly the Moshi - Arusha road. Thus, the selection favored the stretch of four kilometers along the road.

The experiment

Creswell (2005) asserts that the experiments conducted in natural environments do not usually allow full control and random selection of participants. In this case, data collection involved a quasi-experiment which was conducted in a natural setting since it took place in an educational system. To check the impact that might be caused by a single group or single measurement, experimental and control groups engaged three schools each; while also measurements involved a pre-test and three progressive tests.

Treatment of experimental and control groups

Pupils in both groups took a monthly class test as part of the experiment. Pupils who had access to television were given free DVDs with contents of class six topics where they were required to study the topics and prepare for tests. Test schedule was communicated to the potential participants beforehand for them to make necessary preparations for the impending test. After the test, marking was done and marked works were given back to the participants. As per the requirement of the out-of-school time learning technology integration model by Kiwango (2018) pupils of the control group were supplied with and oriented to best practices with respect to the use of the DVDs. Additionally, parents and teachers of the experiment group were also equipped with and oriented to strategies that were essential to support and guide the pupils in making effective use of the provided DVDs. Thus, the main aspect that differentiated the experimental from the control group is that for the former, the use of the educational technology was controlled by the strategies related to the model; while the latter remained under the traditional model of schooling. Therefore, the effectiveness of the new model was measured on the basis of this difference.

Tools for the experiment

The experiment involved the use of Digital Video Disks (DVDs) to be used in DVD players,

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notebooks, mobile phones, examination papers, and a list of perceived best practices.

Procedures

The experiment involved the issuance of DVDs for both groups, issuance of best practices to pupils as well as teachers and parents of experiment group, and administration of a pre-test followed by progress tests. Both groups took a total of three monthly progress tests.

Measurements of the experiment

It was important to monitor the progress to find out whether the use of the proposed model for OST technology integration led to better academic achievements among the learners. The pre-test served as a covariance which made it possible for the scores of the progress tests to be adjusted. The assumption was that pupils who used the educational technology would be more likely to have made more use of the model. For a better picture of the proposed model questions were picked from topics which had been covered in the materials distributed to the participants up to the test period. To maintain the normality of distribution, the log base 10 function in SPSS programme was used to manipulate the test scores. The General Linear Model (Analysis of covariance - ANCOVA) with repeated measures used to measure the learners' performance whereas the pre-test was used as convariance.

RESULTS

Progress test achievements

To establish whether the use of the proposed models for OST technology integration improves learners' academic performance, the following hypothesis was tested;

Null hypothesis (Ho): The use of the proposed model for OST technology integration will not improve the academic achievements in primary schools.

The descriptive analysis shows that the overall mean for the three tests was 29% for experimental groups and 22% for control groups. This shows that performance of the experimental group was higher than that of control group. It was revealed that there was a statistically significant difference in mean scores between the experimental group and control group where, $F(1, 180) = 28.63$, $p=0$. Therefore, null hypothesis was rejected at 95% confidence level and it was concluded that the use of the proposed model for OST technology integration leads to significant improvements in academic achievements.

DISCUSSION

The results of this study revealed that the use of OST learning improves pupils' academic achievements. The findings corroborate previous studies which have shown a positive relationship between the technology use and academic performance among school children. For example, a study by Letao and Kelly (2010) sought to find out whether 15 years old students who used computer frequency performed better than those who did not. The study found that students who use computer frequently had statistically significant higher performance than those who used computers less frequently. This is because the use of technology reinforces classroom learning, reduces material costs, and increases parental involvement. According to Ashleigh (2010) and David (2013), the practice also cultivates the spirit of independent learning while also building interest in school-related activities.

It is worth understanding, however, that the effectiveness of educational technology on learners' academic performance depends on some conditions. For example, Nazir (2016) concludes that learners at a high risk of smartphone addiction are less likely to have any improvements in their academic achievements. Another study by Tabassum and Hanan (2016) found that the use of technology is positively linked with learners' engagement and self-directed learning, but did not find any significant effect on learners' academic achievements. It can be said that the lack of relationship could be attributed to the view that learners' exposure to technology in the absence of a guided model, inspire them to engage in non-academic uses. According to Adel and Aladwani (2016), the use of technology could have adverse impact on learners' academic performance, if irrationally used.

CONCLUSION AND RECOMMENDATIONS

It has been found here that the findings on the use of technology among learners are contradicting. The point of concern is whether or not the use of technology positively impacts on academic performance of learners. This inspires the conclusion that learners' use of educational technology may or may not improve academic performance depending on the extent to which some conditions are met. In the same veins, one could say that under ceteris paribus, non-educational use of technology is more prevalent in lower levels of education because their learners may not be conversant to discern between good and bad use of technology as compared to learners in higher levels of education. This being the case, one could think that the use of technology leads to improvement in

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academic achievements in primary schools where the integration is coupled with effectively monitored settings. This has implications for learning in the Tanzanian context in the sense that if not closely monitored the exposure of technology to primary school pupils may lead to its abuse that may perpetuate risky behaviour and compromise their academic achievement. Therefore, pertinent efforts need to be made to encourage pupils to use educational technology for academic pursuits. It is thus recommended that researchers and educational stakeholders including the government need to invest more in designing contextually relevant models that actively involve learners, parents and teachers in hastening technology integration with a view to improving pupils' academic performance in Tanzanian primary schools. To make this a reality, the government should intervene especially in terms of making policies which favour integration of OST technology. Another area which is really important pertains to studies which aim at further exploring opportunities for technology integration; including also challenges that may hinder exploitation of technology and the way the findings can be used to address issues pertaining to poor academic performance among students and pupils.

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