



USE OF ICT IN TEACHING AND LEARNING IN SECOND CYCLE INSTITUTIONS: UNDERSTANDING THE TECHNOLOGICAL ASPECT OF THE TPACK MODEL

Asamoah¹, R., Asiedu^{2*}, N. K. & Buadi³, D. W.

¹St. Monica's College of Education, Asante-Mampong, Ghana

²C. K. Tedam University of Technology and Applied Sciences, Navrongo, Ghana

³Accra Technical University, Accra, Ghana

*Corresponding author: nasiedu@cktutas.edu.gh

Abstract

This study investigated how ICT can be used to support teaching and learning in public and private second cycle educational institutions in Ghana. The survey approach was used for the study. Using a simple random sampling technique, 182 (112 students and 70 teachers) from the two schools were selected to participate in the study. A comparative study was conducted on the schools' ICT facilities, how they were being used, the challenges that are encountered and the perception of teachers and students on integration of ICT into teaching and learning in both schools. The findings revealed that both teachers and students have a positive perception about the integration of ICT into teaching and learning. Unstable power supply, system breakdown, unstable internet access and unavailability of ICT integration support staff were identified as the main challenges encountered in using ICT. The study recommended the following: ICT facilities should be provided in all classrooms; the teacher and student laptop project should be expanded to cover every teacher and student, especially in public second cycle institutions and the expansion of internet access points in the various schools.

Keywords: TPACK Model, ICT, Teaching with ICT, Learning with ICT, Second cycle Institution

Introduction

Nations around the globe, with Ghana as no exception, have recognized the fundamental role Information Communication Technology (ICT) is playing in all facets of human endeavour, of which education forms a part (Lidstrom & Hemmingsson, 2014; Ghavifekr et al., 2016; Bariu, 2020; Adarkwa, 2021). Its relevance has become even more pronounced in the wake of the Covid-19 pandemic, where most educational institutions have had to find ways of engaging their students from home (Agyei, 2021; Karakostantaki & Stavrianos, 2021; Basaran & Yalman, 2022). Integrating technology in education plays an important role in helping teachers enhance educational development and increase their technical dexterity. It lessens the uneasiness in lessons preparation. It also whips up

the interest of students over time if used effectively (Gulbahar & Guven, 2008; Adarkwah, 2021).

In spite of the proliferation of ICT use, it is still common in Ghana to encounter second cycle students who are unskilled in computer usage. According to Higgins (2003), one of the reasons for incorporating technology in the education sector is to help in the modernization of schools and provide students with skills that would enable them to use such technology properly. ICT, like any other entity, has its flaws. Until the outbreak of the COVID-19 pandemic, the use of ICT in teaching and learning in Ghana was not common, though a lot of advocacies have gone on in this regard (Antwi et al., 2018). The Ministry in charge of Education in Ghana made some attempts to develop and promote quality education by using instructional software packages and technologies (Natia & Al-hassan,

2015). Programmes like the Teacher and Student Laptop Initiatives (TSLIs) had their challenges and failed.

Cost has been a major factor in using technology in schools (Mubashir-Ahmed, 2009). Because of this, some have implemented more inventive solutions to address this issue by engaging the services of private individuals who are major players in the information technology industry to train both students and teachers (Johnson et al., 2016). Notwithstanding the increasing rate of studying computing in schools in Ghana, the majority of the computers lack the required instructive software modules and an internet connection to accommodate the needed assistance teachers require in their use of ICTs (Boni, 2018).

Although a lot of work has been done on the impact, use and integration of ICT in teaching and learning at the tertiary level worldwide and in Ghana (Edumadze, 2015; Kumar & Daniel, 2016; Asabere et al., 2017), very little has been done at the second cycle educational level in Ghana (Buabeng-Andoh, 2015; Boni, 2018; Arkorful, 2021). Thus, shortage of ICT apparatuses in second cycle institutions, low interest or desire by teachers in the use of ICT, lack of needed skills and technophobia are among the reasons that precipitated this study to come out with some answers on ways to improve the use of ICT tools in teaching and learning in second cycle institutions in Ghana, particularly, the schools under study.

Historical Background of the schools

Senior High School (School A) is a public school operating under the auspices of the Ghana Education Service. It has a student population of over 1500 students. The school has one computer laboratory for use by all students, equipped with 45 computers and only a few connected to the Internet. These facilities are used free of charge but under the supervision of the head of the ICT department or a teacher in the department. The facility is guarded with the utmost security one can think of and does not allow students to explore its use outside instructional hours.

Senior High School B (School B) is a recognized international school that operates the Cambridge

system of education. It is situated in the capital, Accra, with a population of about 1400 students from the Nursery to Upper sixth form level. It has about 58 nationalities represented amongst its faculty and student body. It has a very low teacher to student ratio and has a host of teaching assistants who support teaching and learning activities in the school. There are two separate computer laboratories in the school for use by students, and each of these laboratories is equipped with 32 networked computers that are fully multimedia. Computer Laboratory 1 is used by students in Forms 1 to 3, while Laboratory 2 is used by Forms 4 to 6. All computers are linked to the Internet. These facilities are used devoid of charges; however, students need to sign up with the head of the IT department to acquire an e-mail address and other login credentials. There are times scheduled for general use, internet surfing and e-mail use listed in the department's handbook. Each staff has been provided with a laptop to enhance their work.

Objectives of the Study

1. To identify the level of awareness of the various ICT tools available in the two schools.
2. To compare the perception of the use of ICT as a tool for teaching and learning in both schools.
3. To examine the challenges associated with using ICT by teachers and students.

Theoretical Framework

This study was guided by the Technological Pedagogical and Content Knowledge (TPACK) model, developed by Mishra & Koehler (2008). This model brought out the challenges confronting ICT incorporation into teaching and learning by teachers. It points out the essential knowledge that instructors or tutors, and policy makers in the field of education need, to facilitate the useful integration of ICTs in teaching. The TPACK model was adopted for this study because it sought to establish that improving teacher performance at the second cycle educational level through the use of ICT tools in Africa, particularly, Ghana will hinge on the level of technological literacy and the expertise in applying the tools to teaching methods since these

sets of skills are functions of continuous professional development activities. By this, the easier it is for teachers and students to use technology and the appreciation of its usefulness, the better it will influence the user's inclination towards using technology, hence increasing its usage in all spheres of human endeavour. Therefore, the Technology, Pedagogy and Content Knowledge (TPACK) model, fits into the study because it has the capacity to bring out the understanding of the effective integration and use of ICT in teaching and learning in Schools A and B.

Technology Knowledge

This deals with the experiences and understanding of basic, contemporary and advanced technologies employed in teaching students (Mishra & Koehler, 2006; Mishra & Koehler, 2008). Therefore, instructors are expected to be dexterous in their application and use of technology in teaching.

Content Knowledge

Content Knowledge simply refers to teachers' knowledge and understanding of the subject area they teach. It deals with the content, feature and training needed in different disciplines. It also highlights the disparities in disciplines requiring the need to employ different approaches in teaching students (Mishra & Koehler, 2008).

Pedagogical Knowledge

This refers to the procedures and techniques of teaching, learning, values and objectives (Mishra & Koehler, 2008). This also highlights planning of lessons and the technique of implementation, classroom administration, and appraisal of students. A well-developed pedagogical knowledge assists teachers to comprehend and to measure the method students apply to build skills and create the needed knowledge (Evoh, 2009).

Pedagogical Content (PC) Knowledge

It highlights the connection between the three main elements or concepts that underpin the theory (Mishra & Koehler, 2008). Additionally, this also indicates the robust connection between content and teaching. It indicates the differences in subject areas

and the need for each subject to be taught with varied educational methods for a great result.

Technological Content (TC) Knowledge

It explains the relevance and the need to understand the effect of technology on a particular subject area. In actuality, both the content and technology can influence how an instructor prefers to teach a particular subject (Mishra & Koehler, 2008). The authors further added that instructors must be on top of what they teach, bearing in mind that the subject matter can also be changed with the integration of technology in education..

Technological Pedagogical (TP) Knowledge

This highlights the need to know that education which involves teaching and learning is liable to change with the application of certain technologies by instructors. The concurrent incorporation of technology, pedagogy and content knowledge in education helps in unveiling the need to infuse technology into education (Mishra & Koehler, 2008).

Literature Review

The concept of ICT has been diversely defined. It refers to the sector encompassing all converging technologies that carry information. It includes telecommunication, informatics, broadcasting (radio and television), multimedia internet, cable television and geographic information systems (Fu, 2013). For this study, ICT as a tool would be defined to encompass software, hardware and internet access.

Currently, the developing countries at a slow pace are trying to catch up with the developed countries in the use of ICT for national development. In order to champion the course of ICT for development, the United Nations Economic and Social Council, for example, launched the United Nations ICT Task Force with the mandate to bridge the gap in ICT usage globally (United Nations Information Communication Technology Task Force, 2008).

However, it should be noted that the availability and accessibility of computers alone do not automatically translate into ICT incorporation or integration in education. Schoepp (2005) suggested that effective execution and implementation is a multifaceted process that is guided by pedagogical

values, attitudes, curricular needs and physical infrastructures (Keijo, 2011; Adebisi-Caesar, 2012). The integration of technology into educational institutions in Africa has been a challenge as a result of the fact that it is relatively a new concept. However, some strides have been made in this direction (Educational Research Network for West and Central Africa [ERNWAC] & University of Montreal, 2008).

The Ministry of Education in Ghana effected some changes in the educational structure with the integration of ICT into the educational syllabus of schools from primary to senior high school (Asamoah, 2008). Boakye & Banini (2008) opined that teachers with pedagogical proficiency who are ready and willing to transmit knowledge and support students to construct knowledge would make a difference in any learning process. Incorporating ICT in schools in Ghana is commendable, but sadly, this initiative is afflicted with countless challenges. Few among them are poor internet connections, inadequate computers and a lack of competent or skilled workforce (Natia & Al-hassan, 2015).

A cross-sectional survey that was conducted on the use of technology for instructional purposes among senior high school teachers reported low usage of technology in teaching (Agyeman & Mereku, 2015). Higgins (2003) opined that various strategies could be adopted with ICT to make an impact on the teaching and learning of second cycle students.

Krubu & Osawuru (2011) indicated that the invention of ICT has aided schools in using numerous types of technologies in teaching and learning. Tchombe et al. (2008) believed that tutors must understand how to use ICT pedagogically. Salehi & Salehi (2012) posit that the frequent usage of ICT in education is complex and not easy to deal with. The era the world finds itself is characterized by information overload therefore teachers and students need to acquire ICT skills that will help them filter information that is relevant for teaching and learning purposes (Yunus et al., 2009).

Studies on less developed countries also revealed that teachers' inability to use and manipulate ICTs is part of the main reasons they are unwilling to accept and implement its usage in teaching (Pelgrum, 2001; Al-Oteawi, 2002). For example,

teachers' lack of ICT skills in Syria has been cited as the main barrier to ICT usage (Albirini, 2006). Resistance to change and negative attitudes are part of the challenges that have bedevilled ICT use in teaching and learning. Studies conducted on the challenges of integrating ICT into education found that teachers' attitudes and their innate resistance to change were a significant challenge (Cox et al., 1999; Earle, 2002; Schoepp, 2005). A study conducted in Malaysia by Ghavifekr et al., (2016) disclosed the following: some of the challenges teachers face in their use of technology; network issues, inadequate training and technical support and poor attitude of teachers.

Studies have observed that lack of effective training opportunities is one of the main challenges most teachers and students encounter in their quest to use ICT, coupled with a lack of access to resources (Sharma, 2021; Dondofema & Shumba, 2018; Habibu et al., 2012). Toprakci (2006) revealed that inadequate computers, obsolescence of ICT systems and other factors were the barriers to the effective implementation of ICT usage in schools.

Methodology

The survey approach was adopted for this study because of its versatility (Ponto, 2015). The justification for selecting School A, a public second cycle institution and School B, a private second cycle institution, is that they are among the oldest public and private second cycle educational institutions in Accra and were established around the same period. For this study, the target population included all final year students and teachers of both schools. Final year students were selected because their scope in ICT was likely to be broader compared to their juniors. The teachers were included in the study because they are at the centre of all the activities involving the impartation of knowledge to the students. Cohen et al. (2018) posit that for descriptive research, the sample size should be 10% of the population. However, if the population is smaller, 20% or more may be needed or required. For this study, the researcher selected 20% of the total student population (601) and 35% of the total teacher population (218) for the study making 120 students and 75 teachers, respectively. The use of 35% for teachers was based on the

teacher population being relatively small. Again, in the researcher's view, 35% of the population was representative enough. To get the proportionate

sample (P.S) sizes for both teachers and students, the formula below was used:

Students

$$P.S = \frac{\text{Final year student population for each school}}{\text{Total target population}} \times 120$$

Teachers

$$P.S = \frac{\text{Teacher population for each school}}{\text{Total target population}} \times 76$$

Table 1: Population and Sample size

| TEACHERS | | | STUDENTS | | |
|----------|------------|---------------------------|----------|------------|---------------------------|
| Schools | Population | Proportionate sample size | Schools | Population | Proportionate sample size |
| School A | 98 | 34 | School A | 495 | 99 |
| School B | 120 | 42 | School B | 106 | 21 |
| TOTAL | 218 | 76 | | 601 | 120 |

Source: Field Data, 2019.

Data Collection

Copies of an open and closed-ended questionnaire were distributed to students and teachers of both schools. The researchers had access to the list of final year students and teachers in both schools. This was used as the sampling frame to randomly select respondents for the study. Eight weeks was used to administer the questionnaire to the respondents. In all, 120 copies of the questionnaire were administered to students of both schools and 76 copies of the questionnaire to their teachers. Out of the 120 copies of the questionnaire administered to students of the two senior high schools, 112 (93.3%) were retrieved and found suitable for analysis. On the other hand, teachers returned 70 out of the 76 copies of the questionnaire that were administered, pegging the response rate at (92.1%). Out of the 112 copies of the questionnaire that were received from the students of the two schools, 92 were from school A, and 20 were from school B. Similarly, out of the 70 received copies of the questionnaires from the teachers, 31 were from school A and 39 were from school B.

Results

The findings of the study are presented in frequencies and percentages.

Table 2: Use of computer laboratory by both student and teacher respondents

Source: Field Data, 2019.

| Use | STUDENTS | | | | TEACHERS | | | |
|----------------------------------|----------|------|----------|------|----------|------|----------|------|
| | School A | | School B | | School A | | School B | |
| | F | (%) | F | (%) | F | (%) | F | (%) |
| ICT training | 72 | 78.3 | 10 | 50.0 | 10 | 32.2 | 9 | 23.1 |
| Browsing the Internet | 17 | 18.5 | 8 | 40.0 | 14 | 45.2 | - | - |
| Research | 3 | 3.3 | 2 | 10.0 | 7 | 22.6 | - | - |
| Browsing and Research | - | - | - | - | - | - | 10 | 25.6 |
| ICT Training and Research | - | - | - | - | - | - | 20 | 51.3 |
| Total | 92 | 100 | 20 | 100 | 31 | 100 | 39 | 100 |

Students were asked whether their classrooms were equipped with ICT tools. All students of **School A** indicated that their classrooms were not equipped, while students of **School B** indicated their classrooms were equipped with ICT tools. Both schools had all teachers and students being aware of the computer laboratory in their schools. As to what they used the laboratories for, the majority of the students, 72(78.3%) and 10(50%) indicated ICT training; 17(18.5%) and 8(40%) for browsing the internet; and 3(3.2%) and 2(10%) for research; for school A and B respectively. The results show that students in schools A and B equally use ICT for training whilst teachers in SHS A and B use it to browse the internet and conduct research and training with it, respectively.

Table 3: Access to computers at the ICT Lab by students of both schools

| Access | School A | | School B | |
|---------------------|----------|------|----------|------|
| | F | (%) | F | (%) |
| Not often | 48 | 52.2 | - | - |
| Often | 30 | 32.6 | 5 | 25.0 |
| Very often | 10 | 10.9 | 7 | 35.0 |
| All the time | 4 | 4.3 | 8 | 40.0 |
| Total | 92 | 100 | 20 | 100 |

Source: Field Data, 2019.

On how often they were allowed access to its use, students of school A indicated “Not often” 48(52.2%) and “Often” 30(32.6%). For school B, 8(40.0%) and 7(35.0%) said they had access to “All the time” and “Very often”, respectively. The findings indicate that students of senior high school “B” have more access to their school’s computer laboratory than their counterparts in senior high school “A”.

Table 4: Teachers’ perception towards ICT usage for teaching/learning

| Perception | School A | | | | School B | | | |
|--|----------------|----------|-----------|-------------------|----------------|-----------|-----------|-------------------|
| | Strongly Agree | Agree | Disagree | Strongly Disagree | Strongly Agree | Agree | Disagree | Strongly Disagree |
| It is difficult to use ICT tools for teaching | 2(6.5%) | 4(12.9%) | 13(41.9%) | 12(38.7%) | 4(10.3%) | 17(43.6%) | 18(46.1%) | - |

| | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Using ICT to teach is time consuming | 1(3.3%) | 4(12.9%) | 13(41.9%) | 13(41.9%) | 2(5.1%) | 5(12.8%) | 15(38.5%) | 17(43.6%) |
| It is more effective to use ICT in teaching/learning | 2(6.5%) | 8(25.8%) | 19(61.3%) | 2(6.5%) | 22(56.4%) | 15(38.5%) | 2(5.1%) | - |
| ICT use has a positive impact on teaching/learning | 11(35.5%) | 19(61.3%) | 1(3.2%) | - | 30(77.0%) | 7(17.9%) | 2(5.1%) | - |
| ICT use in teaching/learning is unreliable due to poor network connectivity | 7 (22.6%) | 9(29.0%) | 10(32.3%) | 5(16.2%) | 2(5.1%) | 8(20.5%) | 18(46.2%) | 11(28.2%) |

Source: Field Data, 2019.

On the part of the teachers, **School A** disagreed 25(80.6%) that it was difficult using ICT tools in teaching; 26(83.8%) disagreed that it was time-consuming to use ICT in teaching; 21(67.8%) of respondents disagreed that it was more effective to use ICT in teaching and learning than the traditional approach. However they agreed that the internet has a positive impact on teaching and learning, with a response rate of 30(96.8%). Most of the teachers 21(53.9%) in **School B** agreed that it was difficult using ICT tools in teaching; they also agreed 28(71.8%) that it was more effective to use ICT in teaching and learning than the traditional approach, and therefore preferred accessing information through the use of ICT to the use of the library 28(71.8%). The majority 37(94.9%) of the teachers also considered the internet to have a positive impact on teaching and learning. They disagreed with the statement that “It is time - consuming to use ICT for teaching” 32 (82.1%) and “ICT use in teaching and learning is unreliable due to poor network connectivity” 29(74.2%). Comparatively, the study found that teachers at School B were more comfortable using ICT in teaching than their colleagues in School A.

Table 5: Students’ Perception towards ICT usage for teaching/learning

| Perception | School A | | | | School B | | | |
|--|----------------|-----------|-----------|-------------------|----------------|---------|----------|-------------------|
| | Strongly Agree | Agree | Disagree | Strongly Disagree | Strongly Agree | Agree | Disagree | Strongly Disagree |
| ICT should be integrated into teaching/learning | 64(70%) | 23(25%) | 5(5%) | - | 14(70%) | 5(25%) | 1(5.0%) | - |
| My teachers are very competent in using ICT for teaching | 13(14.2%) | 21(22.8%) | 30(41.3%) | 20(21.7%) | 3(15%) | 10(50%) | 7(35%) | - |
| It is time consuming to use ICT for learning | 10(10.9%) | 13(14.1%) | 36(30.1%) | 33(35.9%) | 2(10%) | 9(45%) | 9(45%) | - |

| | | | | | | | | |
|--|-----------|-----------|-----------|-----------|----------|-----------|----------|-----------|
| I prefer accessing information in the library to the internet | 8(8.7%) | 12(13%) | 33(35.9) | 39(42.2%) | 5(25%) | 5(25%) | 5(25%) | 5(25%) |
| It is difficult using ICT for learning | 6(6.5%) | 5(5.5%) | 43(46.7%) | 38(41.3%) | - | - | 11(55%) | 9(45%) |
| One can learn perfectly well without ICT | 15(16.3%) | 21(22.8%) | 34(37%) | 22(23.9%) | 3(15%) | 8(40%) | 8(40%) | 1(5.0) |
| Internet use has a positive impact on learning | 25(27.2%) | 60(65.2%) | 5(5.4%) | 2(2.2%) | 5(25.0%) | 12(60.0%) | 3(15.0%) | - |
| The internet speed in the computer lab is poor | 19(20.7%) | 25(27.2%) | 29(31.5%) | 19(20.7%) | 2(10.0%) | 1(5.0%) | 7(35.0%) | 10(50.0%) |

Source: Field Data, 2019.

The study also sought to find out students' perceptions on the use of ICT as a tool for teaching and learning. For **School A**, the majority of the students, 69(66%), disagreed that the use of ICT for learning was time-consuming; 72(78.3%) disagreed with the statement "I prefer accessing information in the library to the internet"; 81(88.0%) disagreed that "It was difficult using ICT for learning"; 56(60.9%) disagreed that "one can learn perfectly well without computers"; and 85(92.4%) agreed that "Internet use has a positive impact on learning. On the perception of internet connectivity being poor in the computer lab, opinions were split – 29(31.5%) "Disagreed" while 25(27.2%) "Agreed". Perception of students in **School A** regarding the competence of their teachers in ICT was worth noting. Fifty (63.0%) students disagreed with the statement that "My teachers are competent in using ICT for teaching".

Of significance is the fact that they agreed that ICT should be integrated into teaching and learning 87(95.0%).

For **School B**, most of the students 11(55.0%) agreed to the statement that "It is time-consuming to use ICT for learning"; 11(55.0%) of the students also agreed that "One can learn perfectly well without computers"; 17(85.0%); agreed that "Internet use has a positive impact on learning" the statement, "ICT should be integrated into teaching and learning" was agreed by 19(95.0%) of the students; 13(65%) of them agreed that, "their teachers are very competent in using ICT for teaching". Most of them, however, disagreed with the following statements, "It is difficult using ICT for learning" 20(100%), "Internet connectivity (speed) in the computer lab is poor" 17(85.0%). Half of the respondents agreed that they preferred accessing information in the library to the internet.

Table 6: Problems faced in the use of ICT

| Challenges | STUDENTS | | | | TEACHERS | | | |
|----------------------------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| | School A | | School B | | School A | | School B | |
| | F | (%) | F | (%) | F | (%) | F | (%) |
| Power cuts | 19 | 20.6 | 5 | 25.0 | 4 | 12.9 | 2 | 5.1 |
| Virus attack | 18 | 19.6 | 6 | 30.0 | 4 | 12.9 | 6 | 15.4 |
| System breakdown | 25 | 27.2 | 9 | 45.0 | 2 | 6.5 | 31 | 79.5 |
| Lack of sockets in the classroom | 30 | 32.6 | - | - | 21 | 67.7 | - | - |
| Total | 92 | 100 | 20 | 100 | 31 | 100 | 39 | 100 |

Source: Field Data, 2019.

The results from the table show that lack of sockets in the classrooms of SHS “A” is the main impediment to ICT use as indicated by both students (32.6%) and teachers (67.7%), whereas students and teachers in SHS “B” indicated that system breakdown is their main challenge to ICT use with response rates of 45% and 79.5% respectively.

Discussion

The main aim of this study was to compare the use of ICT as a tool for teaching and learning in a public and private second cycle institution in Ghana. The introduction and incorporation of ICT in education can transform the quality of teaching and learning when carefully done. However, the main challenge is teachers’ readiness, willingness and self-confidence in using ICT. The majority of teachers and students in the study had a fair idea about ICT, especially in School B, resulting in a demonstrable proficiency in using ICT. Teachers and students in the two schools had a positive perception towards ICT integrated teaching. Although many teachers, especially in School B, were computer literate, ICT integrated teaching was low but this was more evident with teachers and students of School A. This demonstrated that, with the right training, motivation and resources, teachers would be spurred on to integrate ICT into their teaching. These findings corroborate Tchombe et al. (2008) view that acquiring knowledge on ICT is essential. However, the main issue is centred on the ability of teachers or instructors to understand how to use it pedagogically because the proper use of ICT can arouse the growth of higher reasoning, enhance

learning abilities and improve the attainment of skills needed for life-long learning.

The study also identified that the two institutions have ICT laboratories with qualified ICT instructors, but they hardly ever organized training programmes for the teachers and students, especially for School A. According to Schoepp (2005), the availability of computers in itself does not guarantee ICT use in education, and there is the need for training, for which reason O’Donnel (1999) advocated for continuous training of teachers in that regard.

One of the objectives of this study was to examine the challenges associated with ICT use in both schools. The study found that simple and more complex issues like “lack of sockets in the classroom” and “system breakdown” were the main challenges faced in using ICT. In support of this, Salehi & Salehi (2012) posited that using ICT in everyday education is very complicated and that the opportunities provided by ICT to support teaching and learning are not problem-free.

Conclusion

In situating the TPACK model into this study, it was confirmed among students of both schools

that, ICT based teaching was preferred to the traditional method and that internet use had a positive impact on learning. On the other hand, the responses from teachers of School B corroborated the essence of the theory because they revealed that it was more effective to use ICT in teaching and learning than the traditional approach. This was not the case for School A, and understandably so because they had been exposed to the traditional way of teaching for a long time. In conclusion, the findings from both educational institutions largely confirm the main assumptions of the TPACK theory, which states that teaching and learning become interesting and more effective when teachers acquire and use technological knowledge in addition to their knowledge of the methods and processes (pedagogical knowledge) and content (content knowledge).

References

- Adarkwah, M. A. (2021). I'm not against online teaching but what about us? ICT in Ghana post covid-19. *Education and Information Technologies*, 26, 1665-1685. <https://doi.org/10.1007/s10639-020-10331-z>
- Adebi-Caesar, T. E. (2012). *Assessment of ICT Situation in Senior High Schools, A case study in Lower Manya Krobo District*. [Unpublished Master's dissertation, Kwame Nkrumah University of Science and Technology].
- Al-Oteawi, S. M. (2002). *The perceptions of administrators and teachers in utilizing information technology in instruction, administrative work, technology planning and staff development in Saudi Arabia* [Doctoral dissertation, Ohio University]. <https://www.learntechlib.org/p/126239/>
- Agyei, D. D. (2021). Integrating ICT into schools in Sub-Saharan Africa: From teachers' capacity building to classroom implementation. *Education and Information Technologies*, 26, 125–144. <https://doi.org/10.1007/s10639-020-10253-w>
- Agyeman, M. & Mereku, D.K. (2015). Technology use among Ghanaian senior school mathematics teachers and the factors that influence it. *African Journal of Educational Studies in Mathematics and Sciences*, 11, 31-42. <https://www.ajol.info/index.php/ajesms/article/view/168997>
- Antwi, S., Bansah, A. K., & Franklin, T. (2018). The information technology challenge in teaching senior high school geography in Ghana. *Issues and Trends in Educational Technology*, 6(1), 16–37. <https://journals.uair.arizona.edu/index.php/itet/article/view/21804/21719>
- Arkorful, V., Barfi, K. A. & Aboagye, I. K. (2021). Integration of information and communication technology in teaching: Initial perspectives of senior high school teachers in Ghana. *Education and Information Technologies* 26(1), 3771–3787. DOI:10.1007/s10639-020-10426-7
- Asabere, N., Togo, G., & Acakpovi, A. (2017). AIDS: An ICT model for integrating teaching, learning and research in Technical University Education in Ghana. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13 (3), 162-183. <https://files.eric.ed.gov/fulltext/EJ1166618.pdf>
- Asamoah, D. A. (2008). *Learning through ICTs*. [http://www.digitallearning.in/interveiw/interview-details.asp?](http://www.digitallearning.in/interveiw/interview-details.asp)
- Albirini, A. (2006). Teachers' attitude toward Information and Communication Technologies: The case of Syrian EFL teachers. *Computers & Education*, 47(4), 373-398. DOI:10.1016/j.compedu.2004.10.013
- Basaran, B., & Yalman, M. (2022). Determining the perceptions of pre-service teachers on technology-based learning during the Covid-19 process: a latent class analysis approach. *Education and Information Technologies*, 1-20. <https://doi.org/10.1007/s10639-022-10910-2>

- Bariu, T. N. (2020). Status of ICT infrastructure used in teaching and learning in secondary schools in Meru County, Kenya. *European Journal of Interactive Multimedia and Education* 1(1), 1-8. DOI:10.30935/ejimed/8283
- Boakye, K. F. & Banini, D. A. (2008). Teacher ICT Readiness in Ghana. In T., Kathryn, T. M. S., Tchombe, & T., Karsenti (Ed), *ICT and Changing Mindsets in Education*. Langaa RPCIG.
- Boni, R. K. (2018). *The use of ICT for teaching and learning in senior high schools in Ghana: A study of Nungua and Presbyterian, Teshie* [Master's thesis, University of Ghana, Legon] UGSpace. <http://ugspace.ug.edu.gh/handle/123456789/26126>
- Buabeng- Andoh, C., & Yidana, Y. (2015). Teachers' ICT usage in second-cycle institutions in Ghana: A qualitative study. *International Journal of Education and Development using Information and Communication Technology*, 11(2), 104-112. <https://files.eric.ed.gov/fulltext/EJ1074160.pdf>
- Cox, M., Preston, C., & Cox, K. (1999, September 2-5). *What factors support or prevent teachers from using ICT in their classrooms?*[paper presentation] British Educational Research Association Annual Conference, University of Sussex, Brighton, United Kingdom. <http://leeds.ac.uk/educol/documents/00001304.htm>.
- Cohen, L., Manion, L. & Morrison, K. (2018). *Research methods in education* (8th ed). Routledge.
- Dondofema, T. & Shumba, M. (2018). Challenges of using ICT in the teaching and learning of English Language: A case of Harare Northern Central District of Harare Metropolitan Province: Zimbabwe. *International Journal of Research in Social Sciences*, 8 (8), 107-114. https://www.ijmra.us/project%20doc/2018/IJRSS_AUGUST2018/IJMRA-14179.pdf
- Earle, R. S. (2002). The integration of instructional technology into public education: Promises and challenges. *Educational Technology*, 42(1), 5-13. <https://www.jstor.org/stable/44428716>
- Edumadze, J. K. E. (2015). The integration of Information and Communication Technology for teaching and learning at Ghanaian colleges of education: ICT tutors' perception. *African Journal of Teacher Education*, 4(2), 1-16. DOI:10.21083/ajote.v4i2.3095
- Educational Research Network for West and Central Africa & University of Montreal. (2008). *Integration of ICT in education in West and Central Africa: A study of pioneer schools*. <https://docplayer.fr/8884330-Integration-des-tic-dans-l-education-en-afrique-de-l-ouest-et-du-centre-etude-d-ecoles-pionnieres.html>
- Evoch, C. (2009). Collaborative partnerships and the application of icts in secondary education in South Africa. In J. Salmons & L. Wilson (Eds), *Handbook of Research on Electronic Collaboration and Organizational Synergy*. Information Science Reference.
- Fu, J. S. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development using Information and Communication Technology*, 9 (1), 112-125. <https://files.eric.ed.gov/fulltext/EJ1182651.pdf>
- Ghavifekr, S., Kunjappan, T., Ramasamy, L. & Anthony, A. (2016). Teaching and learning with ICT tools: Issues and challenges from teachers' perceptions. *Malaysian Online Journal of Educational Technology*, 4 (2), 38-57. <https://files.eric.ed.gov/fulltext/EJ1096028.pdf>
- Gulbahar, Y. & Guven, I. (2008). A survey on ICT usage and the perceptions of social studies teachers in Turkey. *Educational Technology & Society*, 11 (3), 37-51. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.469.9281&rep=rep1&type=pdf>

- Habibu, T., Abdullah-Al-Mamu, M. D. & Clement, C. (2012). Difficulties faced by teachers in using ICT in teaching-learning at technical and higher educational institutions of Uganda. *International Journal of Engineering Research & Technology (IJERT)* 1 (7), 1-9. <https://www.ijert.org/research/difficulties-faced-by-teachers-in-using-ict-in-teaching-learning-at-technical-and-higher-educational-institutions-of-uganda-IJERTV1IIS7225.pdf>
- Higgins, S. (2003). *Does ICT improve learning and teaching in schools?* British Educational Research Association. https://www.researchgate.net/profile/Steven-Higgins-4/publication/232607668_Does_ICT_Improve_Learning_and_Teaching_in_Schools/inks/0fcfd50b9fce9c3616000000/Does-ICT-Improve-Learning-and-Teaching-in-Schools.pdf?origin=publication_detail
- Johnson, A. M., Jacovina, M. E., Russell, D. E., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. In S. A. Crossley & D. S. McNamara (Eds.), *Adaptive educational technologies for literacy instruction* (pp. 13-29). Taylor & Francis, Routledge.
- Karakostantaki, E. & Stavrianos, K. (2021). The use of ICT in teaching religious education in primary school. *Education and Information Technologies*, 26 (3) 3231-3250. <https://doi.org/10.1007/s10639-020-10417-8>
- Keijo, S. (2011). No pain, no gain? Teachers implementing ICT in instruction. *Interactive Technology and Smart Education*, 8(1), 39-51. DOI:10.1108/17415651111125504
- Krubu, D. E. & Osawuru, K. E. (2011). The impact of Information and Communication Technology (ICT) in Nigerian university libraries. *Library Philosophy and Practice (e-journal)*, 583. <https://digitalcommons.unl.edu/libphilprac/583/>
- Kumar, S. & Daniel, K. B. (2016). Integration of learning technologies into teaching within Fijian polytechnic institutions. *International Journal of Educational Technology in Higher Education*, 13(36), 1-17. <https://doi.org/10.1186/s41239-016-0036-8>
- Lidstrom, H. & Hemmingsson, H. (2014). Benefits of the use of ICT in school activities by students with motor, speech, visual, and hearing impairment: A literature review. *Scandinavian Journal of Occupational Therapy*, 21(4), 251-266. doi: 10.3109/11038128.2014.880940
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108, 1017-1054. doi:10.1111/j.1467-9620.2006.00684.
- Mishra, P., & Koehler, M. J. (2008, March 24–28). *Introducing technological pedagogical content knowledge [Paper presentation]*. Annual Meeting of the American Educational Research Association, New York City. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.605.9082&rep=rep1&type=pdf>
- Mubashir-Ahmed, I. B. (2009). *An assessment of the ICT situation in senior high schools in the Upper West Region of Ghana* [Unpublished Master's thesis, University of Cape Coast].
- Natia, J. A. & Al-hassan, S. (2015). Promoting teaching and learning in Ghanaian basic schools through ICT. *International Journal of Education and Development Using Information Communication Technology*, 11(2), 113-125. <https://files.eric.ed.gov/fulltext/EJ1074173.pdf>
- O'Donnell, D. J. (1999). *A study of gender differences in beliefs toward computer technology and factors which influence these beliefs in grades 4, 5, 6, and 7* [Doctorial thesis, University of Hartford]. <https://www.learntechlib.org/p/129449/>
- Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide

- educational assessment. *Computers & Education*, 37(2), 163-178. [https://doi.org/10.1016/S0360-1315\(01\)00045-8](https://doi.org/10.1016/S0360-1315(01)00045-8)
- Ponto, J. (2015). Understanding and evaluating survey research. *Journal of the Advanced Practitioner in Oncology*, 6(2), 168-171
- Salehi, H. & Salehi Z. (2012). Challenges for using ICT in education: Teachers' Insight. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 2(1), 40-43. <http://ijeeee.org/Papers/078-Z00061F10037.pdf>
- Schoepp, K. (2005). Barriers to technology integration in a technology-rich environment. *Learning and Teaching in Higher Education: Gulf Perspectives*, 2(1), 56-79. <http://dx.doi.org/10.18538/lthe.v2.n1.02>
- Sharma, H. K. (2021). Challenges and barriers to integration of ICT in Indian schools and role of teacher. *Scholarly Research Journal for Humanity Science & English Language*, 9(46), 11249-11255. <https://oaji.net/articles/2021/1201-1629789771.pdf>
- Tchombe, T. M. S., Maiga, M., Toure, K., Mbangwana, M. A., Diarra, M. L., & Karsenti, T. (2008). *Getting ready for higher education: Role of ICT in secondary schools*. Educational Research Network for West and Central Africa (ERNWACA). Biennale of the Association for the Development of Education in Africa. http://www.kathryntoure.net/docs/Higher_education_readiness_ERNWACA_2008.pdf
- Toprakci, E. (2006). Obstacles at integration of schools into information and communication technologies by taking into consideration the opinions of the teachers and principals of primary and secondary schools in Turkey. *e-Journal of Instructional Science and Technology*, 9 (1), 1-16. https://ascilite.org/archived-journals/e-jist/docs/vol9_no1/papers/commentary/toprakci.pdf
- United Nations Information Communication Technology Task Force (2008, July 25). *Strategic Plan*. <https://www.astrid-online.it/static/upload/protected/UN-I/UN-ICT-TASK-FORCE-Strategy-paper-fin.PDF>
- Yunus, M. M., Lubis, M. & Lin, C. (2009). Language learning via ICT: Uses, challenges and issues. *WSEAS Transactions on Information Science and Applications* 6(9), 1453-1467. https://www.researchgate.net/profile/Melor_Yunus/publication/234793968_Language_learning_via_ICT_Uses_challenges_and_issues/links/5dd27f09a6fdcc7e138a8d79/Language-learning-via-ICT-Uses-challenges-and-issues.pdf