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Influence of CBL Methods on Secondary School Physically Handicapped Students' Academic Achievement in Mathematics in Kenya

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Abstract Learners with special needs education are of diverse categories. Among them are the Physically Handicapped (PH) and the Visually Impaired (VI).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. 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 2008 to 2013. 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) has reported to be effective in the teaching and learning of complex concepts in physics and accounting and could provide solution in the teaching of mathematics among the learners with physical disabilities. The purpose of this study was to establish the effects of CBL Methods on Secondary School Physically Handicapped (PH) academic achievement. The objective of the study was to examine the effects of CBL methods on Secondary School PH students' academic achievement. 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 and 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, student motivation questionnaire, student interview guide and teacher interview guide. Validity of instruments was established by experts in special needs education. Reliability coefficient of student questionnaires was established by test re-test method whereby coefficient of 0.70 and above at *p* value of 0.05 was considered reliable. Quantitative data was analyzed using inferential statistics. The findings indicated that there was statistically significant difference in using CBL method [F (2, 125) =33.14, p=.000] on academic achievement. The CBL influenced the students' academic achievement in Mathematics among the physically handicapped. It showed that there was significant difference in final exam scores of students receiving traditional instruction and those learning through CBL. The findings showed that use of CBL improves the learners' motivation and achievement in their performance of mathematics. Professional should be provided to help teachers understand the needs of 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.

Keywords: *computer assisted statistics text, computer based learning, physically handicapped and the visually impaired*

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1. Introduction

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 [27,31]. 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 [27]. 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, [25].

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. It is

widely accepted that solely addressing the math skills of students is not sufficient. Math anxiety, negative attitudes, poor study skills, and lack of responsibility for learning are also being addressed.

Standards developed by the American Mathematical Association of Two-Year Colleges call for a greater use of technology in the classroom (AMATYC, 1995). Emphasis should be on high-quality technology that enhances student learning but does not become the main focus of instruction. AMATYC emphasizes that just the presence of computers or other technology does not improve learning. In 2000, the National Council of Teachers of Mathematics published *Principles and Standards* for the purpose of improving student learning. The Technology Principle states that "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p.3). Computers, when used effectively, can support fundamental characteristics of learning: active engagement, participation in groups, frequent interaction and feedback, and connections to real-world contexts.

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 creative and critical thinking among students. 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 . Computer Aided Instruction (CAI) has also had positive effects for calculus students psychology students, and low-ability students.

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, . 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. With the advent of internet, a new learning approach has come up as a perfect solution for these special group [33].

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, [18,19]. 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, [27,31]. 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, [5,29,33].

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 [23,29]. 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.

Learners with physical disabilities are not just those on wheelchairs and those with mobility problems. The study specifically focused on those with no or weaker upper limps due to disability. They have poor co-ordination or degenerative disorders, affecting their learning ability and reducing their degree of concentration in studies.

1.1. Statement of the Problem

Mathematics subject in the present 8:4:4 curriculum has been a compulsory subject and have not been offering room for adaptations in the way it is presented either as a subject or in examinations to suit the learners with physical handicaps. Form three class is a crucial stage that require the students to master the concepts of the subject if they are to perform well in form four examinations and in life thereafter. However, it was the worst performed subject among the PH learners in the Kenya Certificate of Secondary Education (KCSE) as indicated in the 2008 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. The maximum expected national mean is 12.00; hence the need to determine the reasons behind this discrepancy in the mathematics performance among learners with PH.

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. Although studies about the effect of computer based learning on regular learners in various subjects abound, there was still a need to look into the effect of the same on learners with physical handicaps with specific reference to mathematics subject.

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. Therefore the research established the effects of CBL Methods on Secondary school Physically Handicapped students' Academic Achievement and challenges faced in Mathematics in Kenya.

1.2. Theoretical Framework

The study adopted information processing models by Tennyson Meta-learning Model of 1987 and Winnie and Butler Conceptual Model of Information Processing of 1994 helps to explain the conceptual model for the study as it integrates the theories outlined. Tennyson' [44] explains how computers influence the cognitive processes in the learner. Meta-learning information processing is represented as a linear process where information is passed from the source to the receiver (teacher to the learner). The message from the external source activates the receptors in the learner, which transmits them as information to the central nervous system. This information is briefly registered in one of the sensory registers and transformed into identifiable patterns to be encoded into STM through perception.

The CBL extends on the senses of the learners and hence facilitates their learning, perception, and motivation. The comparison of the information processing in the mind and the computer does not imply that there is a direct comparison between thought processes and the functioning of a digital computer. Classroom use of computers involves children working in-groups. The presence of a number of children interacting around a computer offers an important social dimension to educational computing. The computer acts as a stimulus for the discussion and exchange of ideas, often promoting teamwork as members of the group act collaboratively to solve a problem presented by the computer.

McConnel (in [15]) observes that computer-supported cooperative learning is largely about emphasizing social interactions as learning is not only about accumulation of knowledge but is also part of a social context in which the students live. The learning is context-related, as well as a process that develops through culturally related activities. What is needed is a new conception of the mind, not an information processor but a biological system that exists equally well within an individual's brain and that has in it tools, artefacts and symbolic systems used to facilitate social and cultural interaction, [38]. The theory reveals the presence of two levels of memory to which information is stored. They are the short-term memory (STM) and the long-term memory (LTM).

1.3. Computer-Assisted Instruction

According to numerous researchers, colleges should offer developmental students choices of instructional approaches. Since developmental students are very diverse in mathematical background and have a variety of learning styles, no one instructional style will meet the needs of all students. Computers and the internet make possible new methods of delivering instruction to developmental mathematics students so that they will have choices about when, where, and how they learn mathematics.

Technological advances have made computers more powerful and less expensive, which have resulted in more students having access to computers at home and at school. The internet has the potential to provide a learning environment that is stimulating and engaging. Educators are able to design a wide array of courses that appeal to the inclination of current college students to use technology and potentially increase learning and retention. According to a 2002 Pew Internet and American Life Project, 20% of today's college students began using the computer between five and eight years of age, 85% have their own computer, and 79% say that the internet has had a positive impact on their college academic experience. College students frequently use the internet to check email, download music files, instant message, browse for fun, and communicate with family, friends, and professors.

Computer-assisted instruction is an alternative to traditional instruction used both for on-campus and distance learning courses, providing individualized, self-paced instruction. Computer-assisted instruction, according to some researchers, has great potential for developmental education because it allows a student to work at his or her own pace, provides immediate feedback, guided practice problems, and 24-hour access. In 1976, only ten percent of the institutions surveyed used computer-assisted instruction to teach mathematics. According to the National Center for Educational Statistics (2003b), in the fall of 2000, 31% of the 3230 colleges surveyed reported that computers were frequently used by students as a hands-on instructional tool for on-campus remedial mathematics, and 13% offered remedial courses through distance education, an increase from 3% in 1995.

Computer-assisted instruction is supported by the early work of Roueche and Kirk. One of their eleven recommendations for effectively serving remedial students is to accommodate individual differences and permit students to learn at their own pace. According to Roueche and Kirk, "Individualized instruction is critical to the effectiveness of developmental programs" (p.88). They did not advocate any particular methodology but asserted that lectures are not appropriate for remedial students. Teachers should not stand in front of the class and talk at the students. Developmental students typically do not have the reading and listening skills to succeed in traditional instruction. They learn best by being active learners, by seeing and doing instead of listening. Computer-assisted instruction requires seeing and doing as students use the interactive tutorials and other multi-media.

Beginning in the early 1960s computer-assisted instruction was used almost exclusively to drill, tutor, and test students. With the rapidly changing capabilities of computer software and hardware in recent years, computer-based instruction now has a greater variety of possible uses. Textbook publishers have developed much of the software currently being used in developmental mathematics. It typically is one of two models: (1) software designed to support a traditional course with the instructor providing the content and the software providing videos and algorithmically-generated problems and (2) software designed to provide a thorough presentation of concepts with interactive multimedia and the instructor as facilitator.

In the selection of software it is critical to first determine whether the learning is teacher-entered or

student-centered. Software can be used in a variety of instructional formats: a supplement to direct instruction, a component of a hybrid course that combines teacher-centered and student-centered instruction, independent learning in an open computer lab with tutors available, computer-mediated learning that is student-centered and meets in a classroom with the same students and same instructor, and distance learning with no face-to-face contact between student and instructor. The current study focuses on computer-assisted instruction as a supplement to traditional instruction and computer-assisted instruction in distance learning courses.

1.4. Traditional Instruction Supplemented with Computer-Assisted Instruction

Computer-assisted instruction, also referred to as computer-based instruction and computer-enriched instruction, can support traditional classroom instruction. The software typically includes problems generated algorithmically, videos of each lesson, online tutoring, and a website with additional resources. It is designed to supplement but not replace the instructor. In this instructional model, students receive instruction in traditional classrooms, but the computer changes how they study outside the classroom. The computer component is available 24 hours a day from any computer with internet capability, so each student can choose when, where and how long he works outside the classroom. Instructors may create electronic homework, quizzes, and exams that are graded and recorded by the software. Drill and practice software leads the student through exercises designed to build accuracy and speed, assuming the student has received prior instruction.

Interactive tutorials include guided practice problems, which encourage students to be actively engaged with the learning process. Software can provide a student with an individualized study plan based on his scores on homework and quizzes. There is an element of competition as the student competes against his own previous score. Software can be programmed for mastery learning so a student does not proceed to the next lesson before mastering the current one. Computer-assisted instruction permits the student to work at his own pace and to receive immediate non-judgmental feedback on assignments (Cotton; Hannafin and Foshay; Merisotis and Phipps). Frequent testing and feedback has been identified by the National Association of Developmental Education as one of the best practices of developmental education. Instructional management features store, organize, and process scores, response times, and other data that inform instructors and students how students are progressing in the course.

Computers as instructors have several advantages over human instructors. The computer has infinite patience but a human does not. The student can revisit the same topic numerous times until he has mastered the concept and developed confidence. Computers do not get tired, frustrated, angry, or bored (Cotton, 1991; Kulik and Kulik). They keep accurate records and are always available. If they are programmed to do so, computers always remember to praise the student's work (Cotton; Mahmood). A student can take risks to try a solution, get instant feedback, and try again without being embarrassed when he makes a mistake. Unlike a human instructor, computers are impartial to gender, race, and ethnicity. In addition, students report they like working with computers because they teach in small increments, individualize instruction, build proficiency in computer use, reduce the drudgery of doing certain activities by hand, and allow teachers to be available for more meaningful interactions (Cotton).

Computer-assisted instruction encourages a student to take responsibility for his or her learning, acquire effective study habits, and persist until he has mastered the content (Brothen and Wambach). He can control when he works and how much time he spends on each lesson. By supplementing traditional classroom instruction with computer-assisted instruction, students receive the benefits of both instructional modes. According to Maxwell, developmental mathematics students need to see the instructor work problems (1979). Instructors are able to observe individual students work, identify their misconceptions, and attempt to change their attitudes and study habits. By providing short lectures, the instructor is preparing developmental students for the lecture approach that is used in other mathematics courses.

1.5. Effects of CBL methods on Secondary School Physically Handicapped students' Academic Achievement in Mathematics

As Philips, (1984) suggests, discovering the appropriate uses for the computer in education has been a problem. Trends in computer software show that the most promising current use of computers in education include: drill and practice to master basics skills; development of writing skills; problem solving, among others. There now seems to be consensus that the computer can best be used in classroom to help students develop information handling and problem solving skills in the subject like mathematics. When people think of physically disabled students, they tend to just think of children in wheelchairs and those who have problems with mobility. Some children have problems with manipulation due to painful joints, poor co-ordination or degenerative conditions. Information and communications technology (ICT) can support learners with physical disabilities by enabling them to access the curriculum alongside their peers. It is particularly helpful for learners who find it difficult to record their schoolwork using conventional methods, (Philips, 1984).

The CBL in mathematics provide the teachers with the effectiveness to provide and organize concrete problem solving in offering data gathering experiences for students that increases skills, understanding, and positive attitudes, [41,47]. The tutorials provide interaction with best and animated graphic materials that illustrate the concepts or processes being studied and give useful corrective feedback when students choose wrong answers, (QUEST Authoring System, 1991).

The manual explains that the computer programs supplement concrete experiences or stimulate them. In simulation, students are given opportunity to develop science and process skills. In biology, computer software have been used to provide a realistic game that encourages students to determine various aspects of animal life like predator-prey relationship of fish and other organisms in

an aquatic environment or in body transplant, which offers a set of games that stimulate the dissection of the human body. The chemistry laboratory stimulates actual laboratory chemical realities that are too dangerous or costly to do in real life. In physics CBL allow students to design, construct, and refine various aspects of the subjects like motion or measurements and calculations [29,42].

And in Geography various programmes like the EARTH, and THE MOON Simulator [47] shows the relative path of the earth and the moon as they orbit the sun, the phases of the moon as seen from the earth and from space. Ellis [17] and Rees note that inspiration software allows students to create webs of ideas that are converted into outline form to be used for essay writing. Mathematics has also come out with programs used by computer to each concept and skills of the subjects like the Copycat software. The first schools to own computers were a few rich private and public secondary schools. Some of these were beneficiaries of the Computer in Education of the Aga Khan (CEPAK) [29]. In 1980, Starehe Boys' Centre introduced a computer awareness course for learners. Other schools have since joined the club of computer owners. Review of computer ownership in year 2002 showed that about one thousand secondary schools had at least a few computers, which could be utilized for instruction purposes assuming there were enough data and manpower to operate them. It is the Kenya government's desire to disseminate ICT to all schools by the year 2020 (Government of Kenya Report, 2000).

The aim of introducing computer knowledge to learners in secondary schools is to equip them with skills on the use of computers. Little is currently mentioned on the use of computers for instruction purposes in Kenya as it is in South Africa, U.S.A and Europe [35]. There is need to emphasize this idea in the minds of educational officials, teachers and students to make use of the ICT since a computer is a powerful tool that will stay with us for many generations to come [29]. Large scale implementation of CBL programs in secondary schools is hindered by the high cost of computers and the constant change in the type of computers and software which causes computer incompatibility. Despite the cost and the logistic difficulties involved in computer acquisition and installation, computational technology and computational ideas can provide teachers and students with new possibilities for learning, thinking and growing emotionally as well as cognitively [35]. Adaptation of the same computers to suit all the learners of diverse disabilities could provide an opportunity for those with degenerative disorders to learn with ease and perform in mathematics like their non-disable peers.

Mathematics teachers at secondary school level in Kenya are, by requirement mathematics graduates with bachelors degree in education (B.Ed). Shortage of qualified mathematics teachers is a worldwide phenomenon and Kenya is no exception [2]. Secondary schools in disadvantaged areas are particularly deficient in mathematics teachers. The situation is worse in special schools for learners with disabilities. The result is that less qualified teachers and sometimes unqualified teachers are entrusted with the work of mathematics teaching [36], which is detouring the whole system of education. This is also due to few teachers and limited communication technology that would make the learning of mathematical concepts easy to understand if they are well introduced, (Government of Kenya, 1998).

The students' achievement is therefore influenced to some degree by such variables as teachers' training and effectiveness, students' effort and ability, instructional methods, physical health and the nature of instructional contact [11]. As Malone, (1981) observes, gender influences the learning of mathematics, and that the differences begin to appear in upper primary schools and increases in secondary schools. In the year 2006, the mean grade in mathematics for girls and boys with physical handicaps in KCSE was 0.821 and 1.122 respectively, (KNEC 2007). The low achievement in girls has been attributed to modes of teacher-student interaction and negative attitudes of girls towards mathematics. Kiboss [29] observes that cooperative learning like the use of CBL produces significantly higher achievement in mathematics and sciences among secondary school students than those taught in the traditional teaching methodologies. Introducing Computer Based Learning provides the students with expanded perspective on content to ensure effective en route mastery during embedded questioning and it is an incentive to cooperate as well as to achieve in the classroom [29].

2. Methodology

2.1. Research Design

A Quasi experimental research design attempts to control the entire research situation, except for certain input variables that may become suspect as the cause of whatever change has taken place within the investigative design. A pre test counterbalanced design was used. 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.

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. The population of the study comprised a total of 156 Form three students from the three secondary schools for the physically handicap in Kenya, namely Joytown, Joyland and Mombasa secondary schools for the physically handicap. It also included a total of 5 teachers for mathematics from the named schools.

Saturated sampling was used to get a total sample of 128 students and purposive 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.

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

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), Quite relevant (3), somewhat relevant (2) and not relevant (1) The consistencies of the instruments were done using the test re-test method where reliability coefficient of 70% and above at p value of 0.05 was considered reliable. This was guided by the degree of the consistency of the results.

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. The students and teachers who participated in the study from Joytown Secondary School in Thika County and Joyland secondary school for the physically handicapped in Kisumu County were selected randomly while all the 32 Form three students from Mombasa Secondary School for the physically handicapped and their 2 mathematics teachers 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. The students 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.

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. Pearson's correlation coefficient, Analysis of variance and multiple regression analysis were used to determine the relationship and to predict students' performance in mathematics.

Qualitative aspects of the statistics concerned with the "whats" and the "hows" of events whereas the explanation component attempts to provide answers to the "whys" of events. Descriptive statistics use; noting patterns and themes, seeing possibilities, clustering, making metaphors, counting, comparing, partitioning variables and subsuming of particulars by more general categories to determine relationships between variables.

3. Results

The objective of the study sought to find out the effects of CBL on students who are physically handicapped (PH) in their achievement in learning mathematics. To measure achievement, students in the treatment group were given a series of tests before the use of the software (pre-test) and after the use of the software (post-test).

3.1. Teaching of Mathematics

The teaching of mathematics was evaluated using the performance since form one, identifying mode of teaching mathematics since form one, interaction with computer, comparison of CBL with traditional method, whether CBL add value, basic information about CAST and information about student motivation. More than half of all the students, 72(55.6%) taught through traditional method performed fairly well. Majority of the students, 100 (77.8%) started interacting with computers while in form three; more than half 72 (55.6%) reported that CBL is easier to understand than traditional method and only 14 (11.1%) said that CBL is time consuming. More than three quarters 100 (77.8%) were in agreement that computers added value to students' motivation and achievement. The information is as indicated in Table 1.

Table 1. Teaching of Mathematics (n = 128)

Teaching of mathematics	Frequency (%)
Performance in mathematics since form one	
Above average	28 (22.2%)
Average	28 (22.2%)
Fair	72 (55.6%)
Bad	0(0%)
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 (22.2%)

The participants listed the following as success in using CAST; accessibility of the software and ability of the software to make students enjoy calculations.

3.2. Computer Assisted Statistical Text (CAST)

Table 2. Computer Assisted Statistical Text (CAST)

Computer Assisted Statistical Text (CAST) n = 96	Frequency (%)	
	Yes	No
Did the resource help or not?	96 (100%)	
Was the resource up to the task?	85 (88.2%)	11 (11.8%)
Did the resource help the students to engage in and enjoy the class?	86 (90%)	10 (10%)
Did the resource add value to students' education?	92 (95%)	4 (5%)

The Computer Assisted Statistical Text (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. From the study with problems notwithstanding, the respondents were in agreement that the software was helpful 96 (100%) as indicated in Table 2. It was up to task 85 (88.2%), it made students enjoy the class 86 (90%) and it added value to student's 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. Problems faced during the lesson included; inadequate computers, the software could not open the page for some questions and difficulty in drawing graphs.

3.3. The Effects of CBL Methods on Secondary School Physically Handicapped Students' Academic Achievement In Mathematics

During the study the descriptive statistics was used to establish the difference in mean between the pre-test, CBL method and traditional method of teaching that was adopted. The mean of the three locations under investigation was sought with respect to students' academic achievement in Mathematics as summarized in Table 3. From the study the lowest students' academic achievement in Mathematics was during the pretest in school A, B and C, with a mean score of 50.60. However the highest students' academic achievement in Mathematics was during the adoption of CBL method having a mean score of 63.75. On average the adoption of traditional method after subjecting the students to the CBL method had an average mean score of 56.40. This mean score was higher than that of the pre-test but lower than that of CBL method.

Table 3. Descriptive statistics on Effect of teaching methods on students' academic achievement in Mathematics

School		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Pre test	A	52	51.33	12.65	1.75	25.00	78.00
	B	44	50.39	9.00	1.36	25.00	70.00
	C	32	49.72	9.66	1.71	28.00	68.00
	Total	**128**	**50.60**	**10.72**	**0.95**	**25.00**	**78.00**
CBL Methods	A	52	67.92	11.99	1.66	40.00	96.00
	B	44	68.55	10.17	1.53	46.00	85.00
	C	32	50.38	9.22	1.63	32.00	72.00
	Total	**128**	**63.75**	**13.18**	**1.16**	**32.00**	**96.00**
Traditional	A	52	58.46	10.84	1.50	30.00	80.00
	B	44	55.80	9.19	1.39	34.00	74.00
	C	32	53.88	8.84	1.56	36.00	70.00
	Total	**128**	**56.40**	**9.92**	**0.88**	**30.00**	**80.00**

Analysis of Variance (ANOVA) was used occasions to compare students' academic achievement in Mathematics. A one-way analysis of variance was conducted to explore the students' academic achievement in Mathematics as shown in (Table 4).There was a statistically significant difference at the p<.05 level in CBL method [*F* (2, 125) =33.14, p=.000]. Since the effects of CBL method was found to be significant, it implies that the means differ more than would be expected by chance alone and despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. There was no statistically significant difference p>.05 in pre-test [*F* (2,125) =.234, p>005] and traditional method [*F* (2,125) =2.29, p>005]. Since the effects of traditional method were found to be not significant, it implies that the means do not differ much. Thus, the adoption of CBL methods influenced the students' academic achievement in Mathematics among the physically handicapped.

Table 4. Analysis of Variance on students' academic achievement in Mathematics

		Sum of Squares	df	Mean Square	F	Sig.
Pre test	Between Groups	54.337	2	27.168	.234	.792
	Within Groups	14542.343	125	116.339		
	Total	14596.680	127			
CBL Methods	Between Groups	7641.899	2	3820.949	33.140	.000
	Within Groups	14412.101	125	115.297		
	Total	22054.000	127			
Traditional	Between Groups	441.098	2	220.549	2.288	.106
	Within Groups	12051.582	125	96.413		
	Total	12492.680	127			

The current study found significant difference in final exam scores of students receiving traditional instruction and those receiving CBL. This agreed with Fletcher, Hawley, and Piele, that a third and fifth graders in Canada

who used the computer to supplement classroom instruction scored significantly higher on a standard test of mathematics achievement than those receiving conventional instruction. Also concurs with Olusi that 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.

The findings support Bialo and Sivin-Kachala that educational technology had a positive impact on achievement for all subject areas from preschool through higher education. The achievement of students using computer-based instruction was significantly related to the amount of technology-related training the teachers had received and whether the technology was being used appropriately. It concurs with Cotton, (1991) that a computer-based learning and student outcomes concluded that computer-assisted instruction as a supplement to traditional instruction produced higher achievement than traditional instruction alone, but when computer-assisted instruction alone was compared to traditional instruction alone.

3.4. Post Hoc Tests (LSD)

The Post Hoc Tests (LSD) multiple comparisons were used to establish the effect of teaching method as summarized in Table 5. The findings showed that there was significant effect between school A and C in the pre-test. The CBL method was found to be significant in school B as compared to C. Also, school C was negatively significant different to school A and B. Finally, school A was significant different to school C. The traditional method was found to be negatively significant different in school C and A. This implies that the adoption of CBL method affect the students' academic achievement in Mathematics among the physically handicapped.

Table 5. Post Hoc Tests (LSD)

Dependent Variable	(I) School	(J) School	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
re test	A	B	.94056	2.21	0.67	-3.43	5.31
		C	1.60817	2.42	0.51	-3.19	6.40
	B	A	-.94056	2.21	0.67	-5.31	3.43
		C	.66761	2.51	0.79	-4.29	5.63
	C	A	-1.60817	2.42	0.51	-6.40	3.19
		B	-.66761	2.51	0.79	-5.63	4.29
CBL Methods	A	B	-.62238	2.20	0.78	-4.98	3.73
		C	17.54808*	2.41	0.00	12.77	22.32
	B	A	.62238	2.20	0.78	-3.73	4.98
		C	18.17045*	2.49	0.00	13.23	23.11
	C	A	-17.54808*	2.41	0.00	-22.32	-12.77
		B	-18.17045*	2.49	0.00	-23.11	-13.23
Traditional	A	B	2.66608	2.01	0.19	-1.31	6.65
		C	4.58654*	2.21	0.04	0.22	8.95
	B	A	-2.66608	2.01	0.19	-6.65	1.31
		C	1.92045	2.28	0.40	-2.59	6.44
	C	A	-4.58654*	2.21	0.04	-8.95	-0.22
		B	-1.92045	2.28	0.40	-6.44	2.59

*. The mean difference is significant at the 0.05 level.

The conclusion of the current study agrees with these previous results as it found significant difference in the mathematical performance of students, although the mean score of the computer-assisted group was higher. The findings agree with Kulik and Liao, that that computer-assisted instruction produced higher achievement, especially when combined with and not replacing traditional instruction.

3.5. Relationship between the Students Exposed to CBL and Those without that Exposure in Their Performance in Mathematics

The performance was measured based on test results of pre-test, CBL method and traditional method of learning.

3.6. Relationship between CBL Method and Pre-Test Performance

A linear regression analysis was used to explore interrelationship among the variables using a model. R^2 represents the values of linear correlation coefficients between the predictors used in the model. From the model, (R^2 =. 436) shows that all the predictor account for 43.6% variation in pre-test performance (Table 6). The change statistics was used to test whether the change in adjusted R^2 is significant using the F ratio. The model caused adjusted R^2 to change from zero to. 436 and this change gave rise to an F ratio of 97.23, which is significant at a probability of. 05.

Table 6. Model Summary on pre-test performance using CBL methods as a constant

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.660[a]	.436	.431	9.26006	.436	97.234	1	126	.000

The analysis of variance was used to test whether the model could significantly fit in predicting the outcome than using the mean as shown in (Table 6). The F- ratio represents the ratio of improvement in prediction that results from fitting the model, relative to the inaccuracy that exists in the model. The F- ratio was 97.23 which is likely to happen by chance and was significant (P<.05). The model significantly improved the ability to predict the pretest performance in mathematics. Thus the model was significant leading to rejection of the null hypotheses. This represented the effect size of the regression model and was significant with a p-value of 0.000.

Table 7. Analysis of Variance on CBL Methods

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8337.668	1	8337.668	97.234	.000[b]
	Residual	10804.332	126	85.749		
	Total	**19142.000**	**127**			

a. Dependent Variable: pre-test performance
b. Predictors: (Constant), CBL Methods.

Table 7 shows the estimates of β values and gives an individual contribution of predictor to the model. The β value explains about the relationship between CBL method and predictor. The positive β values indicate the positive relationship that exists between the predictors and the outcome. The β value for CBL method had a positive coefficient thus positive relationship with pre-test performance.

Table 8. Coefficients of pre-test performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26.381	3.964		6.656	.000
	CBL	.756	.077	.660	9.861	.000

a. Dependent Variable: Pre-test performance.

The regression results in Table 8 show that each of the predicted parameters in relation to the independent factor was significant; β1= 0.756 (p < 0.05) which implies that we reject the null hypothesis stating that there is no significant relationship between CBL method and pre-test performance. This indicates that for each unit increase in the, CBL method there is 0.756 units increase in pre-test performance. Also the influence of CBL method is shown by the t-test value of 9.86 which implies that the effect surpasses that of the error by over 9.86 times.

3.7. Relationship between Traditional Method and Pre-Test Performance

From the model, (R^2 =. 569) shows that the predictor account for 56.5% variation in pre-test performance (Table 9). The change statistics was used to test whether the change in adjusted R^2 is significant using the F ratio. The model caused adjusted R^2 to change from zero to. 569 and this change gave rise to an F ratio of 166.09, which is significant at a probability of. 05.

Table 9. Model Summary on pre-test performance the constant being traditional method

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.754[a]	.569	.565	7.06914	.569	166.093	1	126	.000

The analysis of variance was used to test whether the model could significantly fit in predicting the outcome than using the mean as shown in (Table 10). The F- ratio represents the ratio of improvement in prediction that results from fitting the model, relative to the inaccuracy that exists in the model. The F- ratio was 166.09 which is likely to happen by chance and was significant (P<.05). The model significantly improved the ability to predict the pre-test performance in mathematics. Thus the model was significant leading to rejection of the null hypotheses. This represented the effect size of the regression model and was significant with a p-value of 0.000.

Table 10. Analysis of Variance on CBL Methods

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8300.119	1	8300.119	166.093	.000[b]
	Residual	6296.560	126	49.973		
	Total	**14596.680**	**127**			

a. Dependent Variable: Pre test
b. Predictors: (Constant), Traditional.

Table 11 shows the estimates of β values and gives an individual contribution of predictor to the model. The β value explains about the relationship between CBL method and predictor. The positive β values indicate the positive relationship that exists between the predictors and the outcome. The β value for traditional method had a positive coefficient thus positive relationship with pre-test performance.

Table 11. Using Coefficients of pre-test performance as dependent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.165	3.428		2.090	.039
	Traditional	.782	.061	.754	12.888	.000

The regression results in Table 11 show that each of the predicted parameters in relation to the independent factor was significant; $\beta 1 = 0.782$ ($p < 0.05$) which implies that we reject the null hypothesis stating that there is no significant relationship between traditional method and pre-test performance. This indicates that for each unit increase in the, traditional method there is 0.782 units increase in pre-test performance. Also the influence of traditional method is shown by the t-test value of 12.89 which implies that the effect of traditional method surpasses that of the error by over 12.89 times.

The research on the effects of computer-assisted instruction on the mathematical learning of students of various ages and ability levels suggests that computer-assisted instruction as a supplement to traditional classroom instruction is more effective than traditional instruction alone. The test scores of low-achieving students were higher with computer-assisted instruction combined with traditional instruction than with traditional instruction alone. The findings agree with Fitzgerald and Koury that students with mild and moderate cognitive learning disabilities learned as well or better with computer-assisted instruction than without it.

4. Conclusion

The adoption of CBL methods had influenced the students' academic achievement in Mathematics among the physically handicapped. Students who have been using CBL throughout the learning period had on average, higher results in all the three tests compared to their counterparts who have been using traditional method.

The students with physically handicaps learn equally well with or without computer-assisted instruction. The mere presence of computers does not improve their learning. Students have an interest in using technology for a variety of purposes including academics. Computers have the potential to be useful tools to improve learning. They provide educators the opportunity to create courses in a variety of alternative formats to the traditional lecture in order to address the different learning styles and preferences of students.

The low performance in mathematics was associated with the traditional method of learning mathematics, while the use of CBL greatly led to improvement in mathematics performance alongside creating an enjoyable environment for learning. Physically handicaps students learn mathematics equally well in traditional lecture and lecture supplemented with computer-based learning method.

5. Recommendations

CBL must be modified and made available to all learners, relevant software for mathematics must be made available and the teachers must be trained on the use of the CBL in order for them to effectively handle the learners with physical disabilities.

The area that still needs to be considered is introduction of the use of CBL in solving mathematical problems from form one in all the secondary schools of learners with physical disabilities.

With the advent of intended introduction of free laptops to class one pupils in Kenya Public Primary Schools, the learners with physical disabilities need to be considered if this dreamed is to become reality in line with vision 2030 of the Republic of Kenyan goals.The input systems in the computers are modified to suit learners with physical handicaps right from the free laptops that are intended to be introduced for class one pupils.

Training opportunities for regular classroom teachers should be geared towards equipping the learners with computer skills for application in their studies and their general lives.

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