ASSESSING VOCATIONAL HIGH SCHOOL EFL TEACHERS' TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE IN ONLINE LEARNING

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A B S T R A C T

During the Covid-19 pandemic, classroom activities are mostly conducted online using Information and Communication Technology (ICT). This situation requires teachers to be literate in technology for teaching. Some pedagogical methods and platforms are available to support learning activities and a number of constraints need resolving. This study aimed to investigate the empirical data of teachers' readiness for English education in vocational high school considering the technology integration in teaching and to uncover the obstacles. Teachers' readiness was assessed using Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) framework. Descriptive quantitative research was conducted to the members of the forum of vocational high school English teachers located in Surakarta. It was predicted that a number of English teachers participating in this research were not ready for technology integration in the future in spite of their strong desire to learn the technology. Based on the participants' responses, it was also crucial to have supports from educational institutions where teachers worked to provide relevant devices and encouraging atmosphere to enable technology-enhanced learning. It was predicted that students' primary impediments to learning with technology were the facilities and the teacher's pedagogical methods.

Introduction

The global phenomenon as the impact of the COVID-19 pandemic affects the world of education. At least 188 countries have closed or localized schools from March-April 2020 to avoid the spread of the COVID-19 coronavirus (Basilaia & Kvavadze, 2020; Atmojo & Nugroho, 2020; Rahardjo & Pertiwi, 2020). The face-to-face interaction between teachers and students could possibly transmit the viruses from infected people to others. In spite of the fact that young students have higher immunity and are at the least risk of coronavirus infection, they can pass on the virus to their families at home, especially the elderly and vulnerable. It happens since the virus can stay longer in droplets and even can change into vapour to transport airborne easily (Morawska & Cao, 2020). Therefore, it is recommended that social distancing be implemented in schools (Stifel et al., 2020).

The social distancing measures require schools to immensely adapt the education format from face-to-face classroom instruction to intense dependence on the internet-based learning process (Sandars et al., 2020; Atmojo & Nugroho, 2020). This online classroom activity will conceivably maintain the constructive relationship between teachers and students to enhance learning motivation (Yates et al., 2021). The reliance of learning process on internet connections requires that teachers get to grips with the relevant technology. Teachers need to be capable of integrating technology and pedagogy

as parts of knowledge construction and social interactions (Falloon, 2020; Bostancıoğlu & Handley, 2018). The need for technology-pedagogy integration calls for the readiness of both teachers and learners.

A number of studies on teacher readiness have been conducted both in general areas of education and specific subjects. Various studies discussed students' readiness, like what has been investigated by Wei and Chou (2020). Other researchers investigated elementary teachers' readiness (Andarwulan et al., 2021). Many others focused on readiness in the higher education sector (Tang et al., 2021). The settings of previous studies mentioned earlier were high schools in general, not vocational schools. Therefore, the aim of the study was to figure out the readiness of English teachers in vocational high schools in Surakarta to integrate technology into their learning process. The research questions are (1) To what extent vocational high school English teachers in Surakarta are ready for technology-pedagogy integration? and (2) How do the teachers receive external supports to improve their capabilities in the technology-pedagogy integration?

There is a growing need for the integration of technology in the classroom instructional process. With its rapid advancement, technology develops into a powerful means to promote student learning (Wekerle et al., 2020; Chun et al., 2016). The growing accessibility to mobile devices facilitates both teachers and students to interact and communicate beyond the physical classroom setting (Andujar, 2020; Mbukasa, 2018). In general, vocational high school teachers perceive positively the use of resources in Mobile-Assisted Language Learning (Sari & Sulistyo, 2022). Mobile phones and other similar gadgets allow students to independently select the subjects of learning and also to communicate with teachers and peers; hence the emergence of collaborative learning (Kukulska-Hulme & Viberg, 2018; Mbukasa, 2018; Efriana, 2021). Nevertheless, access to digital technology does not necessarily guarantee the success of the learning process. As the classroom manager, in addition to digital literacy teachers are required to possess adequate knowledge of the subject matter (content) as well as the teaching methodology (pedagogy) to ensure that the technology devices can be utilized in accordance with the instructional needs (Chun et al., 2016; Nazari et al., 2019). The incorporated framework encompassing those three aspects of technology, pedagogy and content knowledge was introduced as TPACK (Koehler & Mishra, 2006).

The history of TPACK's emergence dated back around 20 years prior to the introduction of the concept by Koehler and Mishra (2006). In the early days, teaching was closely related to the mastery of the subject matter or the knowledge of the content to be taught to students (Shulman, 1986). Gradually it was realized that knowledge of the subject matter was not enough and it was required as well for teachers to comprehend and become skilled at the teaching methodology. The competence of how to teach refers to the concept of pedagogy. Incorporating the knowledge of content and pedagogy enables teachers to effectively manage the learning process and successfully achieve the learning objectives (Shulman, 1986).

With the rapid development of technology, there was a demand to integrate the knowledge of technology and pedagogy. The notion of technology equipped the former paradigm of content and pedagogy, resulting in the new framework of TPACK (Technological, Pedagogical, and Content Knowledge) (Koehler & Mishra, 2006). The framework consists of the more detailed elements namely pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK), which overlap into technological pedagogical knowledge (TPK), technological content knowledge (TCK),

and pedagogical content knowledge (PCK). Those three overlapped areas resulted in technological, pedagogical, and content knowledge (TPACK), as presented in Figure 1.
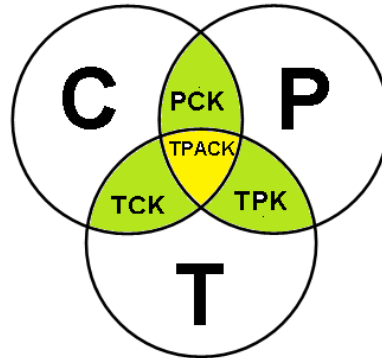
Figure 1. Technological, Pedagogical, and Content Knowledge Framework

TPACK framework can be adopted to assess the readiness of teachers encountering the challenges of the online learning process during the pandemic Covid-19. Readiness assumes that not only do teachers have adequate mastery of technology but they are also capable of integrating technological skills with both the knowledge of teaching methods and subject matter (Fuad et al., 2020; Sari et al., 2021). Moreover, it also incorporates the capabilities of teachers in deciding on teaching materials, conveying materials to students, and conducting an assessment (Sarwa et al., 2020; Nazari et al., 2019; Bostancıoğlu & Handley, 2018).

Research Method

The researcher employed a mixed method combining both quantitative and qualitative methods. The quantitative method was conducted by distributing a close-ended questionnaire consisting of 40 items. The qualitative method was conducted using interview. In the questionnaire, there are 8 items in the section of Technological Knowledge (TK), 3 items in Pedagogical Knowledge (PK), 5 items in Content Knowledge (CK), 4 items in Technological Pedagogical Knowledge (TPK), 2 items in Pedagogical Content Knowledge (PCK), and 7 items in Technological Pedagogical Content Knowledge (TPACK). Those 40 items were constructed in a Google Form and distributed online via social media WhatsApp. Five choices on a Likert scale from (1) "very low" to (5) "very high" were adopted to facilitate respondents to decide the most appropriate answer in relation to their real conditions. The formulation of 40 statements was adapted from the TPACK questionnaire developed by Bostancıoğlu & Handley (2018). The respondents were 35 English teachers selected using purposive sampling from Vocational English Teacher Forum in Surakarta, Central Java, Indonesia. Teacher demographic information is presented in Table 1.

Variable		N	Percentage
Gender	Female	28	80 %
	Male	7	20 %
School Status	Public	20	57 %
	Private	15	43 %

Table 1. Teacher Demographic Information

The data from the Google Form was then converted to Google Sheets to enable mathematical calculation. The Google Sheet data were then examined using descriptive analysis with the mean score to discover the level of readiness of teachers in integrating technology with other TPACK elements.

Based on the analysis of quantitative data, six teachers with the lowest and highest means were selected for further interviews. However, only five teachers were available for the interview, three from the lowest group and two from the highest group. One did not give any response to the request for an interview delivered through social media WhatsApp. Time constraints and online communication hindrances turned out to be the reason for that adjustment.

The interview was mostly conducted via telephone. The recorded phone conversations were then transcribed to facilitate further analysis. The conversation transcripts were analysed for common themes discovered in the cases of English teachers and students. The analysis of the interview results was selected to support the quantitative data collected from the questionnaire responses.

Results

In response to the impulsive implementation of online learning, teachers need to take quick and effective actions. In addition to technological challenges as the primary hindrances, the capabilities of teachers to manage online classes become a determining factor in learning achievement. Therefore, it is imperative that teachers be competent at incorporating technology with their content knowledge and pedagogical skills. The discussion of the finding is divided into two sections: quantitative and qualitative data.

Results of Quantitative Data (Questionnaire Responses)

The detailed responses to the Google Form questionnaire submitted by 35 teachers are displayed in Figure 2.
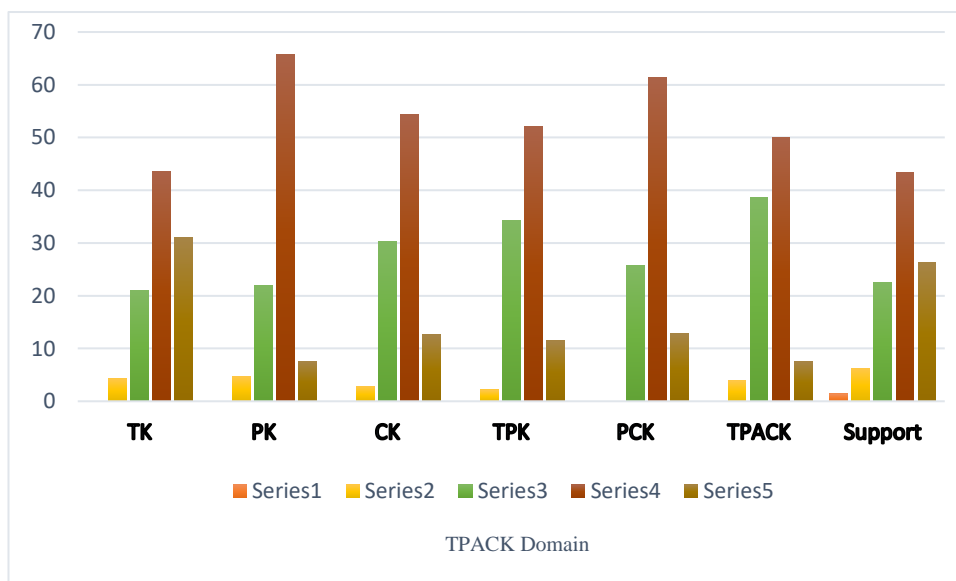
Figure 2. Questionnaire Results

The foot annotations of Series 1-5 represent the knowledge levels of TPACK domains as well as institutional support from very low, low, average, high, and very high, respectively.

It is obvious that most teachers perceived high level of knowledge levels in all TPACK domains (the three bars on the right). The lowest average was mostly observed in the domain of technological external support both from the government and institutions. The detailed responses are presented in Table 2.

No	Item	Very Low Level	Low Level	TOTAL
1.	Internet connection at school	-	-	**-**
2.	Internet connection at home	-	3	**3**
3.	Electronic infrastructures at school	-	1	**1**
4.	Facilities for virtual meeting at school	-	2	**2**
5.	Internet quota from government	1	-	**1**
6.	Internet quota from school	3	3	**6**
7.	Official LMS from school	-	2	**2**
8.	Academic Information System	-	5	**5**
9.	Official storage server from school	1	3	**4**
10.	Official G-Suites accounts	-	3	**3**
	TOTAL			**27**

Table 2. Technological External Supports

The result indicated a high level of dependency on the internet connection (need for support of internet quota) and official school ICT system (for academic information, data storage, and official account).

Results of Qualitative Data (Interview)

The topics for the interview were the challenges encountered by teachers during the pandemic-affected online learning, the strategies to overcome those challenges with or without technologies, and the number of support from educational authorities such as the ministry of education and school management. The challenges mainly stemmed from the students' conditions namely the availability of gadgets, appropriate internet connection, and motivation. Most teachers took personal approaches to students to solve their problems. Two teachers of the lowest level of readiness (the average below 3 on the 1-5 scale) mentioned similar challenges of students' lack access of to internet connection, inadequate data package and unavailability of gadgets.

Discussion

The official account for an institution like G-suite brings about a number of benefits such as wider opportunities for collaboration, customization of tools adjustable to the needs of the learning process, the effectiveness of the system, and security for restricted internal users (Vignola, 2017; Haratikka, 2020).

A low level of knowledge was identified as well in the domain of technology knowledge. Five and six 'low level' options were assigned to the capability of video

editing and the knowledge of computer hardware respectively. Few other items in other domains collected only one or two 'low level' responses. The list of low-level items is presented below in Table 3.

Domain	Item	Number of low-level responses
Technological Knowledge	Capability of audio-video editing	5
	Capability of using office applications in mobile phone	1
	Knowledge of computer hardware (mother board, RAM, internal storage)	6
Pedagogical Knowledge	Capability of selecting appropriate learning approaches	2
	Capability of assigning various tasks to students	1
	Capability of engaging students actively in the learning process	2
Content Knowledge	Writing skill	1
	Speaking skill	1
	Listening skill	1
	Cross-cultural understanding	2
Technological Pedagogical Knowledge	Capability of using technology to process data for learning evaluation	2
	Capability of using technology to foster students' critical thinking and creativity	1
TPACK	Capability of using technology to teach reading	1
	Capability of using technology to teach writing	2
	Capability of using technology to teach listening	2
	Capability of using technology to teach speaking	1
	Capability of using technology to teach grammar	1
	The capabilityCapability of using technology to teach vocabulary	1
	The capabilityCapability of using technology to teach pronunciation	1
	The capabilityCapability of using technology to teach cross-culturalcross cultural understanding	2
	TOTAL	36

Table 3. Low-Level Items in TPACK Domains

However, the total of 12 low-level responses in TK (Technological Knowledge) , which is significantly higher than other domains, does not necessarily signify that most teachers cannot utilize which is significantly higher than other domains does not necessarily signify that most teachers are not capable of utilizing technology in their teaching. It can be contrasted with the overall percentage of the TK domain, reaching the highest number of 80.29 %. The low-level competencies are revealed only in two items: the capability of audio-video editing and the knowledge of computer hardware, namely the capability of audio-video editing and the knowledge of computer hardware which might be of slight significance for online teaching. Quite the reverse, all respondents gave zero low-level answers to the capabilities of storing data in gadgets, using emails, playing

and recording audio-video files using gadgets, and using office applications on computers.

The only domain without any 'low-level' category of response is PCK (Pedagogical Content Knowledge). It shows that teachers perceived themselves to be ready for the implementation of pedagogical methodology in teaching the subject matter to their students. The summary of the overall percentage of TPACK domains is presented in Table 4.

Domain	Percentage
TK (Technological Knowledge)	80.29 %
PK (Pedagogical Knowledge)	75.24 %
CK (Content Knowledge)	75.31 %
TPK (Technological Pedagogical Knowledge)	74.57 %
PCK (Pedagogical Content Knowledge)	77.43 %
TPACK (Technological Pedagogical Content Knowledge)	72.21 %

Table 4. Overall Percentage of TPACK Domains

The summary in Table 4 above showed that most teachers were ready for the integration of technology in teaching English during the coronavirus outbreak.

Due to the scarcity of internet access, students tended not to respond to teachers' online instruction or not to give an immediate response. Such deferred communication forced the teachers to recontact students frequently so as to ensure that the instructions were clearly comprehended and students could give appropriate responses accordingly. At times teachers had to visit students' houses in person to monitor the real condition. During the home-visit activities, they often discovered that students' families lived below the standard of living – parents unemployed and no compatible gadgets. Occasionally, students had to share gadgets with other family members who made use of the gadgets both for educational and non-educational purposes such as family business.

Lack of support from parents also resulted in students' reluctance to engage in the learning process. Certain families from middle-low social status seemed to be not serious about guiding their children during the online learning process. When teachers visited them at home, some parents were caught in the act of hanging out with other parents without any important purpose. Taking into account the negative examples from their parents, students preferred to play games and access irrelevant channels or websites through their gadgets.

One teacher with the lowest level of TPACK percentage realized that she herself was not skilful at utilizing technologies in her teaching. When asked about several online educative games such as Kahoot! and Quizizz, she admitted that she had never learned how to use them. She had never organized any virtual meeting like Google Meet because of students' lack of participation even in Google Classroom. As a consequence, the teacher made use of WhatsApp groups to manage her online classroom.

One teacher with a high level of TPACK reported that he had no problems with classroom management since he established a systematic online classroom using Microsoft Teams where he could easily deliver tasks and assignments and conduct virtual meetings with students. The only problem he had was the students' unstable internet connection. He recommended that students find a better location with a strong internet connection.

The responses to the statements provided in the questionnaire of TPACK readiness distributed to vocational high school teachers revealed that on average those teachers are ready to implement TPACK in their learning activities in the classroom. The relatively high percentage of the scores 80,29% in the Technological Knowledge section confirmed that most teachers have mastered digital devices and technologies used in learning-teaching activities. Most of them are capable of utilizing and developing teaching media in both audio and video formats. It affirms the need for the contemporary learning-teaching process for the application of technology as it is beneficial to engage students to actively participate in the classroom (Pusparini & Astuti, 2019).

The mastery of technology, however, is not necessarily sufficient for effective implementation in the classroom context. As stated by Koehler & Mishra (2006), it is necessary to ensure the proper use of technology in a suitable educational context. Therefore, teachers are required to master the technological pedagogical knowledge (TPK) as well in their instructional activities.

The lowest percentage of the questionnaire item is shown in the aspect of institutional support. The item of internet quota assistance provided by the institution is only 68.57%. It indicated that teachers need more support from the institution to enable them to appropriately incorporate technologies in their teaching practices. Accordingly, it is imperative for the stakeholders including school owners and the government to provide adequate internet connection for education. This calls for the establishment of mutual networked school communities to achieve the best outcome of technology implementation for education (Finger & Lee, 2010).

Conclusion

It can be concluded that most vocational English teachers are ready to integrate all aspects of TPACK namely technological, pedagogical and content knowledge during the pandemic-affected online learning. The problems mostly derive from students. A number of students do not enjoy adequate gadgets required to engage in online learning. Most students have limited access to internet connection and internet quota.

There is a strong need for the provision of public internet access points and subsidies in the form of internet data packages. It is suggested that the government provide public facilities to support free internet access for students. It is expected that the public hot spots will provide free and strong internet connections for students to enable them to more actively engage in the online learning process. It is also recommended that the minister of education transfer a certain amount of internet data package for students to ensure that they can enjoy internet-based distance learning.

There are several limitations of the study. First, the small number of respondents might not represent the bigger population of English teachers. It is advisable that further research involves more respondents from either the same city or other cities from the same province. Moreover, a number of items in the questionnaire do not clearly elaborate on the aspects of TCK (Technological Content Knowledge). This aspect needs to be incorporated into the questionnaire so as to comprehensively portray the real condition of TPACK capabilities.

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