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An Assessment of Ghanaian Language Teachers' Technological Pedagogical Content Knowledge amid the COVID-19 Pandemic in Ghana

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Abstract: The sudden emergence of the COVID-19 resulted in an abrupt shift from the traditional face-to-face teaching method to the technology-mediated form of education at almost all levels of education in Ghana. To this end, teachers are expected to have competence not only in pedagogy and content but also in using technology to facilitate instruction. In this regard, this study sought to examine whether or not teachers of Ghanaian languages have Technological Knowledge and Technological Pedagogical Content Knowledge with respect to implementing technology-mediated instruction. To achieve the set purpose of the study, a cross-sectional survey design was adopted. Data were collected with a questionnaire on a five-point Likert scale. The gathered data were analyzed by computing the means and standard deviations of the Likert scale items. The findings of the study show that teachers of the Ghanaian languages possess good Technological Knowledge as well as Technological Pedagogical Content Knowledge (TPACK). Thus, they perceived themselves to be competent enough to implement any form of technology-mediated instruction in the wake of the COVID-19 pandemic. Having ascertained the perceived Technological Pedagogical Content Knowledge of teachers, the study recommended that Ghanaian language teachers should be resourced with working technological aids to make technology integration feasible amid the outbreak of COVID-19.

Keywords: technology, COVID-19, teachers, pedagogical knowledge, technology-mediated instruction, TPACK

1. Introduction

The COVID-19 pandemic has had a significant impact on every aspect of human life, including education. To curb the spread of the pandemic, almost all nations affected by its emergence had to observe a mandatory lockdown. Though this development was obviously one of the best remedies for controlling the spread of the pandemic, it severely affected the educational sector because students had to quit schooling to avoid being infected by the virus. As such, over 1.2 billion students worldwide were affected (UNESCO, 2020). To mitigate this educational challenge, there was a need for almost all educational sectors across the world to transit into the era of technology-mediated instruction in order to ensure the continuation of education. This is a situation we consider one of the obvious benefits of the unanticipated emergence of COVID-19. The rationale for this position is that until the emergence of the pandemic, teachers had not

totally embraced the essence of integrating technologies into their instructional practices, especially in Ghana (Unwin, 2008; Edumadze et al., 2017; Nyamekye et al., 2021).

In response to the abrupt transition from the traditional face-to-face method of teaching to online tools and processes of teaching, instructors are expected to diversify their instructional strategies to meet the diverse needs of students. As such, the ability to effectively incorporate technology into classroom practices is considered a major parameter for teachers' appraisal. This implies that teachers not only must possess a good knowledge in content and pedagogy but also must be well versed in using technology to facilitate instruction (Clark, 2013). As a result, students pursuing teacher education must be exposed to special programs that teach teachers how to best incorporate technology into their teaching practices (Sadara, 2001). In other words, educational programs offered by various institutions should not only provide teachers with content and pedagogical knowledge but also be innovative enough to prepare students for their profession.

Given the significance of integrating technologies into teaching, one would expect that teachers across all levels of education in Ghana are adequately prepared for technology-mediated instruction. Nonetheless, some studies (Abdulai, 2011; Agyemang & Mereku, 2015; Adarkwah, 2021) in the Ghanaian context reveal that teachers in most schools find it difficult to incorporate technology into their teaching activities. One of the reasons given for this low knowledge of using technologies to support instruction has to do with the lack of special programs specifically geared toward the ability to blend technology, pedagogy, and content. Abdulai (ibid), for instance, concluded in a study that was aimed to examine technology integration in various colleges of education in Ghana that college education tutors did not perceive themselves as proficient enough in terms of technology-mediated instruction. In response to this, it was recommended that stakeholders respond to their urgent needs by providing them with technology centres that would provide in-service training for tutors.

As a result of the pertinence of technology-mediated instruction, most scholars in different disciplines have embarked on studies that have focused on finding out whether or not instructors in their respective fields of study possess the requisite Technological Pedagogical Content Knowledge (TPACK) to deal with the emerging educational needs of students in Ghana. In the field of Religious and Moral Education, Asare-Danso (2017) assessed the TPACK of teachers in all colleges of education. According to the findings of this study, teachers were well-versed in the use of technology to enhance teaching and learning. Nonetheless, teachers were reluctant to implement technology-assisted teaching due to inadequate technology in their respective colleges. In social studies, Yalley (2016) also reveals that social studies teachers in the Kumasi metropolis possess adequate TPACK. Though there seems to be little or no research on the Ghanaian languages discipline, Apau (2017) conducted a relevant study that seems to suggest that all teachers (including Ghanaian language teachers) in the Department of Arts and Social Sciences Education (DASSE) at the University of Cape Coast lack TPACK. However, the findings of this study may not be entirely reliable because they are too holistic and lack specificity. In other words, Apau refused to show the TPACK of teachers in various disciplines within DASSE, hence the study cannot be considered comprehensive enough to suggest that Ghanaian language teachers' TPACK is known. In this regard, this current study pays special attention to the Ghanaian language subject area where there appears to be no literature on the TPACK of teachers. To fill this literature gap, the following research questions were raised to address the issue:

- i. What is the perceived Technological Knowledge of Ghanaian language teachers?
- ii. What is the Technological Pedagogical Content Knowledge of Ghanaian language teachers?

The rest of the research paper focuses on the relevant literature related to the study, the research methods, presentation and discussion of findings, recommendations, and conclusions.

2. Review of related literature

2.1 Theoretical framework

This study is grounded in the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006). This framework was developed to be used as a basis for assessing teachers' perceived competencies in implementing technology-mediated instruction. This framework is exemplified in Figure 1 below.

TPACK is a further development of Shulman's (1986) concept of Pedagogical Content Knowledge (PCK). Mishra

and Koehler (2006) opine that the advent of technology has significantly changed how teacher's competency must be perceived. As a result, competent teachers in this technological era must demonstrate content knowledge, pedagogical knowledge, technological knowledge, and knowledge of how to integrate these components to ensure effective teaching. Content Knowledge (CK) has to do with the subject matter that teachers are required to help the students master. According to Shulman as cited in Apau (2017, p. 23), "...CK includes knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge." CK could be said to be the major aim of schooling. That is to say, the major and explicit aim of the curriculum is to impart such skills to students at a given time. This implies that for educational goals to be successfully achieved, teachers must possess a mastery of the content. However, CK would be ineffective if teachers do not know how to best help students master it; thus, the concept of pedagogical knowledge became a necessary component in education (Ball et al., 2008; Schulze et al., 2014).

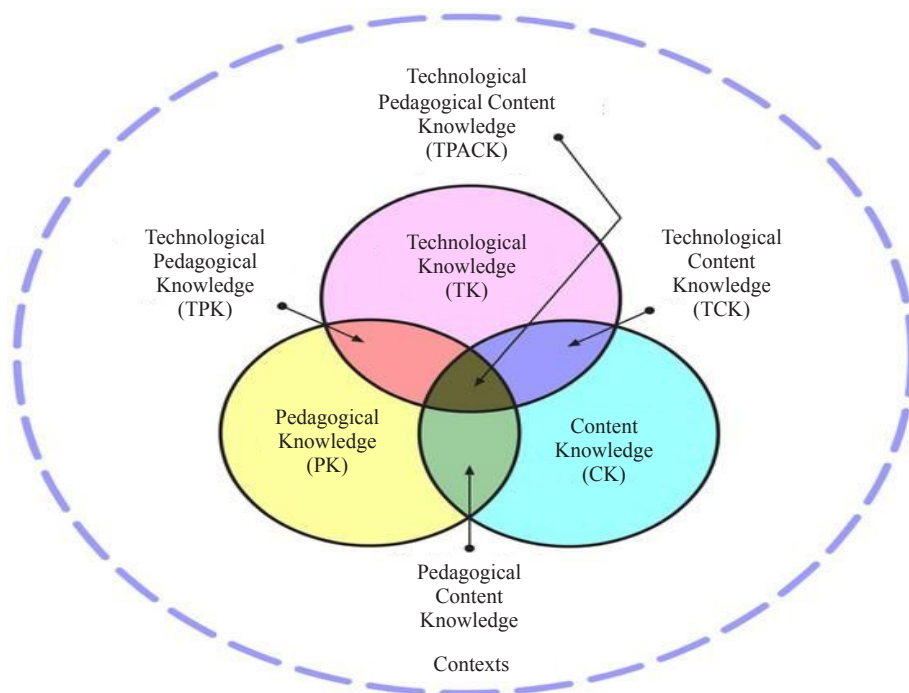


Figure 1. TPACK framework of Koehler and Mishra (2009)

Knowledge of how to make learning possible (pedagogical knowledge) could be considered the heart of education. Within the constructivist theory of learning, knowledge can be constructed independently by students (Steffe & Ulrich, 2020). This means that the teacher's role is not to deposit knowledge for the student, but rather to serve as a facilitator of learning. From this perspective, it could be argued that the effectiveness of a teacher can also be measured by his ability to devise diverse instructional strategies to help learners gain specific knowledge. Teachers endowed with such skills are said to have pedagogical knowledge. This concurs with the opinion of Apau (2017) in that it applies to teachers' knowledge of instructional activities such as planning and effective implementation of lessons, classroom management, and eliciting feedback on learning. Overall, having the PK as a teacher implies that you understand learning theories and how to effectively apply them in the context of the classroom (Shulman, 1986). Having ample knowledge of the content and how to effectively teach it implies that a teacher is endowed with what Shulman terms "Pedagogical Content Knowledge" (PCK).

Pedagogical content knowledge, as the name suggests, binds knowledge of the subject matter and how to effectively execute that particular knowledge. In simple terms, it consists of knowing what to teach and how to teach it. According to Shulman (ibid), the PCK applies to teaching competence in relation to specific content. This implies that a

teacher with PCK is capable of choosing the best instructional technique that suits the particular content. As such, PCK is more concerned with knowing alternative ways of dealing with a specific learning task to achieve the desired learning objective (Abbitt, 2011). In this digital era, however, Mishra and Koehler (2006) advise that to make teaching easier, more interesting, and efficient, knowing how to blend technology in classroom practices is a very pertinent issue. This led to the introduction of the TPACK framework.

TPACK is an overarching concept that goes beyond its components. Owusu (2014) is of the view that the TPACK of teaching is a concept that unites teachers' knowledge of technology, content, and pedagogy. It is simply the knowledge of the effective means of incorporating technologies to effectively assist teaching and learning.

Insofar as not all technologies may be suitable for specific content teaching, it is expected that educational training programmes be geared toward instilling teachers with knowledge of comprehensive ways of interweaving technology, pedagogy, and content. Koehler and Mishra (2009) substantiate this as they posit that the quality of education is contingent on the interplay between technology, pedagogy, and content. In this regard, Clark (2013) provided certain parameters which he expects to be the basis for teacher training programmes. These are as follows:

- i. Teachers need to develop technological literacy skills.
- ii. Teachers need to be given the opportunities to practice the incorporation of specific technological knowledge in specific pedagogical skills.
- iii. Teachers must be trained to adapt emerging technologies on how to vary the use of 21st-century technologies for different instructional purposes.

With these dimensions provided by Clark, teachers would be prepared enough to interweave the three components under discussion in their instructional activities.

2.2 Empirical studies

Various studies have attempted to assess teachers' perceived digital literacy. Nonetheless, findings from both international and local contexts appear to be inconsistent. The inconsistencies could be attributed to geographical diversity.

In the United States of America (USA), studies seem to suggest that teachers are exposed to quality technological content knowledge that prepares them to deal with the emerging needs of students (Easter, 2012; Smith, 2012; Yoon, 2012; Spazak, 2013; Juarez, 2014). Similarly, Owusu (2014) reveals that in New Zealand, science teachers in high schools show greater confidence in the use of technologies for various instructional activities such as preparation of lesson plans, searching for information online, programme installations among others.

In the African context, while some studies have shown that the integration of ICT into teaching is problematic, especially in the educational context (Wright & Cluster, 2000; Asare-Danso, 2017), recent studies (Quayson & Halm, 2020; Yalley, 2016; Asare-Danso, 2017) have shown that teachers have ample technological knowledge. The only problem they have has to do with resources that would facilitate the effective implementation of technology-mediated instruction. That is, most of the available studies show that though teachers may have moderate or high technological pedagogical content knowledge, they face challenges in putting into practice the knowledge they possess in the classroom. For instance, Asare-Danso (2017) reports that religious and moral education tutors in colleges of education in Ghana have a good TPACK but they are unable to utilize their knowledge due to limited technological resources in their schools. Using TPACK as a theoretical framework, Mensah et al. (2022) also examined the technological knowledge of Senior High School (SHS) geography teachers in the central region of Ghana. Unlike the findings of Asare-Danso (2017), this study found that teachers have very good pedagogical and content knowledge, but were not too confident about their technological knowledge. Similarly, Abdulai (2021) also indicates that junior high school teachers in the Abuakwa South Municipality of Ghana are knowledgeable in technology but they feel less confident about their TPACK. Though little is known about teachers' TPACK in the Ghanaian language teaching field, Agyeman (2011) conducted a study that assessed only the PCK of teachers of the Ghanaian language. However, his study did not focus on the technological aspect of the TPACK framework. This, therefore, remains a literature gap that necessitates further exploration.

3. Research methods

The present study adopted a cross-sectional survey as the research design. This quantitative research design was deemed appropriate for a study of this nature because it paves the way for researchers to study the characteristics, perceptions, and views of a population by using a sample of the entire population. The design is mostly used when the researcher aims to gather data from respondents at one specific point in time for inferences and generalisation purposes. (Rindfleisch et al., 2008; Lavrakas, 2008).

The study focused on basic school teachers pursuing a top-up teacher-education programme under the University of Cape Coast's School of Educational Development and Outreach (SEDO) sandwich programme in Offinso College of Education and St. Louis College of Education. Specifically, the third and final-year students were used as participants in the study. The rationale for choosing these participants was that the first-year students had not reported at the time of data collection. In total, Ghanaian language teachers from 76 basic schools enrolled in the sandwich program were proportionately sampled from a population of 150 teachers in both study centres.

To collect data from the sampled participants, an adapted TPACK questionnaire developed by Schmidt et al. (2009) was used. The questionnaire was structured into three sections: The first section (A) was designed to collect demographic data of the respondents, while the second (B) and the third (C) were designed to collect data on teachers' TK and TPACK, respectively. Items in the question were measured on a 5-point Likert scale. The instrument was piloted with 10 senior high school Ghanaian language teachers in the Cape Coast metropolis. An overall Cronbach's alpha of 0.8 and 0.78 were obtained for TK and TPACK respectively. Hence, in line with the general rule of thumb regarding the internal consistency of the instrument, i.e reliability coefficient of 0.7 (Fraenkel & Wallen, 2000), this instrument was deemed appropriate for data gathering.

After data collection, the Statistical Package for Social Sciences (SPSS) version 25 was used for data processing and analysis. Particularly, the data were subjected to descriptive analysis. The Means (M) and Standard Deviation (SD) of the TPACK questionnaire item were computed for analysis.

4. Results and discussions

This section provides a detailed analysis of the data elicited from the respondents. The analysis starts with a brief description of the demographic background of the respondents as presented in Table 1 and is followed by a presentation of the findings based on the two research objectives set to guide the study.

4.1 Demographics characteristics of respondents

Table 1. Background data of respondents

Gender	Age range				Total
	Below 20	21-25	26-30	30+	
Male	0	20	14	8	42
Female	2	20	6	6	34
Total	2	40	20	14	76

Source: Field Data, 2021

4.2 Findings

4.2.1 Research question 1: What is the Technological Knowledge of Ghanaian language teachers?

This research question was meant to ascertain whether or not teachers believed they had the technological

knowledge required for the successful incorporation of technologies into classroom practices. This research question was needed since the knowledge of effective use of technologies is a prerequisite for TPACK. On a five-point Likert scale, the findings from the analysis of the data have been captured in Table 2 below.

Table 2. Descriptive statistics of Ghanaian language teachers' Technological Knowledge

Perceived technological knowledge of teachers	M	SD
I am very proficient in using technological tools in my daily activities	3.53	1.10
I can learn emerging technologies with ease	4.18	0.79
I can use technology to solve a variety of educational problems	3.66	0.74
I know a variety of technological resources that are needed to make communication and performance of educational duties effective	3.63	0.88
I can install and uninstall a variety of software applications on my computer and my phone	3.53	1.19
I can create short videos clips with phones, tablets and laptop	3.55	1.08
I can create a website on my own	2.79	1.29
I am well versed in using computer to save and retrieve relevant information.	3.95	0.95
I can use computers and phone to send emails with attachments	3.76	1.25
I can operate Microsoft Office (Word, Excel, PowerPoint)	3.84	1.05
I can use word to create images and other shapes	3.63	1.25
Mean of Means	3.64	0.74

Source: Field Data, 2021

In response to whether they had the technical skills to use technologies, a mean of 3.53 was obtained, which indicates that they agreed that they had adequate technical skills to use technologies. A standard deviation of 1.10 means there were variations in the response of teachers to that effect. Specifically, most teachers agreed with the fact that they had the knowledge to learn technologies easily, as a mean of 4.18 and a standard deviation of 0.79 were obtained. Moreover, the means and standard deviations of the items 'I can use technology to solve a variety of educational problems' (M = 3.66, SD = 0.74), 'I know a variety of technological resources that are needed to make communication and performance of educational duties effective' (M = 3.63, SD = 0.88), 'I know how to create short videos clips with phones, tablets and laptop' (M = 3.55, SD = 1.08), 'I know how to install and uninstall a variety of software applications on my computer and my phone' (M = 3.53, SD = 1.19), 'I am well versed in using computers to save and retrieve relevant information' (M = 3.95, SD=0.95), Sending of emails with attachments (M = 3.76, SD = 1.25); the creation of PowerPoint presentations (M = 3.84, SD = 1.05), and the ability to use the word to create images and other shapes (M = 3.6, SD = 1.25) indicate that, to some extent, Ghanaian language teachers are confident that they have the requisite knowledge in that respect. In terms of the creation of a website, the mean (2.79) and the standard deviation (1.29) show that teachers have limited knowledge in that respect. Generally, the mean of means (3.64) and the standard deviation (0.74) indicate that the majority of the respondents had the requisite technological skills. These findings are consistent

with Asare-Danso (2017), who found that RME tutors were confident they had the required technological knowledge. In the same way, it reflects the finding of Yalley (2016), who found that social studies teachers have ample technological knowledge. It is also in line with the findings of Apau (2017), which suggest that teachers in the Department of Social Sciences and Arts Education, University of Cape Coast, have ample technological knowledge.

4.2.2 What is the TPACK preparedness of Ghanaian language teachers?

The final research objective sought to find out whether teachers of the Ghanaian language subject area are prepared enough to put into practice their TPACK. Table 3 below summarises the analysis of the data from respondents.

Table 3. The TPACK of Ghanaian language teachers

Perception	M	SD
I can offer skills that blend the topics, technology and approaches to education appropriately	4.13	0.66
I can also choose technologies that improve my teaching	4.14	0.72
I can use policies that integrate instruction, content and technology in my classroom	4.05	0.69
I can use software applications that improve content comprehension for lessons	3.89	0.89
I can find and use study resources which illustrate a particular theory effectively in my field	4.13	0.66
I can use technologies to make scientific research easier in the classroom	4.03	0.85
I can use technologies to construct meaningful content representation that goes beyond textbook approaches	3.71	0.92
I can build self-directed learning activities to promote content knowledge with suitable technology (e.g. Blogs, WebQuests)	3.42	1.05
I can plan research activities that will allow students to understand content with suitable technologies (simulation and web-based materials)	3.66	1.04
Mean of Means	3.90	0.64

Source: Field Data 2021

The mean of means (3.90) for the items indicates that Ghanaian language teachers are very confident that they can operationalize TPACK in practical terms. The standard deviation of 0.64 indicates that the responses are clustered around the mean, hence an indication that all teachers have a similar perception about putting their TPACK into practice. Hence, contrary to the findings of Apau (2017), Ghanaian language teachers from the Department of Art Education perceived themselves to be well equipped in terms of TPACK preparedness. Also, the findings of the present study appear to contradict the findings of Asare-Danso (2017), who reveals that though teachers have the technological knowledge, they feel less confident about their TPACK. It also goes contrary to the findings of Abdulai (2021), whose reports similar issues concerning teachers' limited knowledge of how to unify technology, content, and pedagogical knowledge.

5. Conclusion

The study assessed the TK and TPACK of basic school teachers pursuing a top-up teacher-education programme under the University of Cape Coast's School of Educational Development and Outreach (SEDO) sandwich programme in Offinso College of Education and St. Loius College of Education. Based on the findings, it could be concluded that teachers of the Ghanaian language believe they possess the requisite technological pedagogical content knowledge because they believe they can interweave technology, pedagogy, and content properly. As such, it could also be concluded that Ghanaian language teachers perceive themselves to be competent enough to put into practice their technological pedagogical content knowledge to deal with any educational challenge that may be caused by the COVID-19 restrictions.

6. Recommendations

In light of the research findings, the following recommendations are proposed for imminent consideration. Foremost, considering the fact that teachers believe they possess the requisite digital literacy which they believe they can put into practice, various teacher-training institutions such as the University of Cape Coast, the University of Education, Winneba, and various colleges of education in Ghana may pay particular attention to this domain of teacher competence during their teaching practicum.

Also, since teachers believe they have the requisite competence to implement technology-mediated instruction in Ghanaian language education, the Ghana Education Service (GES), the Ministry of Education and all concerned stakeholders must help in providing technological teaching aids to ignite their interest in engaging in online forms of teaching while students are at home.

7. Limitations and suggestions for further research

This study was quantitative research that elicited data on teachers' perceptions of their competence in executing technology-mediated instruction. However, in an actual sense, it is not known whether or not teachers can put their knowledge into practice. As a result, it is suggested that a qualitative study with multiple data collections such as interviews and observations be conducted to check whether or not teachers of Ghanaian languages can, indeed, put into practice their TPACK. This can also help uncover the actual picture of the situation.

Conflict of interest

The authors declare no conflict of interest.

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