Application of the constructivist methods of teaching-learning through the use of ICTs in Zambian schools. A case of selected secondary schools in Lusaka

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Abstract

The government educational policy in Zambia has been supportive of the use of ICT-mediated constructivist methods at all levels of education. However, little is known about the ways these learner-centred methods are applied to benefit the pupils in secondary schools. This study was conducted with the purpose to establish the various ways teachers use the ICT- mediated methodologies to involve pupils in the teaching-learning process in Zambian secondary schools. The constructivist theory of learning, which stipulates that the learner should actively participate in the construction and transmission of the knowledge content inspired this study. The descriptive survey study design, qualitative and quantitative methods were used in this study. The sample of 72 pupils and 9 teachers was drawn from 3 secondary schools in Lusaka province. The semi-structured interview schedule, questionnaire and focus group discussion guide were used to collect data. The study established that various ICT facilities, dominated by computers and internet are used to apply constructivist teaching-learning methods such as peer teaching, free and directed research by pupils, both individually and in groups.

Key words: Constructivism, Information and Communication Technology (ICT), Teaching-learning Process, ICT-mediated methodologies, application.

In the constructivist-oriented education, learning is regarded as the result of learners' action of constructing and transmitting knowledge, based on personal experiences and social interactions among the peers as well as the individual or group interaction with the environment (Kharad and Thakkar, 2012). Based on the position occupied by the learners in the teaching-learning process and the social interactions involved, Kalpana (2014) distinguishes two different models of constructivism, namely psychological or individual constructivism, whereby the belief system and individual self-concept are the main references in defining education. In this regard, people learn by integrating new information to match or replace the old belief, which had been incorporated previously in one's psyche. This model was developed by Jean Piaget in his cognitive development and views learning as a discovery process based on the prior experiences which takes place through the active participation of the learners in the whole teaching-learning process. The second model, according to Kalpana (2014) is the social constructivism, developed by Lev Vygotsky, and it recognises the fundamental role of social

interactions in meaningful learning. However, this model does not underplay the importance of the belief system although the emphasis is put on the views pertaining to sharing and collaboration among the learners as a primordial condition for learning to take place and succeed. The learning is enhanced by the presence of significant others, more experienced peers or simply computer or any useful ICT device.

In both models ICT comes in as a common factor in the sense that it provides a rich environment, capable of helping learners gain new experiences and enhance collaboration, discovery and social interaction. ICT used in education offers a virtual learning environment rich in stimuli and able to modify the nature of education, minimising the indispensability of the teacher's action hence maximising the learners' involvement through discovery and exploration in full motivation (Majumdar, 2006; Ndlovu and Lawrence, 2012).

ICT is more than just computing and computer related activities. As its evolution indicates, its genesis goes back to the 1980s, when the term IT meaning '*information technology*' was born as a way of giving consideration to the computers' role of storing and retrieving information. In 1992, with the increase in e-mail use, the term ICT or '*Information and communication Technology*', was coined to replace IT, which according to the United Nations report (1999) cited by Noor-Ul-Amin (undated) includes all internet services, technology equipment and services, media and broadcasting, network-based information services and all other information and communication activities. After this evolution ICT was ready to find its use in many life areas, including education in schools.

The integration of ICT into education may sound clear and well understandable but, the practice itself of teaching using the methods involving ICTs did not find its way into education to be straight forward. In the first days of their introduction in schools, Information and communication technologies constituted a very big puzzle to the education officers in the sense that it was difficult to decide whether it could be considered as a subject on its own or as a tool to be used to help transmit other subjects learnt in schools. The debate remained unsolved for a long time (Abbott, 2005). However, as Abbott (2005:46) reports, it has been imperative to adapt the teaching to the revolution of the society and the inevitable inclusion of ICT in all areas of life. To this effect, he further goes on to say: "Schools as institutions are changing rapidly as technology alters the paradigm of schooling [...] we consider the changes that have gone on in how we view learning, whether this be through the views of constructivist thinkers,

educationists, business economists such as Gates, or the thoughts of young learners themselves".

Due to their effects on the improvement of the general knowledge of individuals and in learning situations in particular the ICT based methods have been one of the ways through to improvement of the teaching methods in modern education. Besides, the ICT tools facilitate the move from the "traditional pedagogy" to the modern discovery methodologies which are centred on the learner and mainly based on the learner's activity (Voogt and Knezek, 2008). However, heeding the ICT inclusion demands requires a combination of good will and understanding as well as financial capacity by educational stakeholders.

In most of European countries the introduction of computers and other information technologies in classrooms received a warm welcome and more money was allocated in training teachers on how to use computer programmes and equip the schools with ICT tools such that until 1999, the computer-pupil ratio in the United Kingdom was 1 : 3 in primary, 1 : 8 in secondary and 1 : 4 in special classes (DfEE cited in Abbott, 2005). By the end of 1999 ICT was used in primary schools to teach all the fundamental subjects such as English, mathematics, history, geography, etc. The success brought about by the use of ICT in class on the learners' performance, pushed more other European countries, including United Kingdom to allocate the bigger part of their educational budgets on the improvement of the ICT equipment in the classrooms and they introduced among others, the multimedia blackboards, interactive whiteboards and broadband internet access (Jimoyiannis, 2012).

Today, ICT is learnt in classrooms as a part of IT, computer study or Technology. It is not only a subject of study but also as a tool to facilitate the learning and teaching of other subjects in class, promoting the creativity of the learners, increasing the practical knowledge and self-information, as suggested by a number of studies conducted in the area. The ICT also has the potential of increasing the capability of problem-solving by the learners, critical thinking skills and capacity of dealing with various qualities of information, which constitute the major focus of the modern constructivism. With these tools, the knowledge construction is not limited to the classroom or school, but it even continues at home (Voogt and Knezek, 2008). The importance of pupils' research, whereby the teaching-learning process is made flexible and independent has grown exponentially (Marion and Leather, 2015). The flexibility is well remarkable to the point that the use of these tools itself determines which ICTs should be used (Gill, Dalgano and Carlson, 2015). In this regard, the emphasis of self-instruction as suggested

by modern education was amplified by independent research by the learners and the social interactions were widened and given a new look by extending school education to the home level.

African countries have not been left behind in the exploration of the effects of the ICT-based methods in education. By the year 2007, in most of Sub-Saharan African countries, the computer studies or IT had been introduced in schools, but as an optional subject. However, most schools could not afford the cost of ICT facilities, due to either their reliance on donors or the higher cost of these facilities in the countries until then (Ottevanger, Akker and Feiter, 2007). The ICT was not even commonly used as a teaching tool for other subjects of the curricula. This was as a result of the shortage of the equipment and human that could help incorporate the ICTs in the other subjects. Most ICT literate teachers would leave education to join business or industry areas (Ottevanger, Akker and Feiter, 2007)

More effort was made to overcome these obstacles and attempt to successfully incorporate ICTs in African schools as a way to adopt the constructivist principles of learning. Research conducted in this area in KwaZulu Natal secondary schools in South Africa showed that ICT is used as a teaching and learning tool to shift from traditional teaching to the modern educational system and was found to promote the collaboration among learners, dialogue and knowledge sharing (Govender and Govender, 2014)

In Zambia, The government's policy on the use of ICT in all areas of life was introduced in 2007 and basically targeted education, mainly because that is where the majority of the population is found. It also began with education which is regarded as the foundation of the development of any country. This would help teachers by enhancing their knowledge, facilitating their working conditions and promoting the research and creativity of the learners at early education levels (Chief Chinkanta and Mweetwa, 2007). For the similar purpose, the projects like iSchool (http://www.ischool.zm) have been created with intention to connect various schools on internet and later on, to help students access the learning materials and the teachers to access the materials they need to plan the lesson and improve their professional skills online. It is in this regard that a multimedia Zedupad tablet was made available by the same project to teachers and students, already preloaded with these materials.

Studies were also conducted aiming at finding the most suitable ICTs for use in Zambian schools (Habler et al, 2011) and to foster teachers' preparedness in incorporation of ICTs in

education (Magambo, 2007). However, the need to establish how the development in ICTs applies in the local secondary schools and how these tools are harnessed in attempt to improve the quality of education through the constructivist methods in teaching-learning process especially in the secondary section remained unclear. Hence, the need for the present study to fill the noted gap.

PURPOSE OF THE STUDY

The purpose of this study was to find out the various ways the secondary school teachers in the selected schools of Lusaka get the learners involved in the teaching - learning process through the use of ICT-mediated methods.

METHOD

In the study, both qualitative and quantitative paradigm were assigned to the study specifically using the descriptive survey study design. The approaches allowed for a detailed and holistic description of the ways teachers in secondary schools of Lusaka implement the learner-centred methods as suggested by the constructivist theory through the use of ICT in teaching-learning process in schools under study. The qualitative method was used in this study, supplemented with quantitative method to fulfil that goal.

Research participants

The sample of 81 respondents was drawn from 3 secondary schools in Lusaka. This sample consisted of 72 pupils and 9 teachers (3 ICT teachers and 6 teachers of mainstream subjects). The study employed purposive sampling, and stratified random sampling. The purposive sampling, according to Kasonde (2013), involves using common sense and best judgement to choose a certain group in the population, likely to provide rich information needed for the study. This information is meant to facilitate the in-depth analysis of the focal issue the study is concerned with. This sampling technique was used to only target the schools which were equipped with ICT facilities. Stratified random sampling on the other hand, involves making homogeneous strata among the population and select the representative members of each subgroup using the simple random sampling. This assures that all strata in the population are represented according to their numbers (Kombo and Tromp, 2006). The stratified random sampling was used to allow equitable inclusion of both boys and girls among the pupils and male and female teachers in the sample.

Procedure

Being a case study in nature, the semi-structured interviews were used to collect the primary data of this study from teachers while questionnaires and focus group discussion guide were used to collect data from pupils.

The first phase of data collection, the pilot study, which had as purpose to test the interview guide was conducted in one school which was not part of the sample but was equipped with ICT facilities which were also used for teaching and learning purposes. Before both the pilot and the actual study were conducted, permission to conduct the research was sought from the school head teachers or principals who are the closest authorities in the concerned schools. Thereafter, the data collection was conducted with the sampled respondents on different days. In order to determine validity of the findings, data collected were verified by using respondent validation.

Data analysis

Quantitative data was analysed using the Statistical Package for Social Sciences (SPSS) to yield frequencies, percentages and charts. Thematic analysis was used to analyse get the meaning from the qualitative data. Responses to open-ended questions were recorded and then grouped into categories or themes that emerged.

RESULTS

The findings are presented qualitatively and quantitatively. The findings are presented according to the themes in the instruments. The three main themes which are the ICTs available in schools, the most common subjects taught using ICT-based methods in the sample schools and the methodologies applied using the ICT facilities in the sample schools. In order to keep anonymous the identity of the respondents and the confidentiality, the terms pupil and teacher were used to identify the respondents without revealing their names and address.

ICTs available in schools

All the schools in the sample possess computers and internet connectivity as confirmed by all the 72 participating pupils and 9 teachers. The second common ICT facility used was projectors confirmed by 26 pupils out of 72 (36.11%). The other facilities include, TV and video facilities, tablets and mobile phones, printer, scanner, and webcams, whiteboard, speakers, microphones,

photocopiers, calculators and cameras. Concerning the use of the available ICTs for teaching and learning purposes, 55 (88.71%) pupils questioned, confirmed the use of the ICT facilities available in their schools for some learning activities. Only 7 (11.29%) claimed not to have used these facilities in their school learning. However the situation is not the same in all the schools. Some schools are equipped with these facilities but do not regularly use them in the teaching-learning process. One reason being the shortage in these the facilities as one teacher explained "they are available but not all the time because they are limited".

To find out more information about the use of the available ICTs in the teaching-learning process, the pupils were asked to rate the way the available ICTs were used and their answers are summarised in the following graph:
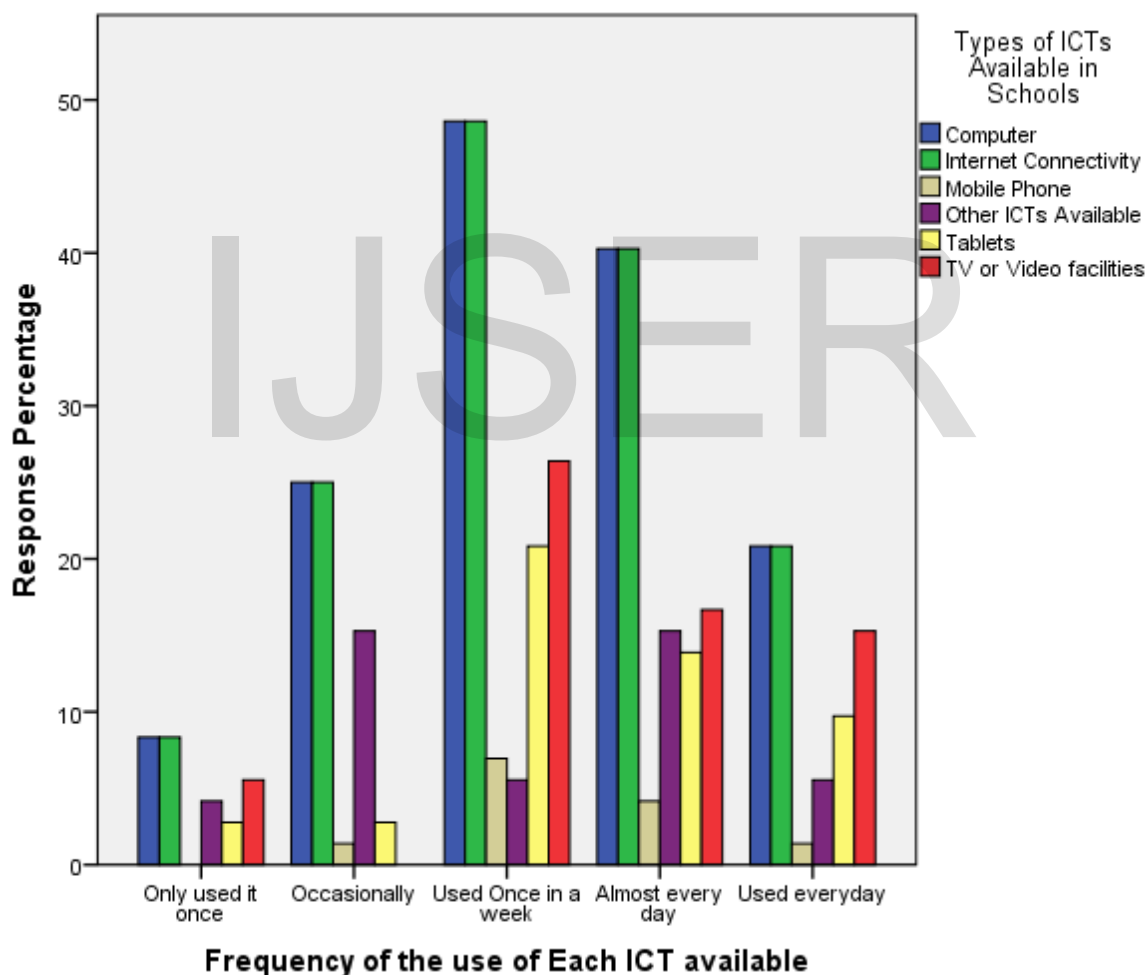

Figure 1: *The rate of the use of each ICT facility available in schools according to the pupils*

The general observation of the graph shows that computer and internet connectivity are the most frequently used facilities, followed by TV and other video facilities. While this could give

a good picture of the ICT usage in classroom activities but it is equally important to know which subjects in schools are taught using the same facilities.

Subjects mostly taught using the ICT facilities in sample schools

The study revealed that the most common subject taught using ICT facilities is ICT as confirmed by all 72 pupils, meaning 100% of the respondents. English was the second with 26 (36.11%), followed by physics and chemistry with 25 (34.72%) each. Biology and integrated science were also confirmed by 14 (19.44%) each to be taught using the ICT-mediated methods, while geography, mathematics, Religious education and history follow in decreasing order.

Methodologies applied using ICT facilities in sample schools

The methodologies based on constructivism through the use of ICT facilities applied in the sample schools were explained by teachers through interview and pupils through answers to the questionnaire and focus group discussion.

According to the pupils questioned, different teachers in different schools proceed differently but working towards achieving similar goals. Some teachers introduce the lesson and allow the learners to search for the content on internet, others use the facilities such as computer and projector to show the pupils some illustrations, like in history, geography or science. Others teachers use the ICT-mediated methods to help pupils get advanced information on the content being taught as one pupil explained in the following statement:

> "Usually, we are taught, on a particular topic and then there are times when you don't really understand and the teacher notices that. So for further explanation, you are told to search and get something and just to test how far you have understood whatever you were searching, you are asked to do a quiz or sometimes tutorial based on the same topic or subject".

Furthermore, some pupils said they do their learning activities with ICTs in groups as one pupil mentioned: "sometimes we do it as group discussion work: we just get what to search on, then what you find you discuss on how to summarise it and put it in point form". Others do the same individually and the teacher guides them on how to use these facilities more especially operating the computer software involved.

As for the teachers, some ICT facilities are used to share some important information with the pupils. These facilities are also used as a transfer media to help pupils access the content easily instead of using the traditional board as one teacher stated: "The lesson is usually prepared in advance on PowerPoint and taught at a given period. Before presentation, the projector, the laptop and the speakers must be set well in advance". Other teachers use the internet as a research media to provide more explanation to the pupils' questions during the lesson. On this one ICT teacher said:"….most of the pupils' questions are answered in a satisfied way because the internet provides the learners with the broader way of learning and also enable them to see what other people in different countries are learning and how they go about ICT." Others use the recorded TV programmes to help learners reflect on some event, either during class time or extra-curricular activities, like one of the teachers mentioned: "the documentary programmes are made available to pupils through television; this could be for a club like Chongololo (wildlife club) or a class learning about traditional ceremonies in Zambia. They would view one or two ceremonies".

All the findings above show a picture of how the ICT facilities are used as a knowledge transmission tool in secondary school. However, to fulfil the requirements of the constructivist learning theory, the same facilities should be able to enhance the learners' participation in the knowledge construction process.

To facilitate the knowledge creation process through the use of ICTs, the study found that some teachers leave some room for the pupils to research for some supplementary information about the topic being taught in classroom. Pupils also use these facilities during the prep time to prepare in advance for the topic yet to be taught in class as one grade 10 pupil stated to say: "ahead of the teacher, with a group of my friends, during prep, we search on internet the content on the topic to be learnt, discuss it with my fellow pupils then what we do not understand we wait to ask the teacher in class"

All the information provided by teachers concerning the ICT-based constructivist methodologies applied in the sample schools is summarised in the following table.

Table 1: ICT-based methods applied in the sample schools

		Responses
		N :
ICT-based methods in sample schools	Free research	5
	Directed research	4
	Group work	4
	Individual work	8
	Peer teaching	4
Total		25

DISCUSSION

First before coming to the methods based on ICTs, the research sought to find out the ICT facilities available at schools which were used for teaching and learning purposes.

It was found that the most common ICT facilities available at schools are basically computers and internet connectivity occupying 33.64% of all ICTs each in the sample schools and confirmed by 100% of the respondents to be used in all schools. A Projector is also used in classrooms and computer laboratories at a percentage of 36.11 of all facilities used in schools. Television or other video facilities, tablets and mobile phones are used respectively at percentages of 29.17%, 23.61% and 8.33%. Other tools used according to the teachers at the moment are printers, scanner, cameras, webcams, whiteboard, speakers, microphones, calculators and photocopiers.

All the facilities are used for teaching and learning purpose in the secondary schools involved in the study, as confirmed by 88.7% of all the questioned pupils. The rate at which they are used varies from the item to another with also, computer and internet connectivity at highest use rate of 67.28 % of all tools used in schools in general. The two were also confirmed to be used in all sample schools on a daily basis at 21.8% of all facilities used in the teaching-learning process. This finding is consistent with the study results by Hue and Jalil (2013), stating that among the top used ICTs in Vietnam, was web browser and computer. The same study found that the mobile devices and games were the least explored among the ICTs used in the teaching-learning process. However, e-mail, which was found to be a more common means of

communication between the facilitator and learners by the study by Hue and Jalil, was not mentioned by either teachers or learners in this study.

The main subject taught using the ICT facilities in all the schools involved in the research was found to be Information and Communication Technology (ICT/ IT), as a subject. This is partially in line with the observation from the survey conducted by Moongwa (2010) showing that in most Zambian schools, ICTs were only used to teach computing skills. The present study conversely, found that in the sample secondary schools, although not at the same level of magnitude, other subjects namely English, physics, chemistry, biology, integrated science geography, mathematics, religious education and history, in decreasing (descending) order, are also taught using these facilities in different schools.

As for the methodologies applied in teaching and learning with support of ICT facilities, most pupils' responses indicated that during the process of using the ICT-mediated methods, the teacher and pupils are all active, with the major role played by the latter while the teacher-facilitator was the coordinator or guide. More common answers by the pupils indicated that sometimes ICT use is done in groups and the pupils' activities dominated the process. These findings are similar to the observation by Govender and Govender (2014) that the incorporation of ICTs in the normal learning programme, was able to facilitate the move from traditional teaching to the learner-centred methods in South African KwaZulu Natal secondary schools. The pupils' responses further showed that the most common activity by the pupils was research which was basically limited to the relevant information. The facilitator's role there, would be to just make sure that the work was done in accordance with the intention of the lesson, by giving the instructions on how to proceed with the research work.

The main ICT-mediated constructivist methods employed in the sample schools, according to the interviewed teachers, were found to be (1) directed research and free research which led to discovery, (2) peer teaching in group discussion and (3) individualised teaching.

Marion and Leather (2015) emphasise the importance of learners' research if the deeper and meaningful learning is to be achieved. The authors insist that for this learning to be fully achieved, the learners should be independent in their work and the process should not be rigid in any way. In some activities, in a similar way, according to the respondents in this study, only the research topics are given to the pupils by the facilitator who guides and leads the whole process, helping those who lack the computing skills where needed, and makes sure that every pupil or group of pupils are doing the right thing on internet, which is in line with the subject

of study. Individualisation and independent work were also enhanced using the ICT facilities in the sample schools for instance, according to the interviewed teachers, the same information is analysed by each and every pupil in his or her own way and understanding at their own pace. Some TV programmes are used for this purpose, whereby all pupils see the same programme together but each one interprets it in his or her own ways. Moreover, in accordance with the outcome of the focus group discussion with the pupils, each and every pupil is allowed to make their own summarised notes from the information got on internet during the teaching-learning process. This method promotes meaningful learning and is also in line with the individualised or psychological constructivist theory proposed by Jean Piaget, described by Kalpana (2014).

The ICT facilities are not only used in class borne activities as a knowledge transmission media under teacher's guidance, they are also used outside the classroom by learners for research work during their various assignments in order to contribute to the construction of their knowledge. The facilities are also used, by the pupils for prep and homework given by teachers. In this way the facilities can indeed be said to be helping the pupils contribute to the construction of their knowledge as well as understanding the content taught in classrooms by themselves. This agrees with the study findings by Voogt & Knezek (2008), which were that with the ICT facilities, self-instruction occupies the major position. This information was also confirmed by the ICT teachers, who affirmed this use of ICT by pupils during their free time, mentioning among other activities, free research work and research for information to use in their homework or assignment.

According to the pupils some of these activities are done in groups where the peer-teaching dominates the activity and sometimes the ICT facilities such as internet/ computer plays the role of the most knowledgeable and experienced peer. This enhances the socialisation and is in line with the principles of socio-constructivist theory of Lev Vygotsky as described by Kalpana (2014). Govendor and Govendor (2014) share the same view, through their observation that the ICT-mediated methods, among other effects, are able to promote collaborative learning, which foster dialogue and knowledge sharing among learners. The findings of this study further show that in some classes, during the ICT-based teaching-learning process, the pupils themselves develop and construct their knowledge using internet and even the assessment is done online for quick feedback.

The above information suggests that the methods applied using ICT-mediated teaching and learning are in line with the principles of the constructivist learning theory, because they put

the learners at the centre of the teaching-learning process. Besides this, the major role of construction and transmission of the knowledge is played by the learners themselves. This is nonetheless done not only on the basis of the pupil's personal experiences but even the peers' experience are also highly valued for the teaching and learning to successfully take place.

CONCLUSION

In relation to the ways teachers involve learners in the teaching-learning process using ICTs, it can be concluded that teachers commonly use computers and internet connectivity as the major ICTs in the teaching-learning process. Teachers apply the individual constructivism by allowing individual pupils to just interact with the computer alone in order to create their own learning materials in their own ways and understanding. This is also done by allowing pupils to use their experience or simulating experience using computer and audio-visual devices to understand the materials being taught and come up with new knowledge about the topic to be learnt.

The Teachers also apply social constructivism by allowing the pupils to interact with other pupils and with the computer through the interactive learning websites. This is regarded as one of the richest experience in the sense that not only pupils learn through social interactive environment but also they are assessed through the same highly motivating environment.

LIMITATIONS OF THE STUDY

This study only focused on three secondary schools in Lusaka province in Zambia and purposive sampling were used in this study. Because all these factors limit the generalisability of the study results, the results of this study could not be generalised to all schools in Zambia.

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