Effect of Computer-Based Laboratory Simulations (CBLS) in Acquisition of Scientific Inquiry Skills in electro_ chemistry in Secondary Schools in Bomet County

[1*]Chepkorir Salome, [1]Kafu A. Patrick and [2]Lusweti Kituyi
[1]Department of Curriculum and Instruction, School of Education, University of Eldoret, P. o. Box 1125, Eldoret, Kenya

[2]Department of Chemistry and Biochemistry, School of Science, University of Eldoret, P.o. Box 1125, Eldoret, Kenya

***Corresponding author's email Address:** salomechepkorir@gmail.com

Abstract

Computer technology has advanced to the point where it can significantly enable inquiry learning to be used at various levels, and offer new tools for representing the science nature in the classroom. It has been revealed that when using computer simulations in a situation where individuals are actively engaged can lead to content knowledge and conceptual change. The aim of this research was to examine the use of Computer-Based Laboratory Simulations (CBLs) in acquisition of inquiry skills in electro- chemistry in secondary chemistry instruction, Bomet County. This study adopted a Quasi-Experimental Research Design. Solomon-Four Non-equivalent Groups Design was applied. Four secondary schools in Bomet County were purposively sampled on the basis of availability of computers. Three hundred and sixty-nine subjects took part in the investigation. The four schools were allocated to control and treatment groups by simple random sampling method. All groups of students were taught similar chemistry content (electro-chemistry). However, experimental groups used CBLs approach while the control groups used regular teaching methods (RTM) including teacher demonstrations and lecture. The control group II and experimental group I were pre-tested prior to the implementation of the CBLs treatment. After four weeks, all the groups (four) were post-tested using the Students' Chemistry Achievement Test (SCAT) which was authenticated by education experts and pilot tested before using to validate its reliability. Data was analysed using ANCOVA, one-way ANOVA and t-test at a significant level of coefficient alpha (α) equal to 0.05. The findings indicated that computer-based laboratory simulations assisted students in acquisition of scientific inquiry skills ($P<0.05$). The study concluded that computer-based laboratory simulation had significant influence acquisition of inquiry skills in electro- chemistry. The study recommended teacher training programmes in universities be modified so as to include computer studies to empower teachers to be able to design CBLs programmes and use emergent technologies.

Keywords: Computer-Based Laboratory Simulations, Inquiry Learning

INTRODUCTION

Chemistry as a subject at the secondary school level assists scholars in building fundamental capabilities, understanding and required competence to tackle problems in their setting. Concurring with Ohodo (2005) chemistry helps learners to develop scientific process skills and competences required for managing perception, classification, estimation, tallying numbers, documenting, communication, forecast, hypothesis, inference, investigation, controlling variable, information interpretation, generalization, research and among others.

Low achievement in chemistry among secondary school students has been attributed to variety of factors. As per Usman and Memeh (2007), cited factors that negatively impact chemistry achievement as learners' disinterest and/or having negative attitude towards the subject (chemistry), teacher-related issues such as inadequate preparation and poor teaching, lack of enough skilled chemistry teachers, scarce resources for instruction and use of traditional teaching techniques.

More significantly, the Ministry of Education, Science and Technology (MOEST) has designated the science laboratory as crucial in the tutoring of sciences because its utilization boosts the accomplishments of the nationwide goals of science education (Government of Kenya, 2005). As a result, the government donated science materials to learning institutions in addition to establishing laboratories for effective teaching and learning of science (Waititu & Orado, 2009).

In addition to donation physical resources, the Government has also initiated an in-service training programme (INSET) to boost science and mathematics instruction in secondary schools (SMASSE, 2004) (Nui & Wahome, 2006; Waititu & Orado, 2009). The INSET is grounded on a report which suggests the need to alter the teachers' attitudes on tutoring of science subjects, also equipping them with proper teaching approaches and enhancement of their content understanding. Concentrating on these three aspects, teachers hoped that they would have the ability to change the science teaching setting (laboratory and classroom) in order to enhance learners' positive outcomes.

The above interventions are all intended to enable science scholars attain the essential scientific content and process abilities that they harnessed to create an industrialized society envisioned by Kenya's vision 2030. Despite these initiatives, the teaching methods of sciences in Kenya remains traditional (with limited use of the science labs) which Oyoo (2010) argues about does not effectively foster development of scientific knowledge and skills in learners. This teaching approach as pointed out in this argument has been associated with candidates constantly performing poorly in sciences which is evident in KNEC science grades for the years 2016 to 2018.

Table 1: KCSE- Analysis of science results for years 2016-2018

	2016	2017	2018
Subjects/mean %	Mean %	Mean %	Mean %
Biology	30.32	27.20	29.23
Chemistry	22.74	19.13	24.91
Physics	36.71	31.33	35.13

Source: KNEC Reports, 2017, 2018 & 2019

The tabulated results in table 1 show that performance in science has been generally poor, the least being chemistry. The poor performance, particularly in chemistry has been blamed on the use of archaic laboratories when conducting practical examinations (Oduor, 2012). Besides the general poor performance in science, the Kenya National Examination Council (KNEC) reports (2017; 2018; 2019) indicate that candidates are persistently performing poorly in questions that require knowledge of scientific process skills. Also, the same reports show that candidates answer practical questions theoretically.

Chemistry being a prerequisite for many technical and vocational courses in colleges and tertiary institutions, it is obligatory to boost students' success and interest in chemistry learning. The achievement in chemistry is less the expectations that would be needed by Kenya to objectify her objective of industrialization hence becoming, by the year 2030, a middle level income country (Republic of Kenya, 2007). Dismal performance of learners in sciences shows the difficulties that face Kenya in obtaining suitable number of qualified learners registering in technological and scientific disciplines in training institutes.

Recommendations have been made by Keraro *et al.*, (2007) concerning the teaching approaches, instructional resources, school and home associated environmental aspects that could enhance good performance in chemistry. Nevertheless, as the indication available illustrates, attainment in chemistry remains unimpressive and low at the secondary school level. The Government of Kenya participated incredibly in this exertion to restore interest in learning of science, particularly, chemistry and boost success in electro-chemistry. Ajaja (2005) recommends more research on in-cooperation of computer aided instruction on the learning and training of sciences.

The inquiry approach, while praised by science instructors, is yet to be prevalent in the classroom, and is frequently misused. This might be as an effect of several factors, including amount of classroom period, lack of effective ways for learners to conduct independent inquiries, the challenge of abstract concepts' incorporation with inquiry, and inadequate teacher experience and expertise. One of the electronic systems that is being incorporated into the classroom to support in the process of learning is the computer. One such area includes computer simulations that have been utilized in learning and training of numerous subjects, such as physics, accounting, medicine and mechanics, with promising results (Omwenga, 2005).

Computer technology has progressed to the era that it can considerably ease the application of inquiry learning on a variety of levels, as well as give new tools for depicting the nature of science in the science rooms. This utilization of technology in provision of new teaching techniques and objectives in science has enormous potential for enhancing scientific learning in the science room, as long as the inherent limits of acquisition are acknowledged and technology is utilized as a tool rather than as a foundation.

While the incorporation of such a teaching/learning technique may help in chemistry teaching, much has not been done in investigating the use of Computer-Based Laboratory Simulations (CBLs) in the tutoring of secondary school chemistry particularly the topic electro-chemistry that has been considered difficult by students who learn it. The utilization of proper teaching equipment and methods is vital to the effectiveness of chemistry teaching and learning. There is still considerable work to be accomplished in terms of making the most use of current educational tools (Bello, 2011). Consequently, this study sought to fill the existing gap on acquisition of scientific inquiry skills by investigating the use of Computer-based laboratory simulations in aiding conceptual understanding of Electro-chemistry in secondary chemistry instruction in Bomet County.

Theoretical Framework

Constructivism served as the theoretical basis for this research. Constructivists argue that learning occurs in the mind and that what enters the mind is formed by the person through social interaction or knowledge discovery. The learner is emphasized as an active agent in the course of knowledge acquisition in this approach. When individuals actively engage in meaningful activities, they are able to learn. They create a learning mechanism as well as their own distinct version of information, which is influenced by their prior abilities and experiences (Roblyer & Edwards, 2000; Chen *et al*., 2000).

Learning, according to the constructivist point of view, is an active procedure that each individual is involved in creating meaning from physical experiences, text, or dialogue (Osborne & Wittrock, 1983). Active learning occurs when scholars are tested to actively use their mental skills while studying (Hout-wolters, Simons & Volet, 2000). Scholars actively seek understanding (Kirschner, Martens, & Strijbos, 2004) and are anticipated to design their own learning experiences (Glaser, 1991). According to Dwyer (1991), the method is not curriculum-centered but rather learner-centered, and knowledge is built rather than passively absorbed.

Interactive CBLs would allow students to manage the pace and order of their studying, which is linked to this notion (Drillscol, 2000). Learners in CBLs learn the topics on their own with the educator's guide and complete the evaluation questions at the conclusion of the study unit. They are permitted to learn by experimenting and are not informed what will happen, so they must draw their own assumptions, findings, and conclusions.

METHODOLOGY

Research Design

In accordance to Orodho (2003), research design is a strategy used to develop responses to research hypothesis or questions. The design of a quasi-experimental pre-test post-test control group was used. According to Maxwell (2012), an experimental design was used because respondents were subjected to a variety of situations. Both control and treatment groups determined the genuine impact of the program or intervention. The intervention was administered to the treatment group. The control group, on the other hand, received business-as-usual circumstances, because they only got interventions that they would have received if they had not taken part in the research. The study selected four schools two girls' and two boys' schools which were coded as A, B, C and D. Therefore, one boys' and girls' school were the experimental group (CBLs) and the next control group was represented by one boys' school and one girls' school. Each school provided 40 students to be used for investigation.

One or more independent variables were modified. The impact of this manipulation on single or more dependent variables were measured, and all other factors were controlled. The effectiveness of CBLs learning strategy was compared with the traditional tutoring technique at the end of a two-week treatment session to assess if it had a meaningful influence on secondary school learners' accomplishment scores in chemistry. The experimental design technique was made available to the teachers.

The investigation was carried out in Bomet County, which is located in Kenya's former Rift Valley Province. Bomet County is bounded to the south east, south, and south west by Kericho County, to the North West by Nyamira County, and to the east by Nakuru County. The County has a total land area of 2,037.4 Km^2 , of which 1,716.6 Km^2 is arable and suitable for farming. Because of familiarity and ease of access, the location was chosen for research.

The total number of Form four learners in selected schools was 687 and 4 Chemistry teachers from public Secondary Schools in Bomet County. Chemistry teachers from the chosen schools were included in the study since they were in charge of planning and developing a suitable teaching and learning environment. Students in Form 4 were chosen because they had been in the school long enough to display the relevant factors. They had accumulated enough experience to be able to think abstractly.

A sampling frame was required for a researcher to pick a representative sample. A sampling frame was constructed in the present study using a list of public secondary schools in Bomet County. To select the four secondary schools from Bomet County and 4 Chemistry teachers for the interview, this study adopted purposive sampling, as well as simple random sampling technique for selecting Chemistry students per school. While utilizing purposive sampling 40 Chemistry students were selected from one class were taught using one method.

Purposive sampling was adopted as a suitable approach because there was prior information of the population through an earlier pilot study and a definite objective for the investigation stated, as a result, human judgment was used to pick a sample (Wallen & Fraenkel, 2001). Because of the nature of this study, the research sample had to be carefully chosen. The County Education Office provided a list of secondary schools in Bomet County, from which samples of four schools which offer computer as one of the teaching disciplines were chosen.

The sample size comprised the sample for experimental group which had 80 students while the control group had 80 students and 4 Chemistry teachers. The sample also consisted of sample of 205 students which represent 30% of 687 total number of Chemistry students in the four schools who filled the questionnaire. This was obtained based on Mugenda and Mugenda (2003) concept of picking 30% where there was target population of 100 to 1000 respondents. This made a total sample size of 369 respondents. The-sampled schools and respondents are shown in Table 2.

Table 2: Sampling Frame for Teachers and Students in Bomet County

Coded	Type Schools	Number of Students	Sample of Teachers for interview	Sample of student for questionnaire	Sample for Experimental test
A	Boys (Exp.)	165	1	49	40
B	Girls (Exp.)	195	1	58	40
C	Boys (Cont.)	180	1	54	40
D	Girls (Cont.)	147	1	44	40
Total		687	4	205	160

Keys: Exp. – Experimental group, Cont. – Control group for Experimental test
Source: Bomet County Education office (2019)

Therefore, the sample size of 369 respondents comprised of a sample of 4 teachers, 205 students who filled questionnaire and 160 students who were involved in experimental design where 80 represented control group and 80 experimental group as indicated in Table 2.

In relation to this study, Student chemistry achievement test (SCAT), questionnaire and interview schedule were preferred tools. These tools were presented as sub-themes.

The data collection instrument chosen for this study was the Students Chemistry Achievement Tests (SCAT), which was developed and used to determine the mean achievement score in Chemistry. It comprised of twelve structured questions which were short answered with a 50-mark maximum score based on electro-chemistry, a topic tutored in Form four in accordance to the secondary school syllabus-volume two (KIE, 2002). The topic was chosen since it is regarded as the most difficult topic in chemistry (KNEC, 2019), and its non-practical nature makes it suitable to computer-based laboratory simulations (CBLs) as a teaching technique. The item format with short response was modeled after the KNEC chemistry paper one, which is acceptable because it is the used format at the secondary school level in Kenya (KNEC, 2005). The test questions were organized and classified into three cognitive domain levels based on Bloom's taxonomy of educational aims in the cognitive domain (Bloom, 1956). They tested the first three cognitive levels of knowledge, understanding and application

Open ended qquestionnaire was developed based on the study objectives, general literature review and the background of the study. This tool was preferred in data collection because it was cost effective and covers a wider area.

Formal teacher semi-structured interviews were carried out to obtain data on their reactions to the usage of CBLs to supplement classroom instruction and their perspective of what was actually happening in the chemistry classroom while the students utilized the CBLs software to learn electro-chemistry. Content analysis was used to interrogate the interviews, which validates the scholars' point of view. It gave qualitative data to back up the quantitative numbers from the chemistry achievement test and questionnaire.

Before collection of data, approval was sought from the School of Education, Centre for Teacher Education, University of Eldoret via a letter, which was then utilized to get a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI). The Bomet County Director of Education and the County Commissioner were both consulted.

The chemistry achievement test instrument was pilot-tested to ensure reliability using a co-educational school in Kericho County that wasn't part of the research but had comparable features as scores sample. The Cronbach alpha reliability coefficient approach was utilized to assess the instrument's dependability. By pre-testing the equipment, a reliability test is a means of ensuring the test's dependability. Pre-testing detects problems in research tool that may be fixed later. The alpha coefficient has a value between 0 and 1 and is used to elaborates the extracted reliability of components from questions with two alternative responses; a number greater than 0.7 indicates that the questionnaire is more reliable. An aggregate of 0.756 was obtained, which was more than 0.7, indicating that the questionnaire was credible, as revealed by data analysis.

A pilot test in two schools in neighboring Kericho County, Kenya, was done prior to data collection. They choice of Kericho County was because the two regions have similar physical resources and facilities, as well as to avoid contamination of the sample population. This allowed for an increase in the instruments' validity and reliability, as well as addressing any other issues that may have arisen. Furthermore, the acquired data enabled a complete examination of the intended statistical processes.

The information from the questionnaire and the chemical achievement test were coded, screened, and put into SPSS version 21.0 of 2019. Data obtained in chemistry achievement test was evaluated using inferential statistics and specifically Analysis of Covariance (ANCOVA), which was intended to establish the differences between computer-based laboratory simulations and traditional teaching methods at a 5% significance level. Further, Analysis of Covariance Variance (ANCOVA) was used to establish significant differences in mean scores for different schools sampled, in the two tests utilized (post-test and pre-test). Also, Descriptive statistics was utilised, with mean and standard deviation used to present the effect of computer-based laboratory simulation on chemistry achievement. Utilizing a 5% significance level, Analysis of Variance (ANOVA) statistics were performed to find whether there was a substantial influence on the acquisition of inquiry skills after using CBLs. The qualitative data acquired through interview schedules was further tested using content analysis to be able to quantify and analyze presence and relationship of some themes. The statistical analysis of the collected data was presented in form of standard deviations, means, and Frequencies, and were done in tables. Data was represented using line graphs, pie chart and bar graphs.

The study assured the respondents of the confidentiality of their responses since their identities would not be revealed. The aims and relevance of the study were explained to the respondents. It was clearly made on the reason they had been selected to participate, also their right to decline, accept, or even participation withdrawal in the research (Edwards, 2005), and they all gave informed consent.

RESULTS AND DISCUSSION

Response Rate and Reliability

A response rate of 86.5% was obtained where 173 copies of 200 questionnaire were returned. This enabled the research to proceed with data analysis because over 80% response rate was excellent for further analysis according to Mugenda and Mugenda (2003). A test was given to the four schools which were coded A, B, C, and D representing boys experimental group (CBLs), girls experimental group (CBLs), boys control group (traditional) and girls control group (traditional), respectively. Each group consisted of 40 students which were given pre-test before using CBLs and post-test after using the teaching method. Therefore, the response on the test was 100% as anticipated with 40 students in all the groups that is a total of 160 students. The study also used four (4) chemistry teachers who were found in the respective four schools teaching the chemistry class. The response rate was also 100% since all the four chemistry teachers were conveniently interviewed.

Demographic Information

Demographic information was given by gender, age and type of school which was collected based on the questionnaire given to students. The information was presented in pie chart format and frequency tables. Sex was therefore, presented in figure 1.

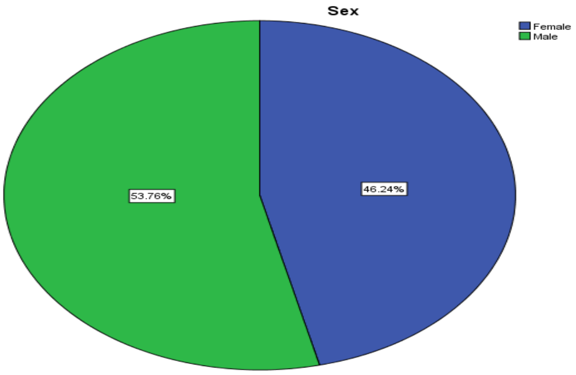

Figure 1: Gender

Source: Field Data (2020)

Figure 1 on distribution of respondents based on sex revealed that male participants were (93) 53.76% while female respondents were (80) 46.24% from the total respondents from the questionnaire. There were slightly more male student respondents (93) than female student respondents (80) students from the collected data. However, for consistencies the Chemistry pre-test and post-test used 40 female and 40 male students for experimental group. Similarly, control group had 40 female and 40 male students. Ages of the students were also examined as indicated in table 3.

Table 3: Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	13-14 years	3	1.7	1.7	1.7
	15-16 years	108	62.4	62.4	64.2
	17-18 years	62	35.8	35.8	100.0
	Total	173	100.0	100.0	

Source: Field Data (2020)

According to Table 3 the majority (108) of the student respondents came from the age bracket of 15-16 years representing 62.4% of the respondents. It was followed by age bracket of 17-18 years representing 35.8% of the respondents. The students ranged from 13 to 18 years. From these it appears that most students were in the age of 15-16 years, which implies that the school going age for children is 6-7. From the findings, there was no significant variation in age of the learners in secondary schools.

Table 4: Type of School

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	39	22.5	22.5	22.5
	B	51	29.5	29.5	52.0
	C	43	24.9	24.9	76.9
	D	40	23.1	23.1	100.0
	Total	173	100.0	100.0	

Source: Field Data (2020)

Table 4 represents response based on the Type of schools. The results revealed that school B had the highest number of responses with 29.5% which was followed by school C with 24.9%, school D with 23.1% and finally school A with 22.5%. Therefore, the girls' schools represented by school B and C were 52.6% while the boys' schools represented by A and C were 48.4% when comparative analysis was conducted. This implies that the results obtained from the four types of school could be used to generalize all public secondary since it consisted of both boys and girls' schools proportionately.

Computer-Based Laboratory Simulations and Acquisition of Scientific Skills

The results from the administered questionnaire were obtained where a Likert scale of 5 points was used strongly disagree = 1, disagree = 2, neutral = 3, agree = 4 and strongly agree = 5 to obtain the mean and standard deviation as the results presented in Table 5 shows. The mean and standard deviations presented in the table were used to describe the relationship in between computer-based learning strategy and acquisition of scientific skills.

Table 5: CBLs and Acquisition of Scientific Inquiry Skills

	N	Minimum	Maximum	Mean	Std. Deviation
The school has computer laboratory	173	2.00	5.00	3.8960	.74758
Computers available are used in performing science activities	173	2.00	5.00	3.7861	.70334
Computers were often used for learning science	173	2.00	5.00	4.0751	.68209
Practical lessons are taught using computer-based laboratory simulations in chemistry	173	2.00	5.00	3.8324	.67401
Level of participation in computer-based laboratory simulation for chemistry	173	2.00	5.00	4.1098	.66871
Computer based simulation help you to develop inquiry skills in chemistry	173	2.00	5.00	4.3295	.69975

Source: Field Data (2020)

Results from the analysis presented in Table 5 on computer-based laboratory and scientific inquiry skills, revealed that majority (80%) of schools had computer laboratory giving a mean of 3.8960. However, the variation was low in school with computer laboratory (standard deviation of .74758). This implied that a larger proportion of schools in Bomet County used computer laboratory on its availability for CBLs.

Computers available were to a great extent used in performing science activities according to the results (mean of 3.7861). Its variation on performing science activities was low (standard deviation of .70334). Based on these results a larger proportion of computer applications were used in science activities besides being used for computer lessons. According to the results from table 5, computers were often used for learning science (mean of 4.0751). The variation of use of computers to learn science was, however, low (standard deviation of .68209). This implied that computer technology was being adopted in chemistry learning process. This tends to support a long-standing arqument that the use of computers for instructional purpose increases motivation among learners (Kiboss, 2002). Practical lessons were taught using computer-based laboratory simulations in electro-chemistry to a great extent (mean of 3.8324). Its variation on using computer-based laboratory in chemistry was low (standard deviation of .67401). This showed that computer-based laboratory simulations were utilizable. This result concurs with findings from SMASSE (2004) in adoption of computer-based laboratory simulation in teaching abstract and difficult lessons that cannot be taught using traditional method.

Level of participation by learners in computer-based laboratory simulation for electro-chemistry was to a great extent (mean of 4.1098). The variation was low on computer-based laboratory simulation (standard deviation of .66871). Computer- based laboratory had improved the level of participation among the students during electro-chemistry lessons. However, teachers with knowledge mastery, high morale, and motivation are crucial, as are learner challenges and the ability to promote learning (Zadra, 2000), the use of an effective tutoring technique is crucial to the successful learning and tutoring of chemistry.

Computer-based laboratory simulation assisted students in acquisition of inquiry skills in electro-chemistry (mean 4.3295). Its variation was low on development of inquiry skills (standard deviation of .69975). This implies that, performance in chemistry improved through acquisition of inquiry skills. Since, computer-based laboratory simulation provides a platform for student to use computer in learning new ideas and to develop new knowledge.

Results obtained from ANOVA

The study investigated the scientific inquiry skills development in relation to the utilization of computer-based learning simulation using F-test at 5% significant level and the results summarized in Table 6.

Table 6: ANOVA relationship between CBLs and scientific skills development

			Sum of Squares	Df	Mean Square	F	Sig.
Chemistry achievement * Scientific skill development from CBLs	Between Groups	(Combined)	12.600	16	.788	3.409	.001
	Within Groups		36.087	156	.231		
	Total		41.688	172			

Source: Field Data (2020)

The results in Table 6 reveals that scientific skills development through the use of computer-based laboratory simulation had significant effect on the achievement in electro-chemistry (F = 3.409, P = .001<.05). This implied that computer-based laboratory simulations approach had significant effect on acquisition of scientific inquiry skills in electro-chemistry. Students develop problem-solving abilities required to tackle scientific questions when they use computers (Salovaara, 2005). Computer-based laboratory simulation assisted students in learning concept that are hard to explain by the teacher using visual and audio explanation as well as it assists in providing hand-on skills in electro-chemistry with vast knowledge on how to conduct practicals.

Results Based on Interview Schedules

Interview responses on the question "What is your personal feeling about the use of CBLs in development of inquiry skills in learning and tutoring process of chemistry?" revealed that majority of teachers (75%) supported the use of CBLs in acquisition of scientific inquiry skills. However, the response pointed out weakness of simulation in some of the scientific skills. Teacher 2 from school B alluded that "Despite, the students' developing inquiry skills, the new technology does not provide hands-on skills experience required during science practicals. There is need to incorporate lecture method to assist students to conceptualize".

The response to the question "In your opinion which skills have CBLs assisted in developing?" revealed that computer-based laboratory simulation encouraged observation skills, manipulation skills, analytic skills and inquiry skills among the learners. According to teacher from school A, "CBLs assisted the students to observe clearly the chemical changes which are not possible during chemistry practical demonstrations. CBLs sharpen the observation skills enabling students to relate chemical changes and physical changes during chemical reactions, he further added that CBLs provided information on electro-chemistry concepts that were difficult to handle and time consuming", this lends more support to the study by Makau (1999) on Computer instruction as opposed to traditional lessons in which students sit quietly and listen to the teacher teaching chemistry, clarifies otherwise enigmatic themes particularly in scientific discourse.

DISCUSSIONS

The findings from student questionnaire concurred with Sreelekha (2018) who found that CBLs had significant impact on practical skills as compared with traditional methods. However, the study did not only examine computer simulation but also examined video-based learning pedagogy in Physics subject rather than Chemistry.This study found more skills besides inquiry skills which included observation skills, manipulation skills and analytical skills. Sarabando, Cravino, and Soares (2014), computer simulation, on the other hand, allowed grade 7 science students to obtain hands-on experience. In this regard, CBLs is a significant tool in improvement of students' scientific skills. These skills range from practical skills, analytical skills, observation skills and manipulation skills as pointed out by the Chemistry teacher from school A. The assessment of students indicates an improvement in achievement in Chemistry through Chemistry experimental group that was under CBLs. Despite the performance in chemistry, the response from students revealed that they had improved in acquisition of science skills.

The constructivist teaching approaches are firmly ingrained in CBLs approach as indicated by Chemistry teacher from school A, B, C and D. It is student-centred other than teacher-centred, and it allows scholars to actively participate in questioning, exploring, and discovering.

CBLs technique has been thought to have the capability of generating inspiration among secondary school scholars since it piques their curiosity in the procedure of gaining scientific information and abilities (Gibson and Chase, 2002). According to the findings of this study, CBLs may be extremely successful in improving learners' motivation and achievement in science, as well as the development of scientific process skills (Sola and Ojo, 2007). This finding concurs with current study which would assist in enhancing policies, strategies and legislation of digitization of learning in secondary schools to enhance science related skills.

CONCLUSION AND RECOMMENDATION

The present study concludes that computer-based laboratory simulations assisted learners in acquisition of inquiry skills in electro-chemistry. They're existed computer laboratories used in science activities in most schools.

Furthermore, CBLs had significant influence on achievement in chemistry. It assisted in improving students' creativity and innovativeness compared to traditional teacher centered instructions.

Based on the findings of this study, and the subsequent drawn up conclusions, this study recommends the following:

i. University teacher education programs should be reorganized to include computer studies, allowing teachers to build CBLs programs and employ emerging technology. This will enable teachers to adopt the skills gain in university and apply in teaching chemistry among other subject using computer-based learning as well as computer-based laboratory simulation.
ii. Studies to be done in other subject and areas of science beside electro-chemistry which will assist in determining its suitability in teaching science subject. It would be beneficial if it only assists in electro-chemistry but with larger scope of use.
iii. A comparative study involving the rural and urban school settings to establish the findings concerning socio-cultural regions.

Conflict of Interest
The authors declare no conflict of interest.

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