Education Qualifications and Teaching Experience on the 21st Century TPACK Level of English Language Teachers

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Abstract. Technology plays a vital role in educational institutions today. Educators are required to integrate technology in their teaching and learning sessions and teach their students 21st-century skills simultaneously, on top of teaching the subject matters. Hence, 21st-century TPACK was introduced as a framework for educators to measure their knowledge and skills when using technology. However, it is observed that some educators have difficulties when using technology due to a lack of knowledge and experience in using technology to teach. Hence, this study aimed to investigate the importance of education qualifications and teaching experience at the 21st-century TPACK level among English language educators in Malaysia. A total of 225 respondents among English language secondary school teachers were involved in this study, which was conducted quantitatively using an adapted questionnaire as the research instrument. The findings of this study revealed that the highest education qualifications play a role in the 21st-century TPACK level, while teaching experience did not. The results of this study showed the importance of upgrading and updating teacher's knowledge to teach with technology in the 21st century.

Keywords: 21st-century TPACK education, 21st-century TPACK, professional development, teacher training, Technological Pedagogical Content Knowledge (TPACK),

1   Introduction

Teaching and learning in the 21st century have changed and no longer depend on the traditional method, which is the chalk-and-talk method. The role of technology in teaching is getting more important and apparent, especially since the COVID-19 pandemic happened worldwide. In other words, the Covid-19 pandemic has expedited the shift to teaching with technology, as educators and students were forced to have their lessons online. In the Malaysian educational setting, all citizens were ordered to stay at home during the Movement Control Order (MCO) in 2020 [1]. During this time, all educational institutions were closed; hence, all students and educators had to have

classes online [2]. They had to depend on their gadgets and internet connection to have their teaching and learning sessions.

Technological pedagogical content knowledge (TPACK) comes into the equation in teaching with technology. [3] improved this framework based on the original work of [4], who came up with the pedagogical content knowledge (PCK) framework. Many scholars and researchers have referenced the TPACK framework to explore and investigate educators' abilities when teaching with technology. Teaching with technology in this sense could mean many things, such as using electrical gadgets (computers, laptops, projectors etc.) or teaching online using an internet connection [5]. Nowadays, teaching with technology has become more advanced in some parts of the world, such as holograms, virtual reality (VR), or artificial intelligence (AI). These advanced technological settings in teaching and learning have intensified the importance of TPACK among educators across all education levels.

Teaching students using technology is not an easy skill, especially among educators who are used to the traditional method in the classroom. During the Covid-19 pandemic, educators were forced to have online classes with their students. Having online classes meant that educators had to change their teaching style and methods, as they were no longer teaching their students face to face in the four walls of a physical classroom [6], challenging conventional educators unfamiliar with online teaching. They had to unlearn what they had known in their teaching experience and be open to learning new skills and knowledge to ensure their students effectively.

The difficulty of teaching with technology could be related to the educators' TPACK level and knowledge. Recently, more studies on TPACK among educators have emerged since its importance has increased. Among the problems frequently faced by educators are technical problems like weak internet connection or low-quality gadgets, and other problems include the ineffective use of technology when teaching [7]. Some educators used the same chalk-and-talk method when teaching online, which was ineffective during online classes due to several factors, such as a lack of knowledge, training, or experience in teaching with technology [8].

Among the studies conducted related to TPACK, it was observed that not many studies were done to investigate the role of the educators' educational backgrounds and teaching experience on their TPACK [9]. This gap needs to be addressed in Malaysian settings since demographic profiles might play essential roles in the education field. Therefore, based on the previous issues, this study aimed to investigate the importance of educational qualification and teaching experience in 21st-century TPACK among in-service educators in Malaysia.

The objectives of this study were:
1) to examine the significant difference between educators' education qualification and their level of 21st-century TPACK;
2) to examine the significant difference between educators' teaching experience and their level of 21st-century TPACK.

2   Literature Review

Before the TPACK framework was introduced by [3], the PCK framework was first created by [4]. In this framework, [4] emphasized the importance of having pedagogical and content knowledge in teaching subject matters. Shulman argued that this knowledge needs to be acknowledged and investigated further for teachers' growth in teaching. Since the introduction of the PCK framework, many scholars and researchers have studied, explored, and investigated it further, in which studies related to PCK were replicated and improved from time to time.

As the teaching and learning scenarios progressed over time, there was a need to improve the PCK framework further. Nowadays, it is no longer sufficient for teachers or educators to have PCK knowledge. As technology made its mark in the education sector, the PCK framework was then improved and updated to the TPACK framework by [3]. In this framework, [3] argued that an intricate relationship between content, pedagogy, and technology. Their study showed that when teachers were introduced to the TPACK framework directly, they became more aware of the interactions among content, pedagogy, and technology and slowly developed their TPCK in teaching.

According to [10], the TPACK framework consists of 3 main components, which are content, pedagogy, and technology, and four interactions between the main components, which are PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge) and finally, TPACK. All of these combined, making the TPACK framework have 7 components in total. They also argued that when technology is in play in teaching, there is no one-for-all solution that can be applied, but educators will have to carefully maneuver these 7 components to ensure that teaching with technology is done effectively. Technology will also be used differently when teaching different subject matters [11]. Due to this, it is imperative for teachers and educators to continuously learn and update their knowledge related to content, pedagogy, and technology to improve their TPACK from time to time.
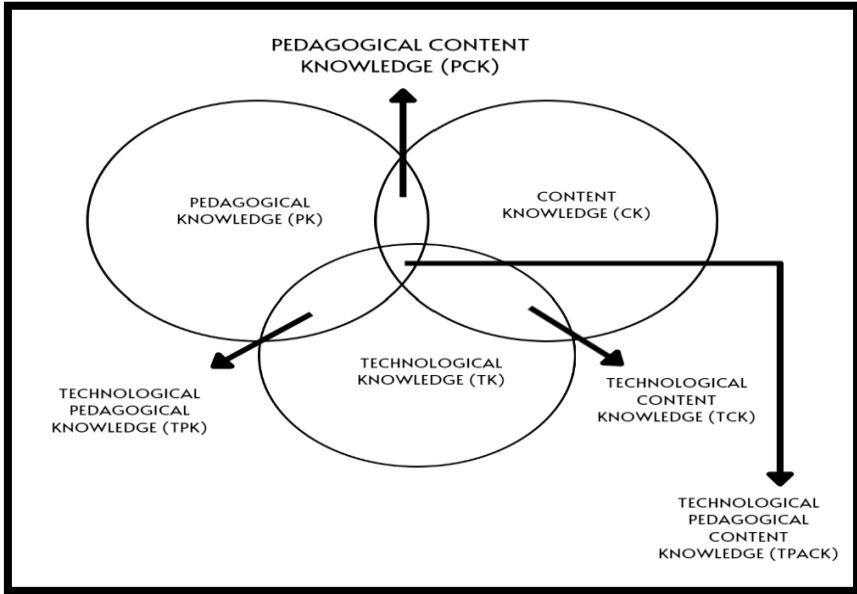
Fig. 1. The TPACK framework
Adapted from [10]. What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education, 9(1). 60-70.

In this 21st century, technology in education has become more advanced and sophisticated. Thus, the TPACK framework plays a more significant role in teaching as educators become more familiar with educational technology. On top of that, education today is also putting more emphasis on 21st-century skills, in which 21st-century learning aims to ensure that students not only master the subject matters but also learn the skills that are necessary for them to survive in the real world [12]. Due to this new shift in education, educators are not only required to integrate technology into their teaching, but they will also have to teach the students 21st-century skills. If integrating technology in teaching subject matters is already a challenge to educators, integrating technology and 21st century skills in teaching is a different challenge for them.

Therefore, another need is to update the TPACK framework, as teaching students holistically now has a new meaning. [13] started to develop a new TPACK instrument to accommodate the TPACK and 21st-century skills learning framework and concepts. In this new instrument, 21st-century skills such as critical thinking, creative thinking, collaboration, and communication were included and named TPACK-21 [14]. This new concept and instrument of 21st-century TPACK helped to measure educators' TPACK level further, and more studies need to be conducted related to 21st-century TPACK, as research in this area is still newly explored [8].

3   Method

This study was conducted using the quantitative approach, specifically using the survey design. These approach and design were chosen as TPACK involved a few dimensions that would confuse the respondents should the qualitative approach was chosen. The target population of this study was secondary school English language teachers, who are currently teaching in Selangor in the Petaling Perdana district. The sole reason this specific population was targeted was because the Petaling Perdana district has the most number of secondary schools compared to other districts, hence the possibility of gaining a large number of respondents was possible. However, not all English language teachers under this district were chosen to be included to help this study acquired fast responses from the respondents. Thus, a two-stage cluster sampling technique was employed to collect data required for this study. The data collection process was then carried out according to the number of sample size determined, which was 250 respondents. After the data collection process was done, this study managed to gather 225 respondents.

The instrument utilized in this study was a questionnaire adapted from two studies, namely from [15] and [14]. After the development of the adapted questionnaire, it was then validated using several measures, such as the Content Validation Index (CVI) and content Validation Coefficient (CVC), and then further measured by using the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The instrument's reliability was also measured using Cronbach's Alpha analysis, yielding a 0.984 reliability score, according to [16] is an excellent score for a reliability test.

Once the validity and reliability measures were done, the data collection procedure was conducted after obtaining permission from several departments. The respondents chosen to be involved in this study were contacted personally through emails and WhatsApp. Then, the link to the questionnaire (using the Google Form link) was distributed to the respondents for data collection purposes. Once the data were gathered, the data analysis procedure started using the SPSS version 26. Descriptive statistics and inferential statistics analysis (one-way ANOVA tests) were employed to analyze the data.

4   Results and Discussion
4.1   Results

After the data collection process was done, the responses from the respondents in this study were keyed in into the SPSS for data analysis purposes. In order to answer the two objectives of this study (1: to examine the significant difference between educators' education qualification and their level of 21st-century TPACK, 2: to examine the significant difference between educators' teaching experience and their level of 21st-century TPACK), an inferential statistics analysis which was the ANOVA tests were performed to determine whether there were any significant differences between these two variables on the respondents' 21st-century TPACK level.

4.1.1   Respondents' Demographic Profiles

Before the inferential statistics were conducted to achieve the research objectives, descriptive statistics analyses were performed first to determine this study's respondents' demographic profiles. The items involved were gender, years of teaching experience, and highest education qualifications. The table below shows the results of the analyses:

Table 1: Descriptive Statistics of Respondents' Demographic Profiles

Items		Frequency (f)	Percent (%)
Gender	Female	177	78.7
	Male	48	21.3
	Total	**225**	**100.0**
Years of teaching experience	Less than 5 years	95	42.2
	6 to 10 years	31	13.8
	11 to 15 years	12	5.3
	16 to 20 years	26	11.6
	21 to 25 years	24	10.7
	25 to 30 years	25	11.1
	More than 30 years	12	5.3
	Total	**225**	**100.0**
Highest education qualification	Diploma	3	1.3
	Bachelor's degree	147	65.3
	Master's degree	75	33.3
	Total	**225**	**100.0**

Table 1 above displays the descriptive statistics results of the respondents' demographic profiles involving gender, years of teaching experience, and highest education qualifications. Based on the table, there were 177 female respondents (78.7%) and 48 male respondents (21.3%). In terms of years of teaching experience, the highest category was less than 5 years (f = 95, 42.2%); meanwhile, the categories with the least number of respondents were 11 to 15 years and more than 30 years (both with f = 12, 5.3%). On the other hand, a majority of respondents in this study have Bachelor's degree (f = 147, 65.3%), while only 3 respondents (1.3%) have diploma as highest education qualification (f = 3, 1.3%).

4.1.2   Significance of Highest Education Qualifications and Years of Teaching Experience

A one-way ANOVA test examined the significant difference between educators' highest education qualification and 21st-century TPACK level. The hypotheses of this analysis were as per below, followed by the results:

H_0: There is no significant difference between the highest education qualification and the 21st-century TPACK level.

H_1: There is a significant difference between the highest education qualification and the 21st-century TPACK level.

Table 2: ANOVA Test Result for Highest Education Qualification on TPACK Level

21st-century TPACK Level				
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23.97	2	11.99	7.84	<.001
Within Groups	339.44	222	1.53		
Total	363.42	224			

The one-way ANOVA test compared the three highest academic qualifications on the respondents' 21st-century TPACK level. The three academic qualifications involved were a Diploma, a Bachelor's degree, and a Master's degree. There were no respondents with PhD qualifications involved in this study. Based on the test conducted, it was found that there was a statistically significant difference in the highest education qualification on the 21st-century TPACK level [F (2, 222) = 7.84, p < 0.05]. Therefore, this study rejects the null hypothesis.

Table 3: Multiple Comparisons (LSD) of Highest Education Qualification

Dependent Variable: 21st-century TPACK Level

(I) Highest Education Qualification	(J) Highest Education Qualification	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Diploma	Bachelor's Degree	.87	.72	.228	-.55	2.29
	Master's Degree	.19	.73	.789	-1.24	1.63
Bachelor's Degree	Diploma	-.87	.72	.228	-2.29	.55
	Master's Degree	-.68*	.18	<.001	-1.02	-.33
Master's Degree	Diploma	-.19	.73	.789	-1.63	1.24
	Bachelor's Degree	.68*	.18	<.001	.33	1.02

*. The mean difference is significant at the 0.05 level.

Table 3 shows the LSD test for multiple comparisons between the three highest education qualifications. Based on the results shown, the mean value of the Master's degree was significantly different from the Bachelor's degree mean value ($p < 0.05$). There were no statistical differences between Diploma and both Bachelor's and Master's degrees ($p > 0.05$).

Next, the ANOVA test for the second objective was conducted to examine the significant difference between years of teaching experience and 21st-century TPACK level. The hypotheses and results of the test are shown below:

H_0: There is no significant difference between the years of teaching experience and the 21st-century TPACK level.

H_1: There is a significant difference between the years of teaching experience and the 21st-century TPACK level.

Table 4: ANOVA Test Result for Teaching Experience on TPACK Level

21st-century TPACK Level	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.894	6	3.649	2.329	.034
Within Groups	341.521	218	1.567		
Total	363.415	224			

Table 4 portrays the result of the one-way ANOVA test between the years of teaching experience and the respondents' 21st-century TPACK level. Based on the table shown, there was no significant difference in the respondents' 21st-century TPACK level among the different groups of teaching experience with a result of $F_{(6, 218)} = 2.329$, $p > 0.05$. Hence, it is concluded that this study failed to reject the null hypothesis. Since there was no significant difference, the posthoc test result is not presented.

4.2   Discussion

This section will discuss the findings presented in the previous section. The discussion will be presented according to the research objectives of this study. Based on the findings above, it was found that there is a significant difference between the respondents' highest education qualification and their level of 21st-century TPACK. Meanwhile, no significant difference was found between the years of teaching experience and their level of 21st-century TPACK.

The result of the first research objective indicates the importance of the highest education qualification when it comes to the 21st-century TPACK. The mean difference between those with Master's degrees is more significant than those with Bachelor's degrees, indicating that having a Master's degree helps to improve one's 21st-century TPACK level. This result is similar to a study conducted by [17], which found that teachers with higher education qualifications had more significant and better results. Even though [17] study involved primary education teachers and early childhood education teachers, the comparison between this study and the current study shows that for educators to have a better level of TPACK or 21st-century TPACK, they must strive to pursue their education further because pursuing study means an opportunity to improve oneself in terms of knowledge, ability, and the chance to improve their technological abilities.

On the other hand, this study's second objective revealed no significant difference between the respondents' years of teaching experience and their level of 21st-century TPACK, indicating that no matter how many years of teaching experience a teacher has, it does not play a role in determining their level of 21st-century TPACK. Moreover, [9] supported the study regarding TPACK level, age, and years of experience did

not differentiate the study's respondents. However, one scoping literature review study, in particular, discovered that age and teaching experience influenced language teachers' perceptions regarding TPACK [18]. The different result from this scoping review might be due to the different focus of the study, in which it focused on the teachers' perceptions of TPACK rather than the teachers' level of TPACK. Regarding perception, teachers of different ages and teaching experience tend to differ due to the experience and knowledge they gather.

5. Conclusion

The findings showed a difference between the results of ANOVA tests for the English language teachers' highest education qualifications and their years of teaching experience. It is summarized that the highest education qualifications significantly differ between Master's and Bachelor's degrees, while there is no significant difference between the different years of teaching experience and 21st-century TPACK level. The study concludes that educators need to enhance their knowledge to ensure that they can keep up with current requirements in education, including using technology in teaching and learning. This study also shows that education institutions or education ministries need to devise a plan to encourage educators to pursue their studies further or plan professional development training for educators to have opportunities to gather new knowledge and learn new skills for teaching and learning in the classrooms.

This study was conducted not without limitations. First of all, this study only involved English language teachers and not teachers from other subjects, which might limit the interpretations of the results. It is recommended that researchers in the future include teachers from different subjects and compare to see whether any more meaningful results could be obtained. Another limitation was that the number of respondents for the highest education qualifications was not similar or close to one another, which may also hinder this study from obtaining more accurate results. Therefore, it is also suggested that future researchers do a stratified sampling to get more accurate results on whether there will be any significant differences between the different levels of qualifications. This study has provided further understanding of the importance of teachers' demographic backgrounds related to the 21st-century TPACK, in which it is concluded that education qualification plays a vital role in this regard. It is hoped that this study may pave the way for future researchers to explore different angles when investigating issues related to 21st-century TPACK.

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