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TECHNOLOGY INTEGRATION MODELLING FOR OUT-OF-SCHOOL TIME LEARNING AND TIMELINESS OF TECHNOLOGY ADOPTION

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Abstract: *This article reports on an examination that was carried out to test the influence of technology modelling on timeliness of technology adoption integration in the context of out-of-school time (OST) learning. The test assumed the form of a quasi-experiment that involved experimental and control groups. Data was captured from respondents purposefully drawn from Meru District Council in Arusha Region. Some 310 pupils, their guardians, mathematics teachers and head teachers from six primary day schools. The experiment involved the use of digital Video Disks, DVD Players, mobile phones, home works handbooks, answer booklets, and a list of perceived best practices. Pupils in the experimental group were subjected to the proposed model while those in the control group were exposed to traditional practices. The timeliness of the pupils' actual use of the developed technology was determined by the length of time taken to adopt the technology counted from the first the technology was availed to pupils to the date the technology was first used. The t-test suggested a statistically significant enhancement in the timeliness of technology adoption by pupils in the experiment group as compared to the pupils in the control group ($t = -5.49$, $N1=110$, $N2=46$, $SD1=9.28$, $SD2=12.80$, $p(0)<\alpha$ (0.05). In view of these findings, the alternative hypothesis was accepted at 95% confidence level; which implies then that the technology integration modelling improved the timeliness of technology adoption among OST learners in primary schools. This suggests that there is a need for capacity building for developers of educational technology so that they can invest more in developing such technologies especially in the context of OST learning for primary school pupils in Tanzania.*

Key Words: *Technology integration, out-of-school time, Technology adoption timeliness, primary school learning.*

1. INTRODUCTION:

Jolene[1] perceives technology integration as organization of teaching goals, learning processes and technology with a view to bring about coordination and harmony among them. According to Kimberly[2] there are five main steps in technology integration, and these are definition of the intended technology; definition of the vision for technology integration; and developing a systematic plan for the technology integration. It also involves seeking the support of stakeholders before the implementation and ultimate review of the effectiveness of the integrated technology. Stages involved in technology integration have also been outlined by John[3] and these subsume planning, engagement of stakeholders, mobilization of resources, and execution of technology integration and management of the same. These steps have been further clarified in five steps which include identifying the goal and vision of technology integration; developing an action plan that is budget-responsive, and identifying training needs and strategies for implementation. The other two are mobilizing stakeholders and implementing the plan as well as evaluating the realization of the expected outcomes. These steps are important in the context of integration of technology for OST learning in that successful integration of technology in owes a lot to the degree the project initiators thoroughly take into account the identified procedures. The speed of adoption of ICTs in Tanzania has a long history also punctuated by government policies; for instance, in 1974 the government did not allow importation of computers; and this was the policy until 1977 when the East Africa Community (EAC) collapsed. Indeed, the government found it difficult to continue the ban since it had to use the computerized systems which were used by the EAC. The use of ICTs was further enhanced by trade liberalization in 1980s.[4]The political will is also noted in the formulation of the ICT Policy for Basic Education.[5] The trade liberalization policy laid foundations for increased use of ICTs in different life circles including education. The education sector, for example, benefitted a lot from such initiatives as the implementation of ICT in Teachers' Colleges, development of ICT in Secondary Education, and introduction of computer subject in the curriculum. Other initiatives include eSchool Forum, Education Management Information System (EMIS), Computer Procurement and Refurbishment for Schools and Tanzania Education Services Website. The Barclays Bank also supported the use of Computer in schools.[6] The development of ICT in Secondary Education had the aim of enabling the use of ICT in all secondary schools by the year 2015. This project procures second-hand computers and supplies them to secondary schools after some refurbishment. As for the Tanzania Education Services Website and EMIS, the goal is to ensure

management and availability of educational information while Barclays intends supply 10,000 computers to 500 schools across the country. Apart from the nationwide initiatives, some local institutions including the Ubongo Kids have punctuated the scene. This is visible in the ICT integration for OST learning.[7] The Ubongo Kids is a series of educative cartoons in Tanzania whose aim is facilitate learning of mathematics and science with the aid of fun, songs and local stories. This programme serves a supplement to classroom based learning and focuses on topics which most pupils find difficult to understand. Inspite of the initiatives mounted by the government and non-governmental institutions towards technology integration, it has been found that the actual use of educational technologies among Tanzanian learners is still limited and this is particularly true of OST learning.[8,9] Among the main explanations for this limitation is the lacking strategies or relevant model which could motivate learners to use educational technologies in order to improve their educational performance.[10,11]

Educational technologies have been deployed to enhance learning in many countries of the world such as the Jordanian Higher Education Institutions by Khasawneh et al[12], Cloud Computing Integration Model for Universities.[13] and Structural Equation Model for ICT Usage in Higher Education in Turkey.[14] However, it seems that technology integration in these countries is mostly favoured in higher education while primary school level is somewhat ignored. One would be tempted to believe that since primary school lays a foundation for higher education, technology integration should be emphasized at this level even more, and in the context of Tanzania, OST learning is a commendable initiative. In order to capture and benefit from OST learning, there is a need for a contextual model that would attract pupils to make use educational technologies so that they can enhance their performance academically. This article draws from a study that modelled the technology integration for OST learning. The intention of the model is to hasten technology integration in OST learning for primary school pupils while bringing together the key stakeholders in children's education, including parents and teachers. This article examines how modelling of technology integration for OST learning could improve the timeliness of technology adoption for primary school pupils in Tanzania. This work is based on a Thesis submitted by Kiwango[15] who is the Author of this paper for the award of a doctoral degree of the University of Dodoma. The Thesis developed a model to hasten technology integration for out-of-school time primary school learning.

2. METHODOLOGY:

A quasi-experiment was conducted involving an experimental and a control group. This design was favored as it allowed access to a natural educational setting and practices. In order to waive the effects that would result from using one group, the experiment involved three primary schools in the experimental group and another three primary schools in the control group. The whole experiment comprised 143 class six pupils in the control group, 167 class six pupils in the experimental group, five (5) Mathematics teachers of the involved class, three (3) head teachers of the experimental group and 127 parents of the pupils in the experimental group. Teachers and parents were included in the experimental group because one of the aims of the model was to enhance their participation in OST learning. As the experiment was expected to measure the use of the new model in OST learning, day primary school pupils were considered more relevant than boarding school pupils. The timeliness of educational technology use was computed in relation to the number of days that elapsed before the educational technology was adopted as shown on the answer notebook. Data was subjected to the Statistical Package for Social Sciences (SPSS) for analysis. Percentages, mean and t-test were then determined and compared between the experimental group and the control group. Finally, t-test was applied to find out whether the experimental and control groups demonstrated a statistically significant differences in the timeliness of educational technology adoption.

Teachers were selected by virtue of their position, as they have close interactions with learners, school administration and parents. In this case, a teacher has the advantage to interlink the parents and administrators in the course of technology integration. The head teachers were involved as they were important to make a follow up to learners, teachers and parents to encourage them to perform their respective practices towards improving the timeliness of technology adoption. The class six pupils as upper class was involved because they were considered to have more experiences in using educational technology, and would better understand and respond to the research questions compared to lower classes. The need to address the gap with respect to the use of educational technology in primary schools as compared to other educational levels, was one of the reasons for the study to focus on primary schools. Primary school learners being among the highly vulnerable groups to the risks of technology abuse[16] probably due to their relatively low reasoning and discerning abilities, as compared to other levels of education, were selected for the study so as to encourage them towards a proper technology adoption. The selection of primary school learners was also built on the reason that: there is a need to inculcate the habit of positive technology use from the early ages, particularly with respect to the primary school learners, as a way of preparing them to embrace educational technology in the future. In addition to that, the researcher thought that the use of educational technology would contribute in tackling the challenge of inadequate academic achievement in primary schools particularly with regard tothe subject of Mathematics.[17,18] Being core to other subjects, there is a need for special efforts to help primary

school learners to improve their performance in Mathematics. In this respect, the Mathematics subject was preferred in the designing of the educational technology. Criterion sampling was used to select the schools where, the aim was to involve schools whose class five or six have at least 30 pupils with television at home. One of the reasons was the availability of television at home as the experiment intended to use DVDs which were to be supplied to pupils for use at home. The use of DVD is neither considered the best of all technologies but, the most-fit to the contexts of the experiment as it is easier to use, affordable and available compared to other technologies such as smart phones and internet. Moreover, the use of DVD as offline technology could flexibly link very well with the nature of the experiment which required the pupil to view the content at own pace. On the other hand, the use such DVDs required a reliable source of power specifically the Tanzania Electricity Supply Company (TANESCO) It was observed that the TANESCO was the major source of power in Meru district which was essential to run the intended technology. It was further observed that, the more the distance from Moshi to Arusha tarmac road the less the availability of power. Therefore, the schools that were not far from the tarmac road were preferred for only and only the sake of having the possibility of schools with reasonable number of pupils that had have television at home.

More importantly, the selection of the schools was made in favour of the relatively less income families. Thus, the other criteria was to select the public and Kiswahili medium schools of which majority of Tanzanian are enrolled and whose majority of pupils come from relatively lower income families, compared to private and English medium schools. The purpose of selecting these kind of schools and pupils was to take care of the life conditions of the Tanzania majority as it was reported by the District education office that private schools are more expensive and comprised of the minority. Similarly, the idea of favoring the relatively less income families was conjunctively supported by the selection of Kiswahili language in designing of the DVD content. It was considered that the designing of Kiswahili-based technology content and the use of the National Examination Council of Tanzanian (NECTA) syllabus would give more significant contribution to relatively less income and majority Tanzanians. Therefore, the researcher obtained the list of Kiswahili-medium day schools with details of their geographical locations from the District Education Office. The first 18 schools closer to Moshi Arusha road were selected for the purpose of investigating on the number of pupils in class 5 or 6 whose family owned a television set. Apart from being asked on whether they owned a television set at home, pupils were also asked to rate the extent of supervisory support that was offered to them during OST learning. Then, the school list was sorted according to their (pupils) number with a television set at home. It was found that in class six, 12 schools out of 18 schools had at least 30 pupils with television sets at home. Therefore, the researcher sorted the list with 12 schools in the order of their OST supervisory services. The list was then split into three categories of 4 schools each, where two schools were selected from the mid of each category. Among the selected two schools, one was assigned to experiment group and another one to control group randomly. The experiment sought to find out how the resultant model would speed up the use of the technology provided. The experiment was conducted for three months where the experimental group was treated under the proposed model and the control group under the traditional practices. Digital Video Disks (DVDs) embedded with all class six NECTA syllabus, and home assignment handbooks were supplied to pupils of both the experimental and control groups. The lists of perceived best practices for handling the use of the intended technology, and as the engine of the model, were exclusively and respectively supplied to the pupils, parents and teachers of only the experimental group. The list of best practices stipulated the roles of pupils, parents and teachers in ensuring timely and effective use of the supplied technology, and these distinctively distinguish between the two groups. As an example, the best practices for parents were to encourage their children to use educational technologies by buying them such technologies and guiding materials for learning; teaching their children on usage of educational technology; instructing them to summarize what they have learned, asking them questions on what they have learned, and giving them lists of educational programmes to use. 3.The learners were supposed to play the DVD and answer the respective questions according to the DVD presentation. There were some questions for each topic which were designed in such a way that a learner would need to view the DVD in order to answer them correctly. Each topic, for example, involved several questions which were unique to the presentation itself, like questions which were related to tools used by the presenter. The learners were supposed to answer the questions supplied to them and submit the answer notebook to subject teacher for marking, as soon as they complete any topic of the assignment. More importantly, Learners were obliged to ensure that they wrote the dates of any day when they answered any number of questions, and parents were insisted upon ensuring that they reminded their children to do so. In addition to that, subject teachers were required to check if the date was written when learners submitted the answer sheets. Also, Mathematics teachers were required to check if the dates were written when learners submitted the notebooks.

3. FINDINGS:

The findings demonstrated a mean of 13 days for the experimental group, and 25 days for the control group. Therefore, the mean range between the two groups was 12 days, implying that pupils in the experimental group used the educational technology earlier than the pupils in the control group. Moreover, the standard deviation for the

experimental group was 9.29 while the deviation for the control group the deviation was 12.80. It can thus be concluded that the duration taken by pupils in the experimental group to adopt the developed educational technology was statistically significant in the sense that they spent less time than that spent by pupils in the control group with a t-test: $t = -5.49$, $N1=110$, $N2=46$, $SD1=9.28$, $SD2=12.80$, $p(0)<\alpha$ (0.05). Therefore, it is hereby concluded at 95% confidence level that the timeliness of adoption of technology can be enhanced by modelling of technology integration for OST learning.

3.1. DISCUSSION:

It is established in this article that the modelling of technology integration enhances the timeliness adoption of technology in OST learning. This is mostly attributed to the adopted philosophy that stakeholders are key champions in the process of technology adoption. Involvement of stakeholders as champions in OST technology integration has been found useful in different countries around the world, notably the United States of America where agencies act as champions including the Michigan State Board of Education, the National League of cities, the Year-Round Learning and the Institute of Education Science. For instance, the National League of cities[19] championing capitalizes on the involvement of school and families for the purpose of forging common goals and outcomes of OST programmes. To that end, they offer a neutral avenue for key stakeholders to coordinate and enhance access to OST standards and resources of various kinds. On the other hand, the Institute of Education Science employs champions to organize and mobilize the school and families with a view to aligning OST programmes with schools. According to the Institute of Education Science[20] the champions establish and maintain necessary relationships and communication that bring together schools and the community, thereby promoting knowledge about OST programmes.

Sarah[21] shows that the Year-Round Learning promotes student-centred as well as family-centred OST programmes. This forum offers necessary mentoring to pupils for them to keep involved and engaged for the whole year. As in the case of the Institute of education science, the Year-Round learning relies on champions in mobilizing the community involvement in education provision. Kathleen et al[22] report that the Michigan State Board of Education establishes OST standards for the Michigan State. Specifically, the responsible board ensures the participation of children, parents and schools in designing and implementing OST programmes. The National League of Cities projects as well as the Michigan State Board of Education engage parents in designing, managing, implementing and evaluating OST programmes. Despite of the efforts employed by the institutions examined above in developing the framework for facilitating OST learning, technology integration seems to have not been given due consideration. It could be argued here then that successful integration of educational technology for OST learning demands the application of a model that involves schools, parents and students in assessing the needs, developing, using and evaluating the developed technology. With reference to school participation, teachers by virtue of their duties, serve as a pertinent role model that can facilitate communication between parents, pupils and school administration with a view to championing productive technology integration for OST learning for primary school pupils particularly in Tanzanian context.

4. CONCLUSION:

The findings and discussion presented above have shown that modelling of technology integration that involves key stakeholders in education provision leads to enhanced timeliness in technology adoption. This implies the need to forge collaboration of educational technology developers, policy makers and school administration as key stakeholders. Unless these are given due space to take roles throughout the technology integration processes, little can be expected in terms of successful technology integration especially for OST learning in various contexts. This, therefore, requires building the capacity of the key stakeholders for them to play their roles more successfully. Furthermore, research is needed to determine the most effective technology modelling that reduces the timeliness of adoption of educational technologies especially with regard to OST learning in various contexts in general, and in Tanzania in particular.

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