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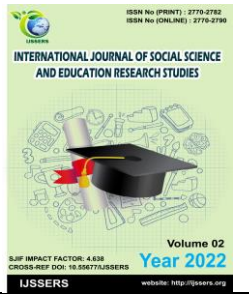

Assessment of Technological Pedagogical Content Knowledge of Senior High School Business Teachers in the Central Region, Ghana

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ABSTRACT

The study explored business teachers' level of Technological, Pedagogical and Content Knowledge (TPACK) in Senior High Schools in the Central Region of Ghana and examined the differences in teachers' level of TPACK on the basis of some demographic variables using the mixed methods approach. The study used descriptive survey design. Simple random sampling technique was used to select 248 business teachers. Questionnaire was used to gather quantitative data. Mean and standard deviation were used to examine business teachers' level of TPACK. Moreover, Independent samples t-test was used to examine whether differences exist in teachers' TPACK and gender. One-way (ANOVA) was also used to examine whether differences exist in teachers' TPACK based on age. The finding showed that teachers possessed higher Content, Pedagogical and Pedagogical Content Knowledge and moderate Technological Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge and TPACK. The study found that there was statistically significant difference in teachers' TK, TCK and gender in favour of the male teachers. The study concluded that teachers' high content knowledge, pedagogical knowledge, pedagogical knowledge suggests that teachers seem to focus much on developing these knowledge to the neglect of other vital contemporary skills such the use of technology. This was evident in their moderate level of technological knowledge, technological pedagogical knowledge, technological content knowledge and technological pedagogical content knowledge. The study recommended that the Ministry of Education through Ghana Education Service and Government should organise refresher courses for in-service teachers to learning the use of technology in teaching.

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Keywords:
Content Knowledge; Pedagogical Knowledge; Pedagogical Content Knowledge; Educational Technology; Information and Communication Technology.

1.0 INTRODUCTION

Advancement in information and communication technology (ICT) require the use of educational technology in teaching to ensure effective classroom instruction (Caena & Redecker, 2019). This is because the use of educational technology has become a natural part of classroom life as it enhances learning, facilitates problem solving, communication, research skills and decision-making processes (Tang, Vezzani & Eriksson, 2020).

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According to Akpan and Akpan (2022), in the era of a technology-driven business world, business education teachers need to acquire basic ICT knowledge and skills to enable them to integrate technology into teaching. The level of technological knowledge of teachers will enable them to use, develop, create and communicate information using technological tools. Adeleye (2013) added that the level of knowledge will help teachers use ICT to solve problems, analyze and exchange information, develop ideas, create models and control devices.

Martin and Bolliger (2018) noted that incorporating technology into instruction is a great way to actively engage students, especially as digital media surrounds young people in the 21st century. Akpan and Akpan (2022) noted that the use of networked computers, modern gadgets, new

technologies, interactive whiteboards or mobile devices can be used to effectively teach and learn complex concepts and subjects as it displays images and videos to increase knowledge and understanding. Learning can become more interactive when technology is used because students can be physically involved during class and also get immediate research materials and information for school work and homework which develops autonomy (Akpan & Akpan, 2022).

According to Shulman (1987), every professionally trained teacher should have seven knowledge bases that will enable him to engage in effective teaching. Shulman categorised this teacher knowledge as content knowledge, general pedagogical knowledge, curriculum knowledge, knowledge of students and their characteristics, knowledge of educational context, knowledge of pedagogical content/teacher craft knowledge, and knowledge of educational goals. However, Shulman did not specifically identify technological knowledge for teaching. This could be due to the time when technology was the focus of industrial work.

Mishra and Koehler (2006) introduced technological knowledge to build on Shulman's (1987) pedagogical content knowledge and came up with technological pedagogical content knowledge (TPACK). The TPACK framework describes the knowledge base teachers need to teach effectively in the technology-enabled classroom. According to Mishra and Koehler (2008), good teaching is based on three main components of knowledge. Content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK) and their intersections represent pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPACK). These seven components are interlinked to ensure that the teaching reaches the students' understanding.

Mishra and Koehler (2008) added contexts to the TPACK framework because context determines how technology is used in educational practice. The TPACK framework suggests that these seven domains and their interactions are needed for effective technology integration. Mishra and Koehler (2006) stated that teachers should understand the relationship and interactions between TPACK components to ensure effective teaching with technology. The importance of using technology in teaching requires teachers to demonstrate a high level of knowledge of technological pedagogical content to ensure effective teaching.

Despite the importance of technology in education, in most Ghanaian Senior High schools, most teachers do not incorporate technology into classroom teaching to make it more interactive (Mensah, Poku & Quashigah, 2021). This is believed to be due to teachers' lack of specific knowledge about technology, content, pedagogy, and how the knowledge interacts to provide effective instruction (Agyei & Voogt, 2012). According to Chukwuemeka and Samaila (2020) the underuse of technology is due to teachers' lack of knowledge and skills to operate it. Redmond and Peled (2019) stated that the ubiquitous nature of technology in the world has not yet translated into the global use of technology to transform learning and teaching. In Ghana, one of the areas of interest when it comes to the use of technology is the education sector. The sector appears to be lagging behind when it comes to integrating technology into teaching and learning. The situation in second cycle institutions is alarming because technological facilities are mostly unavailable or insufficient (Afari-Kumah & Tanye, 2009). Previous studies by some researchers (e.g., Gunu, Nantomah & Inusah, 2022; Mensah, Poku & Quashigah, 2022) showed that in Senior High Schools in Ghana, apart from the introduction of ICT as a subject, most teachers do not incorporate technology into classroom instruction due to their lack the knowledge and competence to integrate technology the emerging technologies in teaching. Anecdotal evidence gathered through lesson observations in the Cape Coast metropolis showed that business teachers do not use technology in their teaching.

An extensive review of the literature showed that teachers exhibited varied levels of TPACK. For instance, studies conducted in Asia, (e.g., Chai, Koh & Tsai, 2016; Koh, Chai, Benjamin, & Hong, 2015; Lee, Chai & Hong, 2019) showed that teachers have moderate level of TK but higher CK, PK PCK. Similar studies in Australia (Albion, 2014; Redmond & Peled, 2019) found that teachers have low technological knowledge, moderate TPACK but high content and pedagogical knowledge. In Africa, some studies (e.g., Asare-Danso, 2017; Mtebe & Raphael, 2018; Sintema & Phiri, 2018, Yalley, 2016), found that teachers have higher content knowledge, pedagogical knowledge, and pedagogical content knowledge but low technological knowledge, technological content knowledge technological pedagogical knowledge. Asare-Danso (2017) study focused on Religious and Moral Education tutors in Colleges of Education, Yalley (2016) focused on Social Studies teachers while Mensah, Poku and Quashigah (2021) focused on geography teachers. From the above studies, it appears that little attention has been paid to the assessment of business teachers' level of TPACK, hence the focus of the study. There are also inconsistencies in findings about the effect of teachers' demographic characteristics (gender, and educational qualification) on their level of TPACK.

The review of the past studies also showed that most international studies have examined the effect of teachers' demographic variables on TPACK and came out with conflicting findings. For example, some researchers (Jang & Tsai, 2013; Ozudogru & Ozudogru, 2019) found that demographic variables (e.g., gender and educational level) had a significant effect on teachers' level of TPACK.

However, other researchers (e.g., Hsu, Tsai, Chang & Liang, 2017; Koh, Chai & Tay, 2014) found that gender and educational qualification do not influence teachers' TPACK. The current study sought to address this paradox of contradiction in the educational literature. Therefore, it is necessary to bridge this knowledge gap by assessing the business teachers' level of TPACK and to investigate whether their demographic characteristics (eg, gender and level of educational qualification) could influence the level of TPACK.

The study investigated the business teachers' level of TPACK in Senior High schools in the Central Region of Ghana and examined differences in business teachers' level of TPACK based on some demographic characteristics.

1.1 Research questions

The study was guided by the following research questions:

1. What is the business teachers' level of Technological Pedagogical Content Knowledge (TPACK)?
2. What is the significant difference in business teachers level of TPACK based on gender?
3. What is the significant difference in Business teachers' level of TPACK based on the level of educational qualification?

Research hypotheses

The following research hypotheses were formulated and tested to examine the influence of business teachers' demographic characteristics on technology pedagogy content knowledge.

1. H0: There is no statistically significant difference in the TPACK level of Business teachers based on gender.

H1: There is a statistically significant difference in the TPACK level of business teachers based on gender.

H0: There is no statistically significant difference in Business teachers' level of TPACK based on the level of educational qualification.

H1: There is a statistically significant difference among all the seven components of Business teachers' TPACK based on educational qualification.

2.0 EMPIRICAL LITERATURE

The Technology Pedagogical Content Knowledge (TPACK) Framework was proposed by Koehler and Mishra (2006) to describe the knowledge teachers need to teach effectively with technology. The framework was built on Shulman's (1986) Pedagogical Content Knowledge (PCK). Shulman's framework connects teachers' content and pedagogical knowledge. The theory claims that teachers' knowledge of pedagogy and content cannot be assessed in isolation. According to Shulman, teachers need to master the interaction between pedagogy and content in order to implement approaches to ensure effective instruction and help students fully understand the content.

Koehler and Mishra (2006) proposed that a new type of knowledge, known as technological knowledge to Shulman (1986), the idea of pedagogical content knowledge to construct the type of knowledge required for teachers to provide effective teaching with technology (Koehler & Mishra, 2009). The TPACK framework consists of three main areas of knowledge: Content, Pedagogy, and Technology. Technological knowledge (TK) defined teachers' knowledge of the latest technologies used in the educational environment. Content knowledge (CK) refers to teachers' knowledge of the subject matter to be taught or taught. Pedagogical knowledge refers to teachers' knowledge of teaching and learning practices, processes, strategies, procedures, teaching and learning methods (Koehler & Mishra, 2005, p. 133). This kind of knowledge requires a deep understanding of learning theories and how they apply to students in the classroom.

The framework noted that the combination of these three basic types of knowledge leads to four additional types of knowledge: technological content knowledge (TCK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK) and technological pedagogical content knowledge (TPACK). Often contextual the model also includes knowledge (Mishra & Koehler, 2006b). Mishra and Koehler emphasized that effective technology integration depends on teachers understanding the relationships between these knowledge components, each of these three main knowledge domains, but also in their interrelationships to ensure effective teaching. The structure of TPACK was described by Mishra and Koehler (2006) as shown in Figure 1 in a Venn diagram with overlapping circles representing the seven main components.

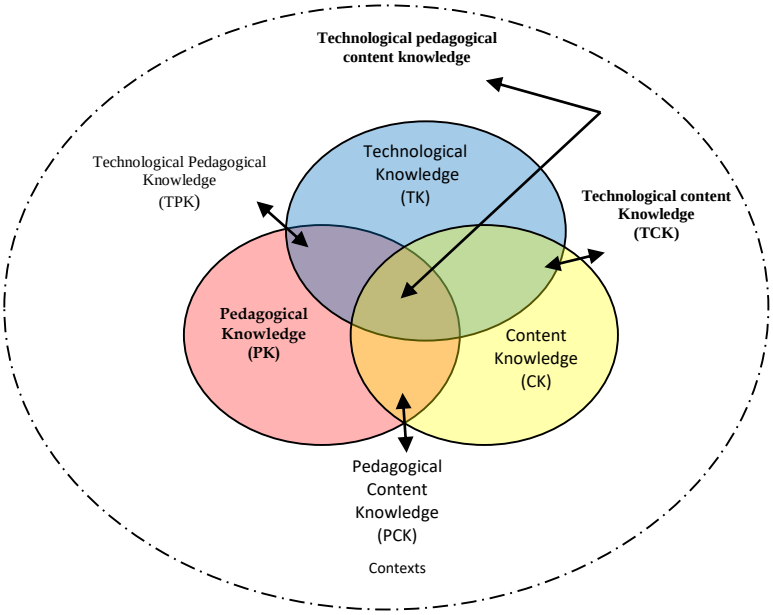

Figure 1: Components of TPACK adapted from (Koehler & Mishra, 2009).

2.1 Teachers Level (TPACK)

In Ghana, Yalley (2016) investigated social studies teachers' perceptions of TPACK. The study used a descriptive survey design and a questionnaire that was measured on a five-point Likert scale type was also used to collect data. Table of frequencies and percentages, mean and standard deviation were used to analyze teachers' perception of TPACK. The findings showed that teachers have higher TK, CK, PK, PCK and TCK. In Ghana, Asare-Danso (2017) evaluated the TPACK of Religious and Moral Education (RME) tutors at the College of Education in Ghana. A survey of 50 lecturers from 38 Colleges of Education in Ghana. The study collected data measured on a five-point Likert-type questionnaire with forty-five questions. Mean and standard deviation were used to analyze the data collected to investigate the teachers' TPACK level. The findings showed that the lecturers had good TK, PK, CK, TCK, TPK. This was due to the fact that teachers did not have a problem with the selection of teaching resources. The finding also showed that lecturers did not face problems using technology in RME teaching. However, the study found that instructional resources were often not available for tutors to use in teaching RME. The results showed that tutors had a high content knowledge.

In Tanzania, Mtebe and Raphael (2018b) examined in-service teachers' TPACK. The sample size for the study was 152 teachers. The study used a self-administered survey to collect data and was measured on a five-point Likert scale. Mean and standard deviation were used to examine teachers' TPACK. The findings showed that the teachers' level of CK, PK and PCK were high and teachers' level of TK, TCK TPK and TPACK were moderate. In Greek, Roussinos and Jimoyiannis (2019) investigated primary school teachers' perceptions of TPACK. The study used a survey to collect data from teachers and data were measured on a five-point Likert type scale. Data were analyzed using mean and standard deviation to determine teachers' perceived level of TPACK. The findings showed that the majority of teachers possessed higher CK, PK, PCK and TK. However, the study found that teachers have lower TCK, TPK and TPACK.

In a similar study, Aniq and Drajati (2019) investigated English teachers' perceptions of competence in TPACK development. The study design was case. The study used a semi-structured interview to collect qualitative data. The population was 20 English teachers. The study used the mean and standard deviation to investigate the level of teachers' TPACK. The findings showed that most of the teachers rated their PK, CK, PCK higher than the TK, TCK, TPK and TPACK components.

Appiah and Mfum-Appiah (2019) investigated the TPACK level of Religious and Moral Education teachers in Aowin District, in the Western Region, Ghana. The study used a descriptive survey design. The data collection instrument was questionnaire which was measured on a five-point Likert-type scale. A sample size of 33 RME teachers and 98 students were used. Frequencies, percentages were used to analyze the data gathered to examine the perception of TPACK. The finding showed that although teachers have sufficient skills in blending technology, pedagogy and content, they often do not practice these skills in the classroom.

In another study, Juhji and Nuangchalerm (2020) assessed pre-service teachers' level of TPACK. The study used a cross-sectional design. The data collection instrument was a questionnaire, lesson plans and an observation sheet. The finding showed that the teachers had good TK, moderate PK, CK, PCK, TCK TPK and TPACK.

Faithi and Yousefifard (2019) assessed Iranian EFLs' perceptions of their TPACK. A total of 148 Iranian English teachers participated in the study. Data were collected through the administration of a previously validated TPACK questionnaire to study participants. Findings obtained from the survey showed that the majority of EFL students perceived that their EFL TK, PK CK and PCK teachers were above average. However, teachers' TCK, TPK and TPACK were low.

Muhaimin, Habibi, Saudagar, Pratama, Wahyuni and Indrayana (2019) explored science teachers' perceptions of (TPACK). The study used sequential explanatory design the study used questionnaire and interview guide to gathered data. The population was 356 respondents for the survey and eight participants for the interview. The mean and standard deviation was used to analyse the data gathered on teachers' perception of TPACK and thematic analyse was used to analysed the qualitative data. Findings showed that the science teachers' perception of their CK, PK and PCK were all high while teachers TK, TCK, TPK and TPACK were all low.

Mensah, Poku and Quashigah (2022) assessed Senior High school geography teachers' knowledge of integrating technology into their classroom using (TPACK) model. The study used descriptive survey design. Questionnaire was used to collect data from 113 geography teachers. Data were analyzed using mean and standard deviation. The results of the study showed that teachers have a high level of content and pedagogical knowledge in geography. However, the analysis showed that teachers were less confident about content and pedagogy compared to technological knowledge and its subsequent integration into geography teaching and learning.

2.2 The influence of demographic variables on TPACK

Teachers' TPACK is very complex because it is influenced by many factors. Each teacher has different characteristics that influence the learning process that will take place.

Research on the effect of gender on TPACK has been conducted in several countries and shows mixed results. Some studies by Scholars (e.g., Liu, Zhang & Wang 2015; Luik, Taimalu & Suviste, 2018; Jang & Tsai, 2013) show that gender was a factor that influence teachers level of TPACK,

and that there are significant differences in TPACK based on gender, with males teachers having higher TPACK than females counterpart. This finding was also similar to that of (Berber & Erdem, 2015) who found that men have better ICT knowledge than women.

In Taiwan, Jang and Tsai (2013) explored Secondary school teachers' level of TPACK. The population was 1292 teachers. The questionnaire was employed to gather data from the respondents measured on five points Likert scale type. An independent samples t-tests and ANOVA was employed to examine the difference in teaching experience influence teachers' level of TPACK. The results of the study showed that male teachers possessed higher TK than the female teachers. The study further found that the experienced teachers have higher CK than the pre-service teachers.

In Zambia, Sintema and Phiri, (2018) investigated of Zambian Mathematics teachers' level of (TPACK). The study examined whether teachers' TPACK components differ significantly based on gender and grade level. The study used a descriptive survey. The population was 126 teachers and students. The study used a TPACK questionnaire to gather data which was measured on five points Likert scale type. Independent samples t-test was used to determine if there was a significant difference in the teachers' TPACK scores based on gender and grade level. The finding showed that there is a significant difference in the TPACK scores of teachers based on gender. The results of the study showed that gender have an effect on teachers' TPACK and male student teachers possessed higher TPACK than females. The results showed that teachers had higher TK, PK and PCK.

In China, Gou, Liu and Wang (2020) examined teachers' perception of their level of (TPACK) and determine the influence of gender on TPACK. The sample size of 361 was selected using simple random sampling. The survey method was employed to gather data measured Likert scale type. The mean and standard deviation was used to examine teacher level of TPACK. The independent sample T-test was also used to examine the differences in gender and teachers' level of PACK. The finding showed that teachers' CK, PK were found to be among the seven sub-constructs. The finding showed that TK, TCK TPK and TPACK were the lowest. The finding of the study further showed that gender influences teachers' level of TPACK. Also, the finding showed that male possessed higher PK, CK and PCK than the female teachers.

On the other hand, some studies (e.g., Ay, Karadag & Act 2016; Ersory, Mehmet, Yurdakul & Ceylan 2016; Karatas & Tutak, 2015) have shown conflicting findings that gender does not have a significant effect on teachers' level of PACK. These studies found no significant difference between gender and teachers' level of TPACK. In Thailand, Adulyasas (2017) measured mathematics teachers' perception of TPACK. The study was a survey comprised of 210 teachers. Questionnaire was employed to gather data from the respondents. The findings revealed that there was no significant differences were found between gender and TPACK. Astuti, Paidi, Subali, Hapsari, Pradana and Antony (2019), examined the biology teachers' mastery of TPACK. A Study Based on Teacher Gender. The study design was a survey and 29 participants participated in the study. The mean and standard deviation was used to examine teachers' level of TPACK and t-test was used to examine the influence of gender on TACK. The finding showed that teachers had good PK, CK, PCK TPK, and TCK. However, teachers TK and TPACK were all moderate meaning that teacher needed further training on TK and TPACK. The finding further showed that there was no statistically significant difference male and female teachers' TPACK based on gender. This implies that teachers' mastery of TPACK was not differentiated based on gender.

3.0 RESEARCH DESIGN, POPULATION AND SAMPLING

The study used a descriptive survey design as it was well suited for the purposes of this study. This study sought to evaluate the level of TPACK of business teachers and their demographic variables. The population for the study included 653 business studies teachers from Senior High Schools in the Central Region of Ghana. There were a total of 75 Public High School. Out of 75 schools, 14 schools did not offer business courses. Thus, only 61 schools offer business courses. The population consisted of teachers of business management, financial accounting and Costing teachers. The sample size for the study was 248. This sample size was arrived at based on a population of 653. The researcher's decision to settle on this number was informed by Yamane's (1967) formula for calculating sample sizes. A sample size of 248 was calculated using Yamane's (1967) formula. The sample size was calculated at the 95% confidence level and P = 0.5. Where n is the sample size, N is the population size and δ is the critical confidence level value (0.05).

N is the population size, and δ is the critical value of the confidence level (0.05).

$$n = \frac{N}{1+N(e)^2} \quad n = \frac{653}{1+653(0.05)^2} \quad n = \frac{653}{1+653(0.0025)} = 248.05.$$

3.1 Data collection Instrument

The study used questionnaires to collect primary data to address the research questions. The structured questionnaire was adapted from Mishra and Koehler (2006). The adaptation of the items was important because these items were used in a different context outside of Ghana and therefore could not fully fit the Ghanaian context. The questionnaire consists of eight parts. Part A of the questionnaire captured demographic characteristics (gender, age, teaching experience and education of the respondents). Sections B, C, D, E, F, G and H captured items that measured teachers' level of PACK. Each section was structured on a 5-point Likert-type scale.

Response scales were strongly Disagree (1), Disagree (2), not sure (3), Agree (4), and strongly agree (5).

3.2 Validity and reliability for the questionnaire

The questionnaire was examined for content validity, face validity and construct validity. The researcher ensured that the items in the questionnaire covered the domains (CK, PK, TK, TPK, PCK, TCK, TPCK) that the instrument intended to measure. The instrument was given to colleague to check clarity and completeness and reworded some items.

Construct validity was again examined to ensure that the variables related to the theoretical constructs they were intended to measure. To ensure construct validity, a factor analysis using principal component analysis (PCA) was performed. 56 questionnaires were valid for analysis. The Kaiser-Meyer-Olkin measure confirmed that sampling adequacy for analysis, KMO = 0.945, was good for principal components analysis (Field, 2009). Bartlett's test of sphericity $\chi 2 = (1431) = 14080.036$, $p < 0.001$ indicated that the correlation between items was large enough for PCA. Initial analysis produced seven components with each eigenvalue more than once. After item iteration (12 iterations) using Promax rotation and scree plot convergence, seven components were retained. Table 1 lists the extracted components.

Table 1: Component of TPACK

	Component						
Items	1	2	3	4	5	6	7
TPCK2	.980						
TPCK4	.942						
TPCK3	.929						
TPCK1	.913						
TCPK6	.881						
TPCK5	.849						
TPCK7	.792						
PK7		.803					
PK3		.792					
PK4		.763					
PK2		.756					
PK5		.752					
PK8		.736					
PK6		.731					
PK9		.627					
PK1		.588					
PCK3			.904				
PCK1			.849				
PCK6			.846				
PCK7			.842				
PCK5			.840				
PCK4			.839				
PCK2			.795				
PCK8			.742				
CK8				.895			
CK3				.872			
CK2				.786			
CK4				.781			
CK1				.757			
CK6				.752			
CK5				.705			
CK7				.673			
CK9				.629			
TPK3					.783		
TPK1					.743		
TPK6					.725		
TPK4					.701		
TPK7					.683		
TPK2					.552		
TPK5					.450		
TK8						.888	
TK5						.750	
TK7						.728	
TK4						.711	
TK2						.621	
TK3						.619	
TK6						.599	
TK1						.569	
TCK1							.666
TCK5							.593
TCK5							.551
TCK2							
TCK4							.543
TCK3							.513

Source: Fieldwork (2022)

The first component had seven items that measured business teachers' technological pedagogical content knowledge. The highest item loading on component one was 0.980 and the lowest factor loading was 0.792. The second component is pedagogical knowledge with nine items; the highest item loading was 0.803 and the lowest was 0.588. The third component is pedagogical content knowledge with eight items; the highest and lowest item loadings were 0.904 and 0.742, respectively. The fourth component is content knowledge with nine items; the highest item loading was 0.895 and the lowest was 0.629. The fifth component is technological pedagogical knowledge with seven items; the highest item loading was 0.783 and the lowest 0.450. The sixth component is technological knowledge with eight items; the.highest and lowest item loadings were 0.888 and 0.569, respectively. The seventh component was technological content knowledge with five items; the highest and lowest item loadings were 0.666 and 0.513, respectively.

The reliability of the questionnaire was tested using Cronbach's alpha coefficient using Statistical Package for the Service Solution (SPSS) version 22. According to (McNeish, 2018) and (Pallant, 2010), Cronbach's alpha value should be higher than 0.70. to considered to be of high reliability. The

closer the alpha coefficient is to 1.0, the greater the reliability of the measurement. It was therefore used for our own study, which also yielded high consistency. Thus, the questionnaire was rated as highly consistent. The results of Cronbach's alpha test are shown in Table 2

Table 1: Cronbach's Alpha test

Variables	Cronbach's Alpha	
	Pilot Data	Actual Data
Technological Knowledge (TK)	.884	.947
Pedagogical Knowledge (PK)	.890	.942
Content Knowledge (CK)	.920	.948
Technological Pedagogical Knowledge (TPK)	.932	.878
Technological Content Knowledge (TCK)	.921	.926
Pedagogical Content Knowledge (PCK)	.900	.960
Technological Pedagogical Content Knowledge (TPACK)	.920	.956

Source: Field Survey (2022)

As seen in Table 2, specific sub-constructs; (TK, PK, CK, TPK, TCK, PCK and TPACK). The lowest was 0.878 and the highest was 0.960. Deriving from the threshold provided by (McNeish, 2018) and (Pallant, 2010), all sub-constructs are highly reliable.

3.3 Data collection Procedure

The data collection process was initiated after a letter of ethical approval was obtained from the Institutional Review Board of the University of Cape Coast. Ethical clearance with the reference number UCC/IRB/A/2016/905 was obtained. The researcher visited selected Senior High Schools in the Central region and introduced himself to the business teachers and explained the purpose of the study. The questionnaire was administered and collected.

3.4 Data processing and quantitative analysis

After the questionnaires were collected, the researcher edited and screened the data. Editing and screening was to ensure that the data was accurate and complete. The researcher coded and entered the data into Statistical Product for Service Solution (SPSS) version 22.0. Descriptive statistics (percentages, frequencies, means and standard deviations) and inferential statistics (independent samples t-test and ANOVA) were used to analyze the collected data. For inferential statistics, significant results were found at $p < 0.05$.

Research question 1 focused on business teachers' level of TPACK. Data collected on these variables were at the measurement interval level. Therefore, the mean and standard deviation were considered the most appropriate statistical tools to describe the TPACK level of business teachers. The mean provided the general level of TPACK possessed by the business teachers. The standard deviation helped measure the homogeneity of their responses.

Research hypothesis 1 examined differences in the TPACK level of business teachers based on gender. The dependent variable was TPACK and the independent variable was gender (two-level categorical variable). Therefore, an independent samples t-test was appropriate for testing this hypothesis because it focuses on differences in the dependent variables when the categorical variable is at two levels. Research hypotheses one and two focused on differences in business teachers' TPACK levels based on age. Age was a categorical variable with more than two levels. Therefore, one-way analysis of variance (ANOVA) was used to test the hypotheses.

3.5 Demographic characteristics of respondents

The demographic profile of the respondents was gender, age, teaching experience and level of education. These demographic characteristics were necessary for the formulated hypothesis. In essence, they helped determine whether business teachers' knowledge of technological pedagogical content is affected by such characteristics. Table 3 shows the results.

Table 2: Characteristics of Business Teachers

Variable	Subscale	Freq. (n)	Percent (%)
Gender	Male	144	58.1
	Female	104	41.9
Age (in years)	20-25	43	17.3
	26-30	77	31.0
	31-35	70	28.2
	36-40	37	14.9
	40+	21	8.5
Highest Academic Qualification	Degree	188	75.8
	Master's	55	22.2
	Doctorate	5	2
Teaching Experience (in years)	1-5	70	28.2
	6-10	75	30.2
	11-15	58	23.4
	16-20	25	10.1
	21+	20	8.1

Source: Fieldwork (2021)

The majority (n = 144, 58.0%) of the respondents were male business teachers. The male business teachers were slightly higher than the female by 16.2%. The results show that the majority (n = 77, 31.0%) of the respondents were within the age range of 26-30 years. The respondents (n = 70, 28.0%), were within the age range of 31-36 years. The respondents (n = 43, 17.3%) were within the age range of 20-25 years. In addition, the respondents (n = 37, 14.9%) were within age range of 36-40 years and respondents (n =21, 8.5%) were above 40 years. The results show that most of the business teachers in the study sampled were within the age range of 26-30 years, followed by those within the age range of 31-36 years. The results suggest that most of the business teachers in Senior High Schools in the Central Region are teachers who are mature to give valid responses to answer the research questions.

In addition, the study examined the highest level of academic qualification of the respondents. The results show that the majority (n=144, 75.8%) of the respondents have obtained Bachelor's Degree as the highest qualification. Some of the respondents (n = 55, 22.2%) have their Masters' Degree and others (n = 5, 2.0%) have their Doctorate degree. The results mean that the respondents hold the requisite academic qualification that qualify them to teach in Senior High Schools. The basic qualification for teaching in Senior High School in Ghana is the First Degree and the respondents have their qualifications up the Doctorate level help in examining the TPACK level.

In relation to the teachers' teaching experience, the results show that (n=75, 30.2%) the respondents have 6-10 years teaching experience. The results show that some of the respondents (n = 70, 28.2%) have worked for 1-5 years. The results further show that the respondents (n = 38, 23.4%) have 11-15 years teaching experience, the respondents (n = 25, 10.1%) have 16-25 years teaching experience and some of the respondents (8.1%, n = 20) have 21 years teaching experience in teaching. It can therefore, be seen that the most of the respondents have worked for 6-10 years and other have worked for 1-5 years teaching experience.

4.0 RESULTS

Research Question One: What is Business Teachers' Level of Technological pedagogical content Knowledge? *The Table 4 presents the results on Business teachers' level of TPACK of the seven constructs.*

Table 3: Business teachers' level of TPACK of the seven constructs

Variables	*M*	*SD*	Interpretation
Content knowledge	4.57	0.88	High
Pedagogical Knowledge	4.17	0.92	High
Pedagogical Content Knowledge	3.89	1.13	High
Technological Pedagogical Content Knowledge	3.45	1.25	Moderate
Technological Knowledge	3.30	1.33	Moderate
Technological Pedagogical Knowledge	3.14	1.37	Moderate
Technological Content Knowledge	2.97	1.38	Moderate

Source: Field survey (2022)

The results in Table 4 show that business teachers rated their level of Content Knowledge as the highest (*M* = 4.57, *SD* = 0.88), Pedagogical Knowledge was rated as second highest (*M*= 4.17, *SD* = 0.92), Pedagogical Content Knowledge was rated third (*M* = 3.89, *SD* = 1.13). The fourth rated was TPACK (*M* = 3.45, *SD* = 1.25), followed by Technological Knowledge (*M* = 3.30, *SD* = 1.33), Technological Pedagogical Knowledge (*M* = 3.14, *SD* = 1.37), and lest rated was Technological Content Knowledge (*M* = 2.97, *SD* = 1.38). The results in the subsequent Tables give the details of the mean and standard deviation of business teachers' responses on each of the items on Technological Knowledge. The results are presented in Table 5.

Table 4: Business Teachers' Level of Technological Knowledge

Statements	*M*	*SD*
I have knowledge about the use of popular application software such as word processor, presentation graphics (PowerPoint), spreadsheet (excel) and standard technologies such as books, blackboard, markers	3.89	1.31
I can use audio-visual education materials in teaching (e.g, computers, smart phones, overhead projectors)	3.81	1.25
I have the technological skills to use the internet and mobile phones to search for information in lesson planning	3.71	1.24
I keep up with important new technologies	3.35	1.42
I have the knowledge needed to use the emerging technologies such zoom meeting and Google Classroom	3.22	1.36
I can use the basic devices attached to the computers such as a printer, scanner, digital camera, and projector	3.18	1.36
I have the ability to install software programs that I need	2.97	1.41
I can learn to use the new software easily	2.32	1.29
Mean of Means / Average standard Deviation	3.30	1.33

Source: Field Survey (2022)

The results show that teachers agree that they can use the popular application software such as word processor, presentation graphics (PowerPoint), spreadsheet (excel) and standard technologies such as books, blackboard, markers as high (*M* = 3.89, *SD* = 1.31). This is good because teachers' knowledge level of application software will enable them to use search for information from the internet to support their teachings. The standard deviation of 1.31 show the majority of the respondents were in agreement. The results also show that teachers agree that to the statement that they have knowledge to use audio-visual education technologies (e.g., computers, smart phones, overhead projectors) (*M* = 3.81, *SD* = 1.25). The standard deviation on this item shows that respondents' opinion converged. Teachers agree that they also have the technical skills to use the internet and mobile phones to search for information in planning their lessons (*M* = 3.71, *SD* = 1.24). The standard deviation shows that teachers' responses were in agreement on this item. The teachers agreed that they have the knowledge to keep up with emerging technologies (*M* = 3.35, *SD* = 1.41). The standard deviation show that teachers' responses were heterogeneous implying diverse opinions that they can keep up with new technologies.

On the contrary, teachers disagreed that they have knowledge on emerging technologies such as Zoom meetings and Google Classroom (*M* = 3.22, *SD* = 1.36). They also disagreed that they can use the basic technological device attached to the computers such as a printer, scanner, digital camera (*M* = 3.18, *SD* = 1.16). The standard deviation lower indicating that responses on this item converged. This implied that teachers cannot use the basic devices attached to computers. Teachers also disagreed that they can install software programs that they need to use in the classrooms (*M* = 2.97, *SD* = 1.14). The standard deviation shows that teachers' opinions were consistent. In addition, they also disagreed with the statement that they can use the ICT to create their own personal websites (*M* = 2.32, *SD* =1.29). The overall mean showed that teachers have moderate level of Technological Knowledge (*M* = 3.30, *SD* = 1.33).

The results in Table 6 provide the detailed analyses of the respondents' responses on the content knowledge.

Table 5: Business Teachers' Level of Content Knowledge

	M	*S*
I have sufficient knowledge about the subject I teach	4.17	.97
I have knowledge of key facts, concepts, theories in my subject area	4.12	.92
I am able to organize and combine ideas and concepts and theories	4.12	.86
I have various ways and strategies to develop my understanding of the business subjects I teach	4.15	.89
I know about various examples of how my subject matter applies in the real world	4.13	.92
I have enough self-confidence to teach in	4.27	.89
I can teach the contents in a logical and	4.23	.84
I have knowledge about the actual subject matter that is to be learned or taught	4.27	.83
I have sufficient knowledge about the educational goals, aims and values	4.14	.87
Mean of Means /Average Standard Deviation	4.17	.88

Source: Field Survey (2022)

The findings from the study show that teachers possess high content knowledge (*M* = 4.18, *SD* = .89). The overall standard deviation shows that teacher responses were diverse. The high content means that teachers understand the content, facts, ideas, theories and practices. Teachers are expected to use this knowledge to assist the students the concepts. The high content knowledge is not surprise because in the initial teacher preparation programmes, teachers are exposed to more of the content to enable them engage in effective teaching. The results show that teachers agreed that they have deep knowledge about the actual subject matter they teach (*M* = 4.27, *SD* = .83). Teachers agreed that they have enough self-confidence to teach in their subject areas (*M* = 4.27, *SD* = .89). The standard deviation suggest that teachers' responses were not agreement.

In addition, teachers also agreed that they can teach the contents in a logical and organized ways in their area of specialisation (*M* = 4.23, *SD* = .84). The observation of the standard deviation shows that their responses on this items were not in agreement. They also agreed that they have knowledge about the various ways and strategies to develop their understanding of the subjects they teach (*M* = 4.15, *SD* =.89); teachers agreed that they also have sufficient knowledge about the subject they teach (*M* = 4.17, *SD* = .97); have sufficient knowledge about the educational goals, aims and values (*M* = 4.14, *SD* = .87). The results further show that teachers agreed to the item that they know about various examples of how the subject matter applies in the real-world situations (*M* = 4.13, *SD* = .92). They have knowledge of key facts, concepts, theories in the subject area they teach, able to organize and combine ideas, concepts and theories (*M* = 4.12, *SD* = .92). The results in Table 7 gave detailed analyses of business Teachers' Level of Pedagogical Knowledge.

Table 6: Business Teachers' Level of Pedagogical Knowledge

Statement	*M*	*SD*
I can comfortably plan the scope and sequence of concept that I teach in my class	4.13	0.92
I can adapt my teaching style to cater for different learners	4.11	0.87
I use students centred approach to achieve specific objective of my lesson	4.20	0.90
I have knowledge about classroom management	4.22	0.97
I can select the appropriate methods suitable for the lessons I teach in my	4.24	0.88
I know how to assess students' performance in classrooms using	4.20	0.94
I can assist my students to monitor their own learning	4.09	0.96
I can plan group activities for students	4.23	0.91
I have the ability to apply a variety of teaching methods (such as cooperative learning, problem-solving approach,	4.15	0.97
Mean of Means / Average Standard Deviation	4.17	0.92

Source: Field Survey (2022)

The overall mean results showed that teacher have higher pedagogical knowledge (M = 4.17, 0.92). The detailed results in Table 7 showed that teachers agreed that they can select the appropriate methods suitable for the lessons they teach in the classroom (*M* = 4.24, *SD* = 0.88). The standard deviation was lower than the composite standard deviation indicating that the responses on this item were in agreement. Teachers also agreed that they can plan group activities for students (*M* = 4.23, *SD* = 0.91). Teachers agreed that they know how to assess students' performance in classrooms using assessment techniques (*M* = 4.20, *SD* = 0.94). Teachers gave diverse opinions on this item since responses did not converge. Teachers agree to the item that they are able to use students centred approach to achieve specific objective in their lessons (*M* = 4.20, *SD* =0.90). The standard deviation showed that teachers' opinions on this item converged. They also indicated that they have knowledge about classroom management practices (*M* = 4.22, *SD* = 0.97). The standard deviation shows that the responses on this item differ.

Moreover, teachers agree that they are able to apply a variety of teaching methods (such as cooperative learning, problem-solving approach, active learning and discovery learning (*M* = 4.15, *SD* = 0.97); teachers also agree to the statement that they can comfortably plan the scope and sequence of the concepts that they teach in the class (*M* = 4.13, *SD* =.92), can adapt their teaching style to cater for different learners they teach (*M* = 4.11, *SD* = .87). The respondents also agree that they can assist their students to monitor their own learning (*M* = 4.09, *SD* =0.96). The standard deviation shows that teachers' responses were in agreement. Teachers with good pedagogical knowledge are able select right teaching methods to engage in effective teach. The detailed analyses of Business Teachers' Level of Pedagogical Content Knowledge results are displayed in Table 8.

Table 7: Business Teachers' Level of Pedagogical Content Knowledge

statements	*M*	*SD*
I can select effective teaching approaches to guide student thinking and learning of	3.79	1.11
I can present the content of my subject area to suit the diverse interest and abilities of	3.88	1.03
I can use strategies to assist students in identifying connections between various	3.86	1.13
I am able to achieve the objectives described in my lesson plans	3.95	1.12
I can use different methods to address the common misconceptions my students in	3.90	1.13
I can use appropriate technique to represent the content in a way that makes	3.88	1.12
I can produce lesson plans with a good understanding of the topic in the subject I	4.03	1.18
I have techniques in assessing students' understanding and diagnosing their	3.82	1.26
Mean of Means / Average Standard Deviation	3.89	1.13

Source: Field Survey (2022)

The results showed that teachers have high pedagogical Content knowledge (*M* = 3.89, *SD* = 1.13). The detailed results in Table 8 showed that teachers agreed that they have knowledge on how to produce lesson plans with a good understanding of the topic in the subject (*M* = 4.03, *SD* = 1.18), they are able to achieve the objectives described in their lesson plans (*M* = 3.95, *SD* =1.12), teachers can present the content of the subject area to suit the diverse interest and abilities of students (*M* = 3.88, *SD* =1.03).

In addition, teachers agreed that they can use appropriate techniques to represent the content in a way that makes it easy for students to understand the lesson (*M* = 3.88, *SD* = 1.12), teachers also agree that they can use varieties of teaching strategies to assist students in identifying connections between various concepts (*M* = 3.86, *SD* = 1.13). The teachers have knowledge about they can use techniques in assessing students' understanding and diagnosing their misconceptions (*M* = 3.82, *SD* =1.26), they can select effective teaching approaches to guide student thinking and learning of the subject (*M* = 3.79, *SD* = 1.11), they can use different methods to address the common misconceptions of students in the

subject area (*M* = 3.90, *SD* = 1.13). The standard deviations on these items were lower than the composite standard deviation implying the responses converged. The results implied that business teachers' level of Pedagogical Content Knowledge is good enough to enable blend pedagogy with content for effective teaching. Teacher with high pedagogical content knowledge is likely to adapt their teaching approaches to different learning needs of their students. The results in Table 9 present the detailed analyses of Business Teachers' Level of Technological Pedagogical Knowledge.

Table 8: Business Technological Pedagogical Knowledge

Statements	*M*	*SD*
I am able to use technology to introduce my students to real-world scenarios	2.95	1.40
I am able to help my students to use technology to find more information on their own	3.59	1.24
I can choose technologies that are appropriate for my teaching	2.94	1.40
I can use new technologies to assess students' various ways	3.00	1.43
I can choose new technologies that enhance teaching approaches or strategies	3.66	1.30
I can choose technologies that enhance students learning of a concept	2.99	1.39
I can use new technologies to increase my students' engagement in learning.	2.89	1.42
Mean of Means / Average Standard Deviation	3.14	1.37

Source: Field Survey (2022)

The grand mean of means recorded on technological pedagogical knowledge shows that teachers rated their level of technological pedagogical knowledge as moderate (*M* = 3.14, *SD* = 1.37). The results show the teachers agree that they are able to choose new technologies that enhance teaching approaches or strategies (*M* =3.66, *SD* = 1.30), teachers are able to help students to use technology to find more information on their own (*M* = 3.59, *SD* =1.40). The standard deviation showed that the responses on the items differ since the responses do not converged.

Conversely, the teachers disagreed that they can use new technologies to assess students in various ways (*M* = 3.00, *SD* = 1.43). The standard deviation shows on this particular show that teacher opinions differ in this line of item. They also disagree that they can select the appropriate technologies that enhance students learning of a concept of the subjects (*M* = 2.99, *SD*=1.39). Teachers further disagree that they can use educational technology to introduce the students to the real-world scenarios (*M* = 2.95, *SD*= 1.40). A closer observation of the standard deviation shows that teachers' responses on this item do not converged, teachers can choose technologies that are appropriate for their teaching and use new technologies to increase the students' engagement in learning (*M* = 2.89, *SD*=1.42). The detailed results of Business Teachers' Level of Technological Content Knowledge are presented in Table 10.

Table 9: Business Teachers' Level of Technological Content Knowledge

Statement	*M*	*SD*
I know about technologies that I can use for teaching specific concepts in my subject	2.92	1.31
I know how the content can be represented by the application of technology	2.97	1.30
I have the ability to use the internet to search for information in my (subject area).	3.10	1.52
I can use various types of technologies to deliver the content in my subject area	2.90	1.41
I have knowledge about how to use technology to represent the content in different ways	2.84	1.42
I have the ability to develop my knowledge in my speciality, using new technologies	3.10	1.31
Mean of Mean / Average standard Deviation	2.97	1.38

Source: Field Survey (2022)

The results showed that teachers have moderate technological content knowledge (*M* =2.97, *SD* = 1.38). The results showed that teachers have knowledge to use the internet to search for information on business subject area (*M* = 3.10, *SD* = 1.52). They are also able to develop their knowledge in subjects speciality, using new technologies (*M*= 3.10, *SD* = 1.31); know how the content can be represented by the application of technology (*M* = 2.97, *SD* = 1.30); know about the technologies they can use for teaching specific concepts in their subject area (*M* = 2.92, *SD*=1.31); can use various types of technologies to deliver the content in their subject area(*M* = 2.90, *SD* = 1.41), teachers have knowledge about how to use technology to represent the content in different ways (*M* = 2.84, *SD* =1.42).

The results show that on average, teachers rated their level of technological content knowledge as moderate (*M* = 2.97, *SD* = 1.38). The results imply that even though Business teachers have knowledge to use technology to teach the content. Their level of technological content knowledge is not enough to effectively teach with technology in the classroom. The possible reason could be that business teachers had not been exposed to adequate training on how to blend the technology with the content for effective teaching in their institutions.

This may create difficulty for teachers to teach with the emerging technologies.

The study carried further analyses to examine the level of Business Teachers' Level of Technological Pedagogical Content Knowledge. The results are displayed in Table 11.

Table 10: Business teachers' level of TPACK

Statements	*M*	*SD*
I can choose technologies that enhance the understanding of the content for a lesson	3.65	1.26
I can use strategies that combine content, technologies, and teaching approaches in my classroom	3.62	1.23
I can teach lessons that appropriately combine the subject matter, technologies, and teaching approaches	3.58	1.18
I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn	3.43	1.22
I have the ability to integrate effective teaching methods with appropriate modern technologies in my subject area	3.35	1.25
I can use strategies that combine business management, technologies, and teaching approaches that I learned about in my coursework in my classroom	3.33	1.24
I could be a leader to help others in teaching content in my subject area by using an appropriate teaching method with the use of suitable new technologies	3.19	1.36
Mean of Means / Average standard Deviation	3.45	1.25

Source: Field Survey (2022)

The results show that business teachers rated themselves moderate on their level of technological pedagogical content knowledge (*M* = 3.45, *SD* = 1.25). The results also depict that teacher can choose technologies that enhance the understanding of the content for a lesson (*M* = 3.65, *SD* = 1.26), can use strategies that combine content, technologies, and teaching approaches in my classroom as revealed by mean and standard deviation of (*M* = 3.62, *SD* = 1.23). The results also depict those teachers can teach lessons that appropriately combine the subject matter, technologies, and teaching approaches (*M* = 3.58, *SD* = 1.18). TPACK reminds teachers that technology is part of great teaching and it the blending of content, pedagogy and technology that create effective teaching and learning. The TPACK framework suggests that effective technology integration demands that teachers as instructors should understanding the relationships between technology, pedagogy and content order to teach a particular topic well.

On the other hand, the teachers disagree that with the statement that they can select technologies to use in their classroom that enhance what they teach, how they teach, and what students learn as shown by mean and standard deviation of (*M* = 3.43, *SD* = 1.22). The responses on this item were in agreement. Teachers disagree that they are to effectively integrate teaching methods with appropriate modern technologies in their subject area (*M* = 3.35, *SD* = 1.23). They also disagree that they can use strategies that combine technologies, and teaching approaches to teach in their subject areas (*M* =3.33, *SD*=1.24), The also disagree that they can use teaching strategies that combine content, technologies, and teaching approaches in their classroom (*M* = 3.42, *SD* = 1.22). The respondents' opinions on these line of items converged.

Research Hypothesis One: There is no Statistically Significant Difference in Business Teachers' Level of TPACK Based on Gender

This research hypothesis sought to determine whether there is significance difference between male and female business teachers with regard to their gender and the results are put together and presented in Table 12.

Table 12: T-Test Results for Differences in Business Teachers' Level of Technological Pedagogical Content Knowledge based on Gender

Gender	Dimension	*M*	*SD*	*t*	*df*	*p*	η2
Male	TK	3.38	1.19	1.368	246	.001	.047
Female		2.87	1.18				
Male	CK	4.18	.79	-.007	246	.995	.000
Female		4.18	.65				
Male	PK	4.13	.81	-1.103	246	.271	.005
Female		4.24	.73				
Male	PCK	3.86	.99	-.583	246	.561	.001
Female		3.93	1.02				
Male	TPK	3.04	.99	-1.764	207	.079	.013
Female		3.28	1.10				
Male	TCK	3.10	1.22	2.048	246	.042	.017
Female		2.79	1.10				
Male	TPCK	3.42	1.12	.284	246	.777	.000
Female		3.38	1.11				

Source: Fieldwork (2022)

The preliminary Levene's test for equality of variances was conducted before the hypotheses were tested. This analysis helps in determining the degrees of freedom

needed in determining statistical significance for the independent samples t-test. Equal variances were assumed for content knowledge, F = .894, *p* = .345; pedagogical knowledge, F = .013, *p* = .909; pedagogical content knowledge, F = .063, *p* = .802; technological content knowledge, F = 2.997, *p* = .085; and technological pedagogical content knowledge, F = .124, *p* = .725. However, equal variances were not assumed for technological pedagogical knowledge, F = 4.736, *p* = .030, technological knowledge, F = 5.474, *p* = .020.

In Table 12, the independent samples t-test results showed that no significant differences were observed in business teachers' level of content knowledge, *t*(246) = -.007, *p* = .995 (2-tailed), η2 = .000; pedagogical knowledge, *t*(246) = -1.103, *p* = .271 (2-tailed), η2 = .005; pedagogical content knowledge, *t*(246) = -.583, *p* = .561 (2-tailed), η2 = .001; technological pedagogical knowledge, *t*(207) = -1.764, *p* = .079 (2-tailed), η2 = .013; and technological pedagogical content knowledge, *t*(246) = .284, *p* = .777 (2-tailed), η2 = .000, based on their gender. For these variables, the eta squared (η2) shows that gender could not explain 6% of the variance. The highest variance explained by gender was 1.3% observed in technological pedagogical knowledge. This is regarded as small based on Cohen's (1988) guidelines for effect size. Therefore, the null hypotheses which examined differences in business teachers' technological knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological pedagogical knowledge and technological pedagogical content knowledge based on gender were all not rejected.

However, significant differences were found in the business teachers' level of technological content knowledge based on gender, *t* (246) = 2.048, *p* = .042 (2-tailed), η2 = .017, technological knowledge, *t*(246) = 3.491, *p* = .001 (2-tailed), η2 = .047. Hence, the null hypothesis was rejected. In Table 11, the male business teachers' (*M* = 3.10) appear to possess higher technological content knowledge than their female counterparts (*M* = 2.79). The difference observed is small (η2 = .017). Again, the male business teachers' (*M* = 3.38) appear to possess higher technological knowledge than their female counterparts (*M* = 2.87). Nevertheless, the difference observed is small (η2 = .047).

Research Hypothesis two: There is no Statistically Significant Difference in Business Teachers' Level of Technological Pedagogical Content Knowledge Based on Educational Qualification.

To answer this research hypothesis, One -way ANOVA was used to test whether there is any significant difference in Business Teachers' Level of Technological Pedagogical Content Knowledge based on academic qualification. The results are presented in Table 13.

Table 13: ANOVA Results for Differences in Business Teachers' Level of Technological Pedagogical Content Knowledge based on Highest Academic Qualification

	Dimension	Levene's Test		*F*	*df*	*p*	η2
		F	*P*				
HAQ	TK	.543	.582	.393	2, 245	.675	.003
HAQ	CK	3.410	.035	1.208	2, 245	.301	.010
HAQ	PK	2.421	.091	.643	2, 245	.527	.005
HAQ	PCK	4.034	.091	1.955	2, 245	.144	.016
HAQ	TPK	3.082	.048	.189	2, 245	.828	.002
HAQ	TCK	1.103	.334	.137	2, 245	.872	.001
HAQ	TPCK	.141	.868	.494	2, 245	.611	.004

Source: Fieldwork (2022)

The preliminary test for Levene's equality of variances failed for content knowledge, F = 3.410, *p* = .035, and technological pedagogical knowledge, F = 3.082, *p* = .048. However, equal variances were assumed for technological knowledge, F = .543, *p* = .582; pedagogical knowledge, F = 2.421, *p* = .091; pedagogical content knowledge, F = 4.034, *p* = .091; technological content knowledge, F = 1.103, *p* = .334; and technological pedagogical content knowledge, F = .141, *p* = .868.

The ANOVA test also showed that there were no statistically significant differences in business teachers' technological pedagogical content knowledge based on their highest academic qualification. Specifically, business teachers' technological knowledge, F(2, 245) = .393, *p* = .675 (2-tailed), η2 = .003; content knowledge, F(2, 245) = 1.208, *p* = .301 (2-tailed), η2 = .010; pedagogical knowledge, F(2, 245) = .643, *p* = .527 (2-tailed), η2 = .005; pedagogical content knowledge, F(2, 245) = 1.955, *p* = .144 (2-tailed), η2 = .016; technological pedagogical knowledge, F(2, 245) = .189, *p* = .828 (2-tailed), η2 = .002; technological content knowledge, F(2, 245) = .137, *p* = .872 (2-tailed), η2 = .001; and technological pedagogical content knowledge, F(2, 245) = .494, *p* = .611 (2-tailed), η2 = .004 reported non-significant differences based on their highest academic qualification. Hence, the null hypothesis was not rejected.

5.0 DISCUSSIONS

The finding from the study showed that Business teachers exhibited high content knowledge. It was evident that most of the teachers had adequate content knowledge of the concepts and theories of the subject they teach. This high content knowledge was credited to the quality of initial teacher preparation programme which exposed teachers to the concepts, principles, and theories in their content areas. Hence, teaching content at the SHS level was not difficult for them. The findings also showed that teachers possessed high pedagogical knowledge. This high pedagogical knowledge was evident in the teachers' use of variety of teaching strategies and various assessments strategies to assess students' understandings of contents. Pedagogical Content Knowledge was high. They used varied teaching strategies such as group activities, classroom discussions and student-centred approaches to teach the concepts to assist students to gain better understanding of lessons. The finding showed that business teachers professed to have moderate technological pedagogical knowledge. This was explained by their inability to select appropriate technology to teach the content in their subject areas. Also, the finding showed that teachers' level of 'technological content knowledge was moderate. The findings aligned with several researchers (Asare-Danso, 2017; Appiah, 2018; Mtebe & Raphael, 2018; Yalley (2016), who found that teachers had higher content knowledge, pedagogical knowledge, pedagogical content knowledge but moderate technological knowledge, technological pedagogical knowledge, technological content knowledge. The teachers' knowledge in TPACK components will make teachers expert in the subject they teach. The in TPACK and its component are very important to every business teacher because without adequate knowledge in TPACK, it will very difficult for the teacher to integrate the emerging technology in teaching which is necessary in the 21st century. The findings gave an evidence that business teachers had moderate technological knowledge. The moderate TPACK means that teachers that teachers had limited exposure and in-service professional training.to the use of emerging technology. The situation where teachers have moderate TPACK can contribute to their non-use of the technologies to teach business lessons. Teachers moderate TPACK implied that teachers may need further technological training enhance their knowledge and probably boost their interest to integrate technologies in teaching. The training may build on teachers' capacity to learn the use of the new technologies. On the other hand, the findings did not agree with (Faithi & Yousefifard, 2019; Muhaimin, Habibi, Saudagar, Pratama, Wahyuni & Indrayana, 2019; Roussinos & Jimoyiannis (2019) whose findings showed that teachers possessed CK, PK and PCK but TK, TCK, TPK and TPACK were all low. A study by Juhji and Nuangchalerm (2020) found that teachers had high TK but moderate PK, CK, PCK, TCK TPK and TPACK. Teachers moderate level of PK, CK, PCK, TCK TPK and TPACK can contribute to teachers' non-use of technology in their classrooms where are inadequate technologies, non-functional of few technologies and limited access to technologies.

Research Hypothesis One: There is no Statistically Significant Difference in Business Teachers' Level of TPACK Based on Gender

The results showed that there was a statistically significant difference in business teachers' level of technological knowledge and technological content knowledge based on gender, at the five percent significance. The findings of the study aligned with some previous researchers (Sintema & Phiri, 2018; Ozudogru & Ozudogru, 2019) whose findings revealed that male teachers possessed higher TK and TPACK than their female teachers. The researchers deduced that male teachers high TK and TPACK could be attributed to the fact that male teachers tend to explore the use of technology and are more familiar with the technology than their female counterpart. However, the finding disagreed with that of (Altun & Akyildiz, 2017; Astuti, Paidi, Subali, Hapsari, Pradana and Antony (2019), who found no significant difference in gender and TK, CK, PCK, TCK, TPK and TPACK. Adulyasas (2017) found no significant differences between gender and TPACK. The findings implied that teachers' mastery of TK and TPACK does not depend much on gender.

Research Hypothesis Two: There is no statistically significant difference in business teachers' level of Technological Pedagogical Content Knowledge and academic qualification.

The ANOVA test also showed that there were no statistically significant differences in business teachers' level of technological pedagogical content knowledge and their highest academic qualification. This finding suggests that educational qualification does not bring differences use of technology in teaching. This observation can be explained by the fact that the respondents were closer in their level of educational qualification. The possession of higher qualification than degree is not a requirement for teaching in the Senior High School level. This implies the curriculum developers design their content, technological and pedagogical needs to suit the maximum qualification of professional degree in education.

The findings of the study support (Mai & Hamzah, 2016) whose finding showed that there are no significant differences in Sciences level of TK, CK, TCK and TPACK based on their educational qualification. This implies that all the teachers irrespective of their qualifications have the same level of perception of their TPACK. Academic qualification has no influence on teachers' level of technological knowledge, content knowledge. On the other hand, the findings of this current study contradict the research finding

of Antony et al. (2019) whose findings showed that academic qualification has influence on teacher level of TPAC

6.0 CONCLUSION AND RECOMMENDATIONS

The paper explored business teachers' level of TPACK in Senior High Schools in the Central Region of Ghana and to examine the differences in business teachers' level of TPACK based on some demographic characteristics. The finding from the study showed that Business teachers rated their high content knowledge as the highest. The findings revealed that teachers had adequate content knowledge of the concepts and theories of the subject they teach. This high content knowledge was credited to the quality of initial teacher preparation programme which exposed teachers to the concepts, principles, and theories in their content areas. Hence, teaching content at the SHS level was not difficult for them. The second rated knowledge was Pedagogical Knowledge. The finding showed that teachers had high pedagogical knowledge which was evident in their ability to use variety of teaching strategies and various assessments techniques to assess students' understandings of contents. Teacher rated their Pedagogical Content Knowledge as the third highest knowledge. This was also evident in their competent use of varied teaching strategies such as group activities, classroom discussions, student-centred approaches to teach the concepts to assist students to gain better understanding of lessons.

The finding showed that business teachers had moderate technological pedagogical content knowledge. The moderate level of teachers TPACK sends signals that their ability to amalgamate technology, pedagogy and content knowledge to teach specific topics to students understanding is underdeveloped. By extension, the business teachers are not likely to achieve high classroom effectiveness with their moderate. Further conclusions on teachers TPACK draws the attention of stakeholders on the need to develop teachers' technological knowledge, technological pedagogical knowledge and technological content knowledge. Also, the finding showed that teachers' level of technological content knowledge was moderate. This was shown in their inability to use some of the new application softwares such as zoom meeting and google classrooms to enhance their teaching. This contributed to their limited use of technologies for teaching purposes.

The findings showed that there was a statistically significant difference in business teachers' level of technological knowledge and technological content knowledge based on gender. Male business teachers displayed higher level TK and TPACK than the female counterpart. By implication, the male teachers appear better in amalgamating technology, pedagogy and content knowledge in instructing lessons than their female counterparts. Hence, the female teachers must be trained. There were no statistically significant differences in business teachers' level of TPACK based on their educational qualification. The study concludes that teachers' technological knowledge and educational qualification are separable entities. This implies that, teachers' use of TPACK does not depend on the level of educational qualification. Hence, given the needed support, any teacher can learn how to use technology in teaching.

To improve the teachers' moderate level of TPACK, the researchers recommend that the Ministry of Education and Ghana Education Service should supply the Senior High Schools with computers, projectors, laptops and internet facilities and training teachers to building their capacity on how to use these facilities to ensure effective teaching in Senior High Schools in Ghana. Organising regular refresher will assist the teachers to be abreast with the modern technology since technology keeps on changing. The study recommends that Ministry of education through GES should organise refreshers courses on modern methods of teaching and motivate teachers to apply them. The researchers also recommend that National Council for Curriculum and Assessment (NaCCA) should integrate TPACK into Senior High School curriculum. The researchers also recommend that in order to bridge the gender technological knowledge gap, GES should motivate female teachers to learn the use of technology in teaching. This can be done through organising seminars and workshop focus on the relevance of technology in teaching.

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