Influence of CBL Methods on Secondary School Physically Handicapped Students' Motivation towards Mathematics in Kenya

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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 motivate and 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 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. The purpose of this study was to examine the effects of Computer Based Learning (CBL) Methods on Secondary School Physically Handicapped (PH) students' Motivation, towards Mathematics in Kenya. Objective of the study was to determine the effects of CBL Methods on Motivation of Secondary School PH students on learning Mathematics in Kenya. A pre-test quasi experimental and correlation research designs were employed. 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 and Student Motivation Questionnaire. 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. There is positive effect of CBL Methods on motivation (r= .561), p<.05) of Secondary school students on learning Mathematics. The findings showed that use of CBL improves the learners' motivation towards their performance of mathematics.

Keywords: Mathematics, Motivation, Physically handicapped

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

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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 (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 motivation, 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 motivation towards mathematics among 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 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).

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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 had been conducted in Kenya to collate views of teachers and learners of mathematics in order to establish the relationship between the motivation to achieve in mathematics and the use of CBL with specific reference to the physically handicap learners. This study therefore brought 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 could 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 was 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 was 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

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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).

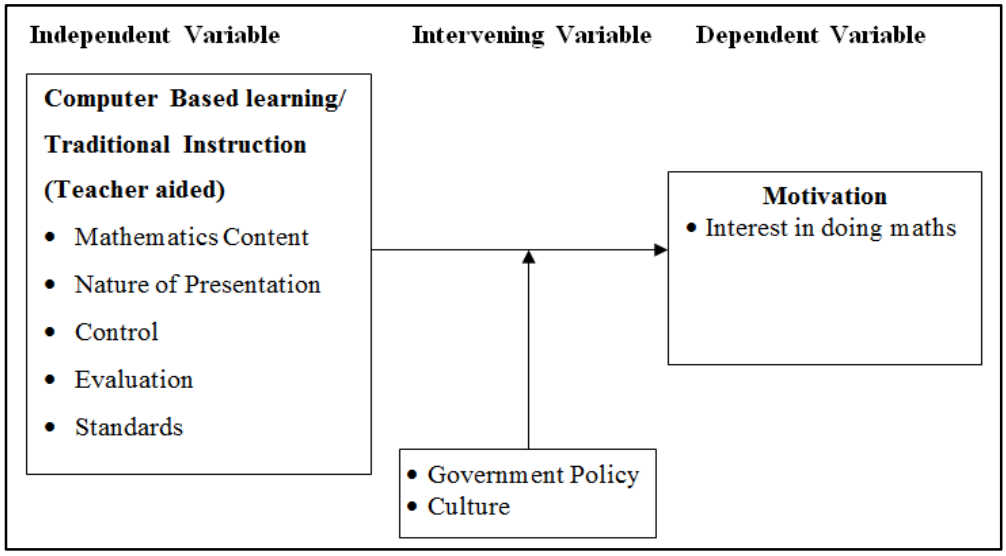
OBJECTIVE OF THE STUDY

The objective of the study was to;

Determine the effects of CBL Methods on motivation of Secondary school PH students on learning Mathematics in Kenya.

CONCEPTUAL FRAMEWORK

The conceptual framework was be adopted from Winnie and Butter, (1994) a model which was modified and adapted to suit the study. The model identified three variables; Independent variables (characteristics of instructional tasks), the Dependent variables (learner) and Intervening variables (events that transpire during learning).



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

Figure 1. Conceptual model of instructional information processing

The Effects of Computer Based Learning Methods on Secondary School Physically handicapped Students' Motivation in Mathematics in Kenya

Motivation is the process behind the vigour with which learners acquire new knowledge. It is the mental state arising in processes that are internal and external to the individual in which the person perceives to pursue a certain course of action (or actions) directed at achieving specified outcome (or outcomes) with a degree of vigour and persistence, (Rollinson, Broadfield& Edwards, 1998). Motivation is an individual phenomenon that shows uniqueness in how it is reflected in behavior. It is intentional and results in behavior that is of conscious choice. In motivation there is a driving force within which prompts a learner to want to achieve a goal that result from change of environment that may include introduction of CBL.A motivated student is one who has a drive that channels behavior to a desired need or

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goal (DeCecco& Crawford, 1988). It determines arousal, selection, direction, and continuation of a learner's behavior. Motivated behavior is assumed to conform to three basic psychological principles, (Rollinson&Broadfield, 1998).

i. All physical activity is preceded by mental action

ii. All behaviour is goal directed and aims to achieve some desired state of affairs

iii. That there is an element of hedonism in which the individual seeks to minimize pain or unpleasantness.

A person engages in any behavior that has been triggered off by the expectation of a reward that satisfies a need of some sort. Maslow's hierarchy of needs theory suggests that the satisfaction of needs is a reason for the peoples' aim of working which also applies to students in the classroom. Once survival needs have been satisfied, the next level of needs motivates the person to work harder.

Gagney, (1981) gives a reclassified structure of Maslow's needs in form of maintenance motives and growth motives. Maintenance motives include survival, security, belonging and esteem. The growth motives include knowledge, understanding, aesthetics and self-actualization. The satisfaction of one need drives a person to aim higher to achieve the next need in the hierarchy. Each student's hierarchy of needs is central to his or her motivational potential. The effective teacher should try to provide a classroom environment that satisfies as many of those needs as possible. Need fulfilling learning activities help students direct their energies into educational pursuits (Gagney, 1981), which include arousal, expectancy, reward and punishment.

A teacher wishing to arouse and direct the students' attention must learn to manipulate relevance, complexity, intense, novelty and sometimes incongruous stimuli into their lessons. Expectancy and rewards describe the student's action that is followed by need fulfilment or other pleasant feelings and sensations. Punishments are negative consequences that follow some actions and affect motivation of students' to learn. Such approach of describing motivation is relevant to the study that is finding relative effects of CBL on students' motivation on the learning of mathematics.

However, how the environment affects student learning may be explained by Herzberg's two-factor theory of motivation (Gagney, 1981). Herzberg's hygiene factors are features of the work environment which if present helps avoid dissatisfaction with work. These include working conditions, status procedures, and quality of supervision and interpersonal relations. These factors stop dissatisfaction from occurring and encourage participants to work together. Motivators are intrinsic in nature and they include achievement, recognition, responsibility, and nature of work and prospects of growth. Performing well is a major source of satisfaction in workers, which are also important factors in student learning.

The student expectancy whether in an action will result in a favourable outcome or not will determine their motivation. It is the goals and prospects of achieving them that act as the motive force which results in persistency and intensity of behaviour among students. Locke (in Lotham& Locke, 1979) notes that to enhance future commitment, it is important to give people accurate feedback on performance, which tends to increase their sense of achievement and accomplishment. Instruction process needs to establish clear links between performance and rewards. Mitchel (in Rollinson&Broadfield, 1998) notes that application of motivation should be based on some underlying assumptions:

a. That people are unique and motivation allow for uniqueness to be reflected in behaviour.

b. That motivation is intentional and results in behaviours that are the result of conscious choices.

c. That motivation involves factors that arouse people to action, choice of behaviour, choice about the persistence and intensity of behaviour.

The Reward System in Motivation

Motivation may be achieved through dispensation of rewards (Jung, 1978; Malone, 1981), which fall into three systems. They are extrinsic, intrinsic and sociological rewards. Extrinsic motivation comes from reinforcement that is unrelated to the task. It is where students receive external rewards for them to put more effort in their learning. These include higher grades in their examinations, praises from teachers or parents, the promise of better jobs in future, stars, badges, points awarded for good performance and parental pressure to avoid failure in examination. Social rewards that are also termed "affective motivation" are the pursuits of achievement that come from social factors such as prestige, recognition and admiration by others. This can enhance the users' enjoyment of any activity and provide pleasure at a good performance, which motivates the learners to strive to excel in their lessons (Biehler& Snowman, 1982).

Intrinsic motivation are those in the student but can be supported by the use of external rewards that are valuable to the learner and their receipt contributes to the learner's feelings of competence and efficiency. The use of technology to attract attention in software is motivational. Although novelty and dramatic effects can be used to gain attention, it is not enough to assume that these must always be present in order to promote efficient learning and maintain motivation, (Jung, 1978; Boucher, 1998). It should be noted that an attention gaining strategy, which works today, might not work tomorrow because its novelty value is lost. In such cases students need the use of variety to maintain and retain student motivation.

Jung (1978) and Cagney (1981) pointed out that motivation process should encompass aspects of physical environment, student's physical condition, emotion and social environment. The physical environment includes weather, time of the year and attitude. The physical condition of the learner includes state of health, amount of rest, and nutritional value while emotional condition describes mood state, anxiety, depression and elation while the social environment includes peer influence and quality of instruction. Other factors to consider in motivation analysis include fantasy, challenge, curiosity, attention, confidence and satisfaction (Malone, 1981; Keller & Suzuki, 1988; Wachanga, 2002). Malone's analysis indicates that internal motivation can be increased by the provision of the opportunity to exercise control autonomy in a personally significant and challenging task. A summary of motivational factors is given in Table 1.

Table 1. Observable motivation variables

Malone	*Kelly*	*Description*
Fantasy	Attention	Extent to which the subject felt encouraged applied the information learned.
Challenge	Confidence	Extent to which the subject finds the information learned.
Curiosity	Satisfaction	Extent to which the subject finds the lesson attractive, challenging or surprising.
Control	Relevance	Extent to which the subject finds the information useful for the future.

(Adapted from Kiboss, 1997)

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Motivation is a highly personalized process that depends on a person's mix of extrinsic, intrinsic and social needs to determine performance. The student's mental frame also influences the intrinsic motivation of the students.

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 handicapped, (School 1), The Joytown Secondary School for the physically handicapped, (School 2) and Mombasa Secondary school for the physically handicapped, (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 handicapped, (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. The experimental and the control groups were interchange after two weeks in schools 1 and 2 as shown in table 2 below.

Table 2. A pre Test Counterbalanced Design

Design Week	*School 1*		*School 2*		*School3*
1	G!	G2	G1	G2	All Class
	PT	PT	PT	PT	PT
2-5	TT	NT	NT	TT	NT
	(CBL)	(RI)	(RI)	(CBL)	(RI)
6	T	T	T	T	T
	M=	M=	M=	M=	M=
7-10	NT	TT	TT	NT	NT
	(RI)	(CBL)	(CBL)	(RI)	(RI)
11	T	T	T	T	T
	M=	M=	M=	M=	M=

Keys:
PT: Pretest, T: Test, M: Mean, G1: Group 1, G2: Group 2, S1: School 1, S2: School 2, RI: Regular Instruction, NT: No Treatment,TT: Treatment, S3: School 3

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

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understanding of events. Pearson's r and multiple regression analysis were used to determine the relationship and to predict students' performance in mathematics.

Pearson Chi-square test was used to analyse motivation of students using CBL in mathematics. Inferential statistics on the other hand was useful in making objective comparisons of results about the subjects, (Coolican, 1999). Percentages, means, standard deviations were obtained while t-test, analysis of variance (ANOVA) performed on the data. Analysis of covariance (ANCOVA) was used to adjust initial group differences on one or more variables related to the dependent variable but that cannot be controlled. This made it possible to compare means of subjects not randomly selected or randomly assigned. In practice, ANCOVA equated the pre-treatment status of the subjects to the post-test by evaluating their gains (Best, 1989).

Motivation of Secondary School PH students on Learning Mathematics in Kenya

The respondents rated the learning mathematics through the teacher to be motivating in various forms as summarized in table 3. Majority of the respondents 68 (70.1%) agreed that learning mathematics through the teacher was fun, with 78 (80.4%) to stimulating and satisfying as well as 79 (71.2%) as informative and involving. However, majority of the respondents 89 (91.8%) disagreed that learning mathematics through the teacher was hard, with 71 (73.1%) as dull and boring. The findings showed that learning mathematics through the teacher was fun, stimulating and satisfying, informative and involving

Table 3. Learning Mathematics through the Teacher

Learning Mathematics through the Teacher was	*Strongly Agree*		*Agree*		*Undecided*		*Disagree*		*Strongly Disagree*	
	Freq	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*	*Freq*	*%*
Fun	27	27.8	41	42.3	29	29.9				
Stimulating and Satisfying	47	48.5	31	32.0	19	19.6				
Informative and Involving	35	36.1	34	35.1	20	20.6	8	8.2		
Hard			8	8.2	23	23.7	43	44.3	23	23.7
Dull and Boring					26	26.8	21	21.6	50	51.5

CONCLUSION

Effects of CBL on Motivation

There was a general feeling that learning mathematics through CBL was more motivating than learning it through the traditional method. More specifically, learning mathematics through CBL was; a pleasure 69 (72.2%), exciting 59 (61.1%), appreciative 59 (61.1%), made students develop likeness towards mathematics 80 (83.3%), not a source of anxiety and fear 27 (27.8%) and not stressful and demanding 29 (29.4%). However, the participants viewed traditional method of learning as, involving 43 (44.4%), hard 11 (11.1%) and boring 21 (22.2%).

Learning using computer based teaching (CBL) was a pleasure, exciting and curious, appreciates mathematics and liked mathematics. Learning using computer based teaching (CBL) was not a source of anxiety and fear, stressful and demanding and hated mathematics.

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The rapidly changing capabilities of computer hardware and software, computers have the potential to enhance learning in a greater variety of ways. When traditional instruction is supplemented with computer-assisted instruction, students receive traditional instruction in the classroom, but the computer changes how they study outside the classroom.

Motivators are intrinsic in nature and they include achievement, recognition, responsibility, and nature of work and prospects of growth. Performing well is a major source of satisfaction in workers, which are also important factors in student learning. Motivation is a highly personalized process that depends on a person's mix of extrinsic, intrinsic and social needs to determine performance. The student's mental frame also influences the intrinsic motivation of the students.

There was positive effect of CBL Methods on motivation of Secondary school PH students on learning Mathematics, ($r = .561$), $p<.05$). This indicated that the more the teachers adopted CBL in their classroom the more the PH students were motivated in learning Mathematics. This finding is supported by (Kiboss, 2001) who found out that CBL produced positive results in the teaching of difficult subjects or where pupil motivation is low. The authors concur that CBL has the capacity to improve the students' performance by motivating them in learning. A motivated student is one who has a drive that channels behavior to a desired need or goal (DeCecco& Crawford, 1988). It determines arousal, selection, direction, and continuation of a learner's behavior.

The findings agreed with (Brown, 2003; Cotton, 2001; Hannafin and Foshay, 2008; Kinney and Robertson, 2003) that computer-assisted instruction offers students an opportunity to be actively engaged in the learning process, to receive instruction through a variety of multi-media, to choose when and where they learn, to work at their own pace, and to receive immediate and accurate feedback. Students in the current study and several others (Bump, 2004; Ford and Klicka, 1998; Kinney and Robertson, 2003) reported choosing a math class based on what fit their schedule, not whether the class used a computer.

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