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COMPUTER-SUPPORTED COLLABORATIVE LEARNING ON ENHANCING INTERACTIVE ACTIVE CLASSROOM: A CASE OF ARUSHA CITY SECONDARY SCHOOLS

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Abstract

The aim of the study was to examine how the Computer-Supported Collaborative Learning (CSCL) approach can support students and teachers' active interaction in physics lessons in Arusha City secondary schools. The study involved four ordinary level secondary schools having computer laboratory rooms. The respondents were 196 form two students and eight physics teachers. The research tools used were: interview and a classroom observation to identify teachers' awareness of the CSCL approach, training them on CSCL and how they could support their students under this approach. Data was analysed both qualitatively and quantitatively. The data from interviews was analysed thematically while the classroom observation was analysed for frequency distribution and percentages in the Statistical Package for Social Sciences (SPSS). The study found teachers lack awareness of CSCL as a pedagogical approach. However, the study found that the CSCL approach is a key supporter of teachers' and students' active interactions during teaching and learning of electricity.

Key Words: Computer-Supported Collaborative Learning, Information and Communication Technology, Information and Computer Studies, Active and Interactive Classroom

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Introduction

Teaching and learning should be an active process. However, this may depend on the nature of the classroom. Worldwide, the interactive and active classroom has been encouraged to support teaching and learning activities (Kafyulilo, 2013). Kumar & Lightner (2007) describe the activities that enable students to engage actively and participate in the classroom and raise their attention and performance. The introduction of digital support such as Information and Communication Technology (ICT) in education plays a key role in supporting teaching and learning. ICT has evolved into an effective tool for engaging students in a self-centred manner (Oliver, 2002). The use of Computer-Supportive Collaborative Learning (CSCL) is among the pedagogical digital tools which involve the use of computers and the internet to create an interactive, collaborative, and active classroom to enable successful teaching and learning (Mäkitalo-Siegl et al., 2011).

In Tanzania, the transition from the Knowledge-Based Curriculum (KBC) to the Competence-Based Curriculum (CBC) occurred in 2005, when secondary school executions occurred in the same year (Ministry of Education and Vocational Training [MoEVT], 2005). In 2006, the introduction of Information and Communication Technology took place at all levels of education. In the case of secondary schools, the Ministry of Education, Science, and Technology added information and computer studies to the curriculum as an optional subject to be studied. In 2021, the introduction of Physics, Mathematics, and Computer Studies (PMC) as a new combination has begun to be studied at an advanced level (FV & FVI), which involves both theory and practical activities. The designers came up with an overview of the computer laboratory where both students and teachers can access it during teaching and learning. However, there is still a challenge to how best the formulation of teaching and learning activities can be formulated in ICT integrated learning in physics.

Despite the introduction of ICT taking place in Tanzania, the efficiency of ICT literacy is still limited (Ndibalema, 2014). Teachers are struggling to use ICT as a support for teaching and learning, while some schools use CSCL as a digital pedagogical approach to teaching and learning (Kafyulilo, 2010). Among the teacher misconceptions are those regarding laboratories, where both science and arts teachers

believe that the computer laboratory is only for Information Computer Studies (ICS) subjects. Some physics teachers use CSCL to help students develop their conceptual understanding of electricity and to encourage collaboration and interaction. In fact, students' interaction is highly recommended by researchers to promote an active learning environment for students (Sarawagi & Bhamidipaty, 2002; Schweitzer & Brown, 2007)

Consequently, CSCL involves models which facilitate collaboration and active learning (Devedi 2006). Since CSCL involves a lot of interesting activities, learners must collaborate and active learning will occur. Guido (2018) demands that learners be motivated through the set of activities which take place in the classroom. Regarding this, the perceptions of learners toward a lesson may be increased or decreased depending on the events conducted in the classroom. Teachers, as coordinators and facilitators, must ensure that a series of related activities occur throughout the lesson to capture the learners' mindset. If CSCL were equally used during teaching and learning, an interactive and active classroom would occur and the intended learning outcome would materialise.

Although teachers try to use various traditional methods to engage students to collaborate actively in the classroom, digital support is still needed for efficiency (Gao & Hargis, 2010; Guido, 2018; Kafyulilo, 2010). The challenges facing the adequate use of CSCL are teachers' awareness of CSCL as a pedagogical approach, high students' enrolment rates in schools, poor internet connectivity, as well as in-adequate modern computer laboratories in schools (Olan'g, 2015).

However, if this were done accurately, interactive, active and collaborative lessons would take place and learners would be able to lift their understanding. To fill this gap, the present research seeks to investigate:

i. The teachers' awareness toward CSCL approach;
ii. Teache' and students' interaction and collaboration in the classroom

Thefrefore, the researches shall find out how the CSCL approach enhances the active interactive classroom through answering the research question below: -

i. How is the teacher's awareness toward CSCL approach?
ii. How does CSCL approach permit teachers and students to interact and collaborate in the classroom?

The Review of Literature

Computer Laboratory in Tanzania

Through ICT policy of 2007 in Tanzania, computer studies should be taught from pre-primary to higher levels. Information and computer studies in secondary education include both theoretical and practical activities in the National Examination. However, each school with Information and Computer Studies should have a computer laboratory to serve the purpose. However, not all schools are able to enrol in ICS due to the in-adequateness of some facilities, such as electricity (Olan'g, 2015). More so the availability of computer laboratories in Tanzanian schools is very low. Furthermore, less access to high-speed internet and electricity limits the effectiveness of computer use in many schools. Malero et al. (2015) states that, schools with computer laboratories easily promote educational quality.

Computer-Supported Collaborative Learning (CSCL) as a Pedagogical Approach

Devedi (2006); Mäkitalo-Siegl et al. (2011); Urhahne et al. (2010) claim that CSCL is a pedagogical approach where learning takes place in the context of social interactions under the influence of computers and the internet. Furthermore, it entails the sharing and creation of knowledge on the basis of technology. Learners are given the chance to collaborate interactively and actively when teaching and learning activities take place. In the CSCL classroom, the teacher's role is to facilitate learning and guide students toward innovations and knowledge structures (Urhahne et al., 2010). Manunure et al. (2020) conducted a study in Zimbabwe on the effect of digital support on improving students' conceptual understanding of electric circuits. Manunure et al. (2020) found that digital support closes the gap between abstract ideas that are missing in the physical laboratory. Even when physical laboratories fail, the CSCL approach provides learners with the complete set of knowledge required to cover everything.

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CSCL Approach in Active and Interactive Classroom

Jensen & Craig (2016) define CSCL by emphasizing the collaborative structure, which promotes interactions and active learning. Popov et al. (2014) added that the use of CSCL increases collaboration in the classroom and enables learners to interact strongly. The reforms above show that an interactive and active classroom is when learners are collaborating together. Elmahadi and Osman (2012) demonstrate that students only engage in peer-to-peer physical collaboration. These authors proposed that collaboration should be done not only when students meet together in a classroom setting, but that they can use CSCL even when they are at home. In summary, it appears that technology is very powerful and it can allow learners to interact without consideration of distance.

The use of technology supports the demand for broader participation and collaboration in the classroom (de Vreede & Mgaya, 2006). However, Kafyulilo (2013) argues that collaboration results in an active and interactive classroom that enhances learners' performance. When students work together, they can benefit from both the curriculum and extracurricular activities, as well as gain new experiences that are relevant to their everyday lives. The active and interactive classroom motivates learners to concentrate and pay full attention during the lesson. When students work together in a collaborative environment, the expected outcome improves.

Teachers' Awareness of CSCL Approach

Teachers must be aware of various and specific teaching methods in order for students to fully participate in their learning. Meyer et al. (2007) states that, for students to actively participate in their learning, teachers' awareness of various and specific teaching methods is paramount. Porcaro (2011) found that many teachers lack awareness of the use of 21st century technology to bring active learning to the classroom. The insufficient use of digital technologies such as the CSCL approach to implement interactive and active teaching and learning reduces the ability of learners to build the required understanding. Mfaume (2019) explains that teachers are well informed about the benefits of technology in a teaching context, but implementation becomes difficult. Teachers should make sure that the methods they use support a student-centered approach that will illuminate their ability and

competence to achieve the desired results. However, among the methods that teachers are required to use are the 21st century technological skills, which are the core worldwide in all fields. Thus, when the CSCL approach is carried out in the classroom, the positive outcome will be latent and veiled.

Theoretical Framework

The study adopted the Sociocultural Theory of Cognitive Development established by Lev Vygotsky (1978-1987). This theory is grounded in the assumption that learning has its basis when people interact with each other. Vygotsky (1980) contends that for active learning to occur, there is a key zone of proximal development where the composite task to be handled by the learner when working with individuals becomes simple enough to be monitored when working together. Among the approaches that allow learners to interact and collaborate is the CSCL approach.

However, some cultural interactions bring new experiences to learners and improve their cognitive empathy. Classroom interactions are almost unavoidable for active learning to occur. Voogt et al. (2015) assert that collaboration transforms individuals through a reciprocal process during the execution of planned activities. The CSCL approach is one of the pedagogical approaches that allows students to collaborate in the classroom.

Methodology

Research Design and Approach

The study used a mixed-method approach and an exploratory research design. Berman (2017) defines an exploratory research design as an approach which characterizes the collection of qualitative data and its analysis followed by quantitative data collection and its analysis. To answer the research questions, the following sequence was followed:-

Step 1: An Interview-

The interview was conducted with form two physics teachers in all four schools to assess their awareness of the CSCL approach. The interview was prepared by the researcher and at least two form two physics teachers from each school participated to obtain eight teachers in the four schools. On the side of students, they responded to the pre-test to

assess their current level of conceptual understanding of the concepts of electricity before the classroom lesson.

Step 2: Classroom Observation

In the classroom practice of the CSCL approach, classroom observation was conducted. The observation tool was designed and prepared by the researcher while the researcher was a non-participating observer to avoid bias. The classroom observation was conducted in an 80-minute lesson in each school and each class had two observers. The purpose of the classroom observation was to check how the CSCL approach could support students and teachers to interact in the classroom.

Sampling and Sample Size

Four ordinary level secondary schools having computer laboratories were selected purposefully in Arusha City. The study used only form two students and their physics teachers. To select the number of students for classroom lessons, the study used a stratified random sampling technique to obtain 49 students in each school to generalize a sample of 196 students in four schools. The boys and girls were selected as a stratum and simple random sampling took place where each strata counted the numbers from one to five to get some groups.

Data Collection

The study involved various methods of data collection as follows:

An Interview Schedule

An interview schedule is a set of prepared structured questions to guide an interviewer and researcher when collecting information from respondents on a certain specific topic (Sherrill & Kovacs, 2000). A set of structured questions regarding the CSCL approach was prepared to be answered by the form two physics teachers. The interview aimed to assess how teachers were aware of the CSCL approach before the classroom intervention took place. However, analysis was conducted so as to see if teachers need training to equip them with skills for the respective approach.

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Teachers Training Toward CSCL Approach

Training equips teachers with skills and knowledge of teaching and learning activities (Wati, 2011). In the current study, training was conducted to give teachers adequate skills and knowledge about CSCL approach. Nevertheless, the training involved eight form two physics teachers in four schools. Teachers got the chance to explore the technological resources that may be used in teaching physics. This gave them the opportunity to ask many questions and increased their confidence in 21st-century technology.

Classroom Observation

Whitehurst et al. (2014) urge classroom observation as the process of recording teacher performance and behaviour in the context of the classroom. It tends to measure teachers' teaching ability by systematic recording of their acts and performances. Often, classroom observation helps to improve teachers' ability to teach and enables students to perform well. In the study, classroom observation was conducted in four schools during physics lessons. The researcher was a non-participating observer in the activities conducted during the observation. Each school received an 80-minute physics lesson on the subtopic of the concept of current electricity. There were 49 students in each school class, for a total of 196 students across four schools. The observation tool was prepared and given to the observers during the recording of all the activities that took place in the classroom.

Data analysis

Qualitatively, the interview results were analysed thematically, where themes were developed from the data and coded. Quantitatively, frequency distribution and percentages were used to analyse classroom observation results under the Statistical Package for Social Sciences (SPSS).

Validity and Reliability of the Study

Validity

To ensure validity, the tools of study were piloted. However, the triangulation as a method to check validity was employed. The multiple data collection and analysis were involved with form two physics

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teachers and in the classroom physics lessons to capture various dimensions of the same phenomenon.

Reliability

Further, the reliability was checked to ensure the consistency of the results. The parallel-forms reliability was conducted and Pearson's method of correlation was used to compute the coefficient of correlation for comparison.

Ethical Considerations

The study got the permit for data collection from various authorities and institutions, including: The University of Rwanda, Presidents Office, Regional Administration and Local Government (PO-RALG)-Dodoma, Regional Authoritative Secretary (RAS), Arusha City Council District permit.

Participant consent was considered for anonymity and confidentiality. The codes were given to both schools and participants to ensure anonymity. In the case of confidentiality, the hard copy information was locked in the cabinet while the softcopy was stored on the external hard drive with a specific pin for privacy.

Results

Teachers' awareness of CSCL approach

The study found that teachers use various methods to encourage classroom collaboration, such as group discussion, questions and answers, models and practical work. Some teachers possess their own computers-laptops which are used to support their teaching and learning. Although some teachers possess their own computers-laptops, they do not use them in teaching and learning. Among eight form two physics teachers, six of them possess their own computers, while two do not have computers. Teachers with computers-laptops described how they use their computers to teach and learn about physics.

Teacher A_1 from school S_1 explains *"I use my laptop to download the notes and physics physics"*

Teacher B_1 from school S_2 elaborates "I *use my laptop to watch some videos on the respective physics topics"*

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Teacher D_2 from school S_4 answered that "*I use my laptop to download some software's such as THL so as to access the notes, past papers and practical questions"*

Similarly, teachers with no computer's-laptops demanded that they use other device to support their teaching and learning. This motivated the researcher to know much about that device.

Teacher A_2 and C_1 from school S_1 and S_3 explore that *"I use my smartphone to download the past-papers and notes to support my teaching"*.

Furthermore, the study noted that teachers use their devices themselves without involving the students. In this regard, teachers do not allow their students to engage in teaching and learning on their computers or laptops. As the study involved sampled schools with computer laboratories, we aimed to understand if teachers use their school computers for teaching and learning physics or if they are aware of the CSCL approach. The various responses were recorded.

Teacher B_2 from school S_2 *"To project the notes as we are having a large number of students"*
Teacher D_1 from school S_4 *"I didn't use it even a single day"*
Teacher C_2 from school S_3 *"Often used by ICS teachers"*

Teachers believe that the computer laboratory is only used by Information and Computer Studies (ICS) teachers where science and art subjects are not involved. The study found that only three teachers were aware of the CSCL approach, while five teachers were not aware.
The study was interested to know what CSCL approach is and where they benchmarked the approach. The following responses were received:

Teacher A_1 and C_2 from school S_1 and S_3 reported that *"We heard about CSCL during the seminar conducted in 2019 in Arusha entitled ICT in Teaching and Learning"* while

Teacher B_1 from school S_2 reported that *"I heard about CSCL from online workshop designed by Lucien Ngenze assistant lecturer at The University of Dodoma, entitled Becoming 21st Century Teacher"*

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It is not enough to claim that teachers are aware of the CSCL approach and can easily use it just based on evidence above. Serious ways are needed to make sure that, teachers are able to use CSCL approach in classroom.

Teachers were further asked if they know all the models in physics topics to support their teaching and learning. Unfortunately, all of them said "*we do not know these models*". The researcher went further to find out how teachers deal with these challenges. The following were findings were received;

Teacher A_2, C_1, and D_2 from school S_1, S_3, and S_4 reported that *"We use our smartphones to download the notes and videos"*
Teacher B_2, and D_1 from school S_2 and S_4 said that *"We do not use any digital support"*

Teacher A_1, B_1 and C_2 from school S_1, S_2 and S_3 reported *that "We teach some topics without any models".*

Teachers training on CSCL approach

Training on CSCL approach with teachers was conducted and teachers were given an opportunity to evaluate this training. This training motivated teachers to become more confident in using the CSCL approach and computer laboratory in teaching and learning. Among evaluations made by teachers was that, digital support is very crucial in overcoming challenges of teaching and learning. One of the teachers confessed that *"I never knew how teaching physics is easy and enjoyable while using CSCL approach"*. Another teacher reported that, *"there is no difficult topic in physics if digital support is well incorporated into teaching and learning"***.**

Teacher - student classroom interaction through CSCL

The tool was created to allow observers assign numerals based on the teachers' classroom performance. In each school, one lesson was observed on the subtopic of the concepts of current electricity. Within each classroom, two observers were given the same observation checklist to rate the performance while the researcher was a non-participant observer. The checklist had four parts, including: organization, presentation, classroom interaction, knowledge content

and relevance. The results of the two observers were tallied (table 1 below).

Table 1. First and Second Observer combined results

	Frequency			
Sections of the classroom observation checklist	Total Numbers of Items on classroom observation Checklist for both two observers	Not observed	More emphasis Recommended	Accomplished	Accomplished very well
Organization	32	0 (0%)	4 (12.5%)	11(34.375%)	17(53.125%)
Presentation	64	0 (0%)	3 (4.688%)	22 (34.375%)	39 (60.938%)
Classroom Interaction	80	0 (0%)	1 (1.25 %)	25 (31.25%)	54 (67.5%)
Content Knowledge and Relevance	24	0 (0%)	1 (4.167%)	8 (33.33%)	15 (62.5%)

In the classroom Interaction section in table 1 above, the study found that, 67.5% was accomplished very well, 31.25% was accomplished while 1.25% was recorded as more emphasis recommended. After the intervention students got the chance to reflect on the lesson. One student reported that, *"Now I understand why home wiring connections are connected in parallel rather than series after seeing the circuits on Solve Elec"*. Another student added, *"I saw how the electron and current move oppositely in PhET. I used to cram and memorize without justification"*. Thus, it shows that the approach allowed active interactive during teaching and learning.

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Discussion of the findings

The study revealed that teachers lack awareness of the CSCL pedagogical approach in their teaching. However, the study discovered that CSCL approach permits teachers and students to interact actively during teaching and learning in the classroom. This was demonstrated during lesson observation of physics class on the sub-topic of electricity. In the similar view, Olan'g et al. (2015) found that computer laboratory is a key to motivating students to acquire active learning. Dega et al. (2013) found the involvement of computer technology plays a great role in improving students' conceptual understanding of electricity.

However, the study found that computer laboratory is only used by Information and Computer Studies teachers, while physics teachers quite often neglect it (Kafyulilo, 2010). Ndihokubwayo et al. (2020), re-iterates that, many teachers in less developed countries have limited knowledge of electronic tools in classroom practice. This inadequate knowledge makes teachers not to know the impact of technology on teaching and learning, yet in the 21st century it is a core tool in STEM. To make a classroom active and interactive, the inclusion of multiple activities is a key (Kumar & Lightner, 2007). The series of activities designed by the teacher offer learners the chance to reflect on their daily life experiences.

In this study, during classroom observation under the the use of CSCL, students were able to ask various questions, which enabled them to search for the answers. This promotes a much more learner-centered approach because students can critique themselves until they reach a final conclusion. The approach triggered the teacher to become less-authoritative and passive, whereas the students were extremely active. CBC recommends using a learner-centered approach rather than a teacher-centered approach, to bring active interaction into the classroom (Kanyonga et al., 2019; Schweisfurth, 2015).

During this study, it was made clear that, CSCL makes students active and interactive during teaching and learning activities. Gikandi (2020) reported that, the series of activities found in CSCL approach encourage learners to fully participate in the lesson. Therefore, to ensure the cognitive build-up of knowledge, technological approaches should be incorporated into the classroom (Dega et al., 2013; Kirschner &

Huisman, 1998; Taşldere, 2013). The considerations will bring the learning expected outcome to occur.

Conclusion

This study found out that, there is low awareness of CSCL approach among Tanzanians teacher in Arusha. The CSCL approach training conducted during this study, equipped teachers under this study with adequate skills on technological use in classroom for productive teaching and learning. With this training both teachers and students interacted actively making teaching and learning more productive. As a result, teachers understood the impact of 21st Century technology, which facilitate learners to conceptualize the abstract ideas of electricity concepts.

Recoomendations

The study recommends the government of Tanzania, policy makers, curriculum developers and ministry of education in Tanzania to create supportive infrastructures to ensure that students study Information and Computer Studies in a technological capable environment. This will enable the usability of technology where all students and teachers are involved. Teachers should navigate and utilise the CSCL approach in a classroom context to enable students advance and capture the integrated content.

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