IJIRR

International Journal of Information Research and Review
Vol. 03, Issue, 02, pp.1795-1800, February, 2016

Research Article

CHALLENGES FACED BY LEARNERS WITH PHYSICAL HANDICAPS IN LEARNING MATHEMATICS USING COMPUTER BASED LEARNING METHODS IN KENYA

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ARTICLE INFO

Article History:

Received 27th November, 2015
Received in revised form
19th December, 2015
Accepted 24th January, 2016
Published online 28th February 2016

Keywords:

Computer Based Learning,
Challenges,
Physically Handicapped,
Mathematics.

ABSTRACT

Learners with special needs education are of diverse categories. Among them are the Physically Handicapped (PH) .These learners may lag in education if there are no environmental and instructional adaptations to enable them compete on equal footing with their non-disable peers. Among the learners with PH are those with postures that make them strain when they stay in a given position for long like the case of paraplegia. This affects their learning ability by reducing their degree of concentration in studies. The study focused on those with no or weaker upper limps due to the disability. Mathematics has been the worst performed subject among the PH learners in the Kenya Certificate of Secondary Education (KCSE) as indicated in the results of the years 2007 to 2013.The means score in 2008 was 1.102; in 2010 it was 1.502; in 2012 it was 1.409 and 2013 it was 1.303. This is way below the national average of 3.155 over the same period. Traditional mode of instruction had been the only method of teaching these learners. There was therefore, need to device ways to enable them to participate in learning with ease. Computer Based Learning (CBL) was reported to be effective in the teaching and learning of complex concepts in physics and accounting and could provide a solution in the teaching of mathematics among the learners with physical disabilities. However, attempted use of CBL by these category of learners have not fully succeded despite the Governments effort to ensure all learners irrespective of various disabilities become technologically relevant in line with vision 2030. The purpose of this study was to examine challenges faced by learners with PH in learning Mathematics using CBL methods in Kenya. The conceptual framework was adopted from Winnie and Butter, (1994) model. Saturated sampling was used to get 128 form three students and purposive sampling to get the 5 mathematics teachers from Joyland secondary school for the physically handicapped in Kisumu County, Joytown Secondary School for the physically handicapped in Thika County and Mombasa Secondary school for the physically handicapped in Mombasa county. The instruments used were Computer Assisted Statistics Text (CAST), Student Interview Guide (SIG) and Teacher Interview Guide (TIG). Validity of instruments was established by experts in special needs education. Reliability of instruments was established by test re-test method whereby coefficient of 0.70 and above at p value of 0.05 was considered reliable. The study found significant difference in final exam scores of students receiving traditional instruction and those receiving CBL. There is positive effect of CBL Methods on motivation ($r = .561$), $p<.05$) of Secondary school students on learning Mathematics. Professional developmental should be provided to help teachers understand the needs of physical handicapped. Teachers must be committed to continually improving their instructional practice in order to provide a high-quality education for all students, no matter what method of instruction is being used. The findings showed that use of CBL improves the learners' motivation and achievement in their performance of mathematics.

INTRODUCTION

The availability of Information and Communication Technology (ICT) tools and programs spread all over the world. Instructors are supplementing the traditional lecture with teaching strategies that emphasize understanding of concepts, active learning, and relevant applications (Armington, 2003; Kinney, 2001). It is widely accepted that solely addressing the math skills of students is not sufficient (Hall and Pontoon, 2005). Math anxiety, negative attitudes, poor study skills, and lack of responsibility for learning are also being addressed. For instance, in a recent report by the World Bank (2008) it is made clear that the Jordanian educational system, like other educational systems in the Middle East and North Africa

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(MENA region), depends heavily on memorization, definition, knowledge of facts and concepts. It fails to concentrate on learning and the usage of new approaches or techniques that reinforce creative and critical thinking among students. Over the past two decades or so, technology has a significant impact on the educational system. Drucker stressed the idea that new technologies will force us to shift from teaching to learning (Drucker, 1999). Research into teaching and learning with new technologies is currently a very dynamic, high-profile and relevant area of educational enquiry (Muller et al., 2006). Multimedia technology is probably one of the most exciting innovations in the information age. The rapid growth of multimedia technologies over the last decade has brought about fundamental changes to computing, entertainment, and education (Norhayati & Siew 2004).

Multimedia technologies and applications are probably one of the most exciting innovations in the age of information evolution. They helped and got help from the Internet and other communication and computer inventions. Multimedia has the potential to create high quality learning environments, with the capability of creating a more realistic learning context through its different media. It also helps allowing a learner to take better control of the classroom especially when the class size is large. Multimedia has the potential to create high quality learning environments. With the capability of creating a more realistic learning context through its different media and allowing a learner to take control, interactive multimedia can provide an effective learning environment to different kinds of learners (Margie & Liu, 1996). A study of the mathematical achievement of high school students in Nigeria who were randomly assigned to computer-assisted instruction or traditional instruction revealed a significantly higher mean for the computer-assisted group (Olusi, 2008). Computer Aided Instruction (CAI) has also had positive effects for calculus students (McSweeney, 2003), psychology students (Brothen and Wambach, 2000), and low-ability students (Hannafin and Foshay, 2008).

Computer based learning is a technology with enhanced kind of learning which offers several advantages over traditional schooling. Computer based learning helps a lot in improving the teaching methodologies of the physically handicap but although the field of computer based learning for disabled group has witnessed a huge progress, there is yet more to be done, (Johnson and Johnson, 1995). Unfortunately, there is a great number of the physically handicap learners who cannot study because of their physical conditions. This modern system of learning is alleged to provide them with an equal opportunity to study, as their regular friends and relatives. This method is reported to increase motivation amongst handicapped learners and enable them to manipulate learning materials with ease hence increasing their ability to achieve in complex subjects like accounting (Kagan, 1990; Lerman 1997). While proper access to buildings and facilities is generally of primary concern, access to the curriculum and learning is of equal importance to children with physical disabilities (Kagan, 1990). Computer based learning include the use of head pointers or head mice (particularly optical); keyboard/mouse accessibility utilities and key guards; overlaid keyboards; predictive word processors; switches and scanning systems; touch pads; tracker balls and speech recognition, (Johnson and Johnson 1995).

Oslon, (1988) notes that computer based techniques can be used both as a replacement for conventional approaches for instruction that do not result in learning. It is the teachers' structuring and framing of information and communication technology (ICT) supported tasks, which allow pupils to realize their own potential, and that of technology (Scot, 1997; Davies & Selyn, 1999). CBL produces positive results in the teaching of difficult subjects or where pupil motivation is low (Makau, 1990; Alessi &Trollip, 1991; Blomeyer & Martin, 1991; Garcia, 1992; Voogt, 1993; Kiboss, 2001). The authors concur that CBL has the capacity to improve the students' performance by motivating them in learning. Instructional technologies can be integrated as an effective component in any area of subject matter when instructional personnel understand the practical significance of the new methods and delivery systems, (Blomeyer & Martin, 1991; Crawford, 1999). Most of the teachers' failure to model the use of the technology in their teaching may be attributed to lack of training on the use of technology, lack of confidence in the new medium and insufficient funding put in the infrastructure in schools, (Gaed, 1995; Davies & Selwyn, 1999). Despite the shortcomings, computers open new ways of learning which go beyond the traditional classroom activity, help teachers to do better what they already know (Bostrom, 1982) and act as amplifiers of existing practice (Philips, 1984; Boucher, 1998). They also stimulate the intellectual climate and social interaction among pupils, (Papert, 1980; Crawford, 1999). It is on this basis has led to the choice of CBL be used in the teaching of mathematics in secondary schools in order to determine its effects on learners achievements and motivation.

In Kenya, the history of the learners with physical handicaps date back to post Second World War period, when those who had been injured in wars were put together to facilitate the provision of treatment services, (Christensen, 1997). Some of the earliest schools that were started in Kenya to cater for the education of the children with physical disabilities include Dagoretti Children's Home that was started in 1961 by the Red Cross Society and the Joytown School for the Physically Handicapped in Kisumu that was started in 1962 by the Salvation Army. Mathematics is one of the science based core subjects which has existed in the secondary school curriculum for a long time and plays an integral role in education, (Government of Kenya, 2002). The Kenya National Examination Council reports have shown that few of the physically handicap students perform above the grade C in their Kenya Certificate of Secondary Examination. This could be due to the fact that the curriculum has not been modified in the way it is presented to the learners with physical handicaps or in the way it is taught and examined. Disabilities may range from psychological to physical conditions and the physically handicapped learners find it hard to find a learning facility that can fully satisfy their education needs. (Christenten, 1997).With the advent of internet, a new learning approach has come up as a perfect solution for these special group. (Ogunyi & Kiboss, 2010).

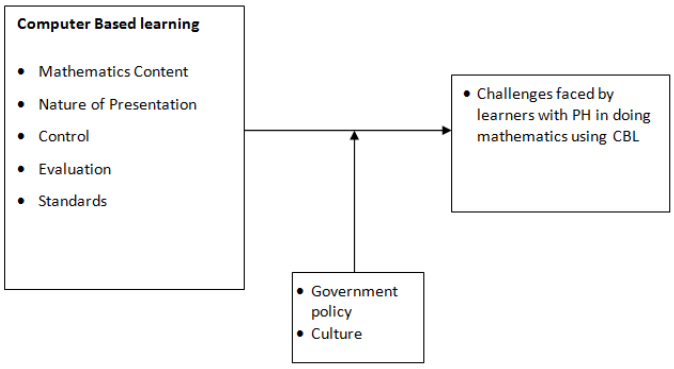
No comprehensive study has been conducted in Kenya to collate views of teachers and learners of mathematics in order to establish the relationship between the achievement and the use of computer learning using CBL with specific reference to the physically handicap learners. This study therefore will bring into focus the use of information and communication

technology (ICT) in the teaching of mathematics with the objective of determining whether the perception of ICT potential in classroom instruction in Kenya can influence the students learning of mathematics. Computer based learning (CBL) in Kenya may be classified as instruction that does not only present information just like a book, video tape or television but also controls information during the teaching-learning process. It is interactive in that the learner interacts with the hardware, software, and the subject matter (Gavora, & Hannafin, 1995; Crawford 2000; Kiboss, 2002). The focus of the study is on the use of CBL that is able to present lesson content and offer guidance to students in the acquisition of knowledge and skills in the classroom. The reality of learning and educational use of ICT is its perceived strength of encouraging active classroom participation between the teacher, the students and the content rather than the passive intake and rote memorization prevalent in most traditional classes, (Eraut, 1991; Fisher, 2000). This falls in line with the current theories of instruction that recommends that teaching should be related to the socio-cultural environment of the learner, (Kagan, 1990; Lerman, 1997). This therefore, brings out the need to design a collaborative CBL programme that emphasizes peer interaction in the context of cooperative goals and to investigate its effects on cognitive and affective domain in the learning of mathematics among the students with physical disabilities, (Ogunyi, 1998; Johnson & Johnson, 1995; Kiboss, 1999).

Conceptual Framework

The conceptual framework will be adopted from Winnie and Butter, (1994) a model which will be modified and adapted to suit this study. The model identifies three variables; Independent variables (CBL), the Dependent variables (Challenges) and Intervening variables (events that transpire during learning). It ties together information processing theory dealing with memory, constructivist theory, situativity and social learning theory.

Independent variable Intervening variable Dependent Variable



Source: Adopted from Winnie and Butter, (1994).

Figure 1. Conceptual model of instructional information processing

Literature Review

A physical handicap condition among the learners can affect how a student performs in the classroom.

Because of laws such as Individuals with Disabilities Education Act (IDEA) and advances in technology software, students with physical disabilities can succeed in the classroom. Technology can be a powerful "equalizer" for people with disabilities, allowing them to "get around" a limitation in any number of areas, (Boucher, 1998). Students with physical disabilities may have difficulty performing basic functions such as, gripping objects with their hands, moving arms or legs in a full or even limited range of motion.

Technology has played an important role in attempting to bridge the gap necessitated by this handicapping condition. However the process of using the CBL has led to some challenges in handling mathematics in the classroom such as using keyboards, touch screens, computer mice, and scroll wheels which are all used with the technology, Hohenwarter, M. (2002).

Children with physical handicaps may have multiple disabilities which can include speech difficulties, physical mobility problems, learning difficulties, mental retardation, visual impairments, hearing impairments, brain injury and possibly others. Along with multiple disabilities, they can also exhibit sensory losses and behavior and/or social problems. These students may exhibit weakness in auditory processing and have speech limitations. Physical mobility will often be an area of need, Hohenwarter, M. (2002).

These students may have difficulty attaining and remembering skills and/or transferring these skills from one situation to another. Support is usually needed beyond the confines of the classroom. There are often medical implications with some of the more severe multiple disabilities which could include students with cerebral palsy and severe autism and brain injuries. Manipulation and in-depth understanding of computer operations among these children for success in mathematics can be a challenge, (Beehler & Snowman, 1982).

MATEIALS AND METHODS

Research Design

A pre test counterbalanced design was used. The design equates the treatment and control groups and can give the most reliable results at the end of the experiment (Leedy, 1993; Coolican, 1999). In this design, the treatments are given to all the groups in a different order, and the number of groups should be equal to the number of treatments. The researcher carried out the study using three Secondary schools; The Joyland Secondary School for the physically handicacapped, (School 1),

The Joytown Secondary School for the physically handicacapped, (School 2) and Mombasa Secondary school for the physically handicacapped, (School 3). Schools 1 and 2 had two streams each, herein named as Groups 1 &2; in there form three classes while school 3 was a single stream and had no computers that could be used for CBL. All the 32 learners of Form three in Mombasa Secondary school for the physically handicacapped, (school 3) were therefore used as control to experiment. The pre-test was administered in order to get the baseline information from the groups before the experiment.

Study area

The study was carried out in Kisumu, Thika and Mombasa counties using the following schools respectively: Joyland secondary school for the physically handicap, Joytown secondary school for the physically handicap and Mombasa secondary school for the physically handicap in Kenya.

Sample and Sampling Techniques

Purposive sampling was used to get atotal sample of 128 students and saturated sampling to get the 5 mathematics teachers from the three schools that participated in the study. From Joyland secondary school, only 52 students participated in the study because the available and serviceable computers to be used were 26 in number. A total of 44 students from Joytown Secondary School in Thika were used because only 22 computers were available for CBL.All the 4 teachers that teach mathematics from the named schools participated in the study. All the 32 Form three students from Mombasa Secondary School for the physically handicapped and their 1 mathematics teacher were used as control group in the study. This was due to the fact that the school was a single stream and had no computers that could be used for CBL. The information is shown in table 5 below.

Research Instruments

Four instruments were developed and used in the data collection for this study namely; Computer Assisted Statistical Text (CAST), the student interview guide (SIG and teacher's interview guide (TIG). The researcher personally visited the schools identified to experiment and collect relevant information.

Validity of Research Instruments

Validity refers to correctness or soundness of conclusion reached in a study. (Kothari, 2008:73; Pelto 1973:33; cited in Scrimshaw, 1990:83).It is the extent to which an instrument purports or measures what it is designed to measure. To establish validity, the instruments were given to the researcher's two supervisors to critically evaluate the relevance of each item in the instruments to the objectives of the study and to rate each item on a scale of very relevant (4), quiterelevant (3), somewhatrelevant (2) and not relevant (1)

Data Collection Procedure

The researcher personally visited the area of study to experiment and collect relevant information. Letters were written to seek permission to carry out research in the stated areas. The approval to conduct research in the named areas was sought through the national council for science and technology and the head teachers of Joytown Secondary School in Thika county, Joyland secondary school for the physically handicapped in Kisumu County and Mombasa Secondary School for the physically handicapped in Mombasa county. Before administering the study, the researcher discussed with the head teachers of the named schools the purpose of the study and the general overview of the tools to be used. The same discussion was extended to heads of mathematics department, computer laboratory technologists and research assistant in respective schools.Saturated sampling was used to select the four teachers who participated in the study from Joytown Secondary School in Thika County and Joyland secondary schoolwhile the students from the named schools were purposively selected.

Table 1. Teaching of Mathematics

Teaching of mathematics (n = 128)	Frequency (%)
Performance in mathematics since form one	
Above average	28 (22.2%)
Average	28 (22.2%)
Fair	72 (55.6%)
Mode of teaching mathematics in class since form one	
Use of chalk only / traditional method	128 (100%)
Use of computer	0
Since when have you interacted with the use of computer in your learning	
Since form one	28 (21.9%)
Since form two	24 (18.8 %)
Since form three	76 (59.4 %)
Compare the use of computer based learning in mathematics with the teacher mode	
CBL is easier to understand	72 (55.6%)
CBL is time consuming	14 (11.1%)
CBL is encouraging	14 (11.1%)
CBL is not better than traditional method	28 (21.6%)
Does the use of computers add any value to your motivation and achievement	
Yes	100 (77.8%)
No	28 (22.2%)

Table 2. Sample Population

Category	JT Sec schl	JL Sec Schl	MSS	Total
Form Three students	44	52	32	128
Maths Teachers	2	2	1	5
Total	46	54	33	133

Key;
JT Sec schl-Joytown Secondary School
JL Sec schl-Joyland Secondary School
MSS-Mombasa Secondary School for the physically handicapped

All the 32 Form three students from Mombasa Secondary School for the physically handicapped and their 1 mathematics teacher were used as control group in the study. The researcher discussed with the respective respondents the issues at hand and distributed the questionnaires after agreeing with them on how to be completed. Thestudents completed in their respective classrooms while teachers did theirs in the departments. Data from CAST were personally collected by the researcher with the help of research assistant in the computer laboratories of the named schools. This was done after the students had been briefed on what was expected of them and the same process was repeated for the treated group after the exposure (post-test). The treated groups were then asked by the researcher to respond to questions at the end of CAST on their contributions about the use of CBL.

Data Analysis

Because of the nature of information collected, quantitative and qualitative data analysis was carried out in the study. Quantitative data analysis involved making sense of things or events intuitively, conceptual grouping and figurative grouping data, exploring "what is there", clustering and distinguishing observations, unbuilding variables and assembling a coherent understanding of events.

RESULTS

During the study most 52 (54%) of the respondents had problems with using the CBL method in teaching physically handicapped and 46 (45%) had no problem. This indicates that majority of both the teachers and learners experienced problems while using the CBL method. The challenges associated with CAST included; success in using the software, problems faced during use, helpfulness of the software, ability of the software to perform the tasks, ability of the software to make students enjoy the class and whether the software added value during its use. Some of the challenges are captured under teaching of mathematics as shown in Table 1 below. However, the participants listed the following as success in using CAST; accessibility of the software and ability of the software to make students enjoy calculations.

The problems notwithstanding, the respondents were in agreement that the software was helpful 96 (100%), it was up to task 85 (88.2%), it made students enjoy the class 86 (90%) and it added value to students education 92 (95%). However, the participants suggested that the software need still be improved by introducing new methods, modifying the input method to suit the learners with varied physical disabilities and also connecting the computers to the internet when using the software. To overcome these challenges, the participants also suggested the solutions that included adding more computers, buying more software, by activating the site in discs and flash disks, going through the work being done and installing the program before lesson begin to avoid time consuming. They should be practicing the use of computers everyday while consult others, creating enough space to draw the graphs by giving students procedure during the lesson and keeping the computers free from virus, buying more computers having all software required and asking the teachers for directions in case of help.

Conclusion

Teachers and students had problems with using the CBL method in learning. The solutions to these problems included adding more computers, buying more software, by activating the site in discs and flash disks, going through the work being done and installing the program before lesson begin to avoid time consuming. In order for students to receive the maximum benefit from using a computer learning system, schools should provide instruction in how to use the system.

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