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The role of technological pedagogical and content knowledge on career adaptability among teachers in Indonesia and Malaysia

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ABSTRACT

Since the COVID-19 pandemic, face-to-face learning has been transformed into online learning. This phenomenon was really challenging for teachers because they were not used to it. The adaptability of the teacher becomes an indispensable aspect to face the problem. The ability to integrate materials, pedagogy and technology or technological pedagogical and content knowledge (TPACK) supported the adaptability in implementing online learning. The purpose of this study was to investigate the impact of TPACK on professional adaptability. A sample of 457 junior and senior high school teachers in Indonesia and Malaysia completed the technological pedagogical and content knowledge scale and the career adaptability scale. Based on partial least square analysis, this study found that TPACK played a role in predicting four dimensions of career adaptability: concern, control, curiosity, and confidence. This structural model was also supported with path analysis. Therefore, TPACK becomes an essential aspect in influencing teachers' career adaptability.

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1. INTRODUCTION

Careers are influenced by various contextual factors such as culture and national conditions, economic issues, political climate and personal variables such as interpersonal relationships [1]. All these situations require individuals to adapt with different roles and transitions in order to manage life and achieve certain goals [2], [3]. One of the psychological concepts used to explain these problems is known as career adaptability.

Career adaptability is defined as a set of attitudes, competencies and behaviors used by individuals to adapt themselves with the appropriate jobs [4], [5]. Career adaptability is a multidimensional construct, made of various dimensions reflecting diverse kinds of aspects in personality, motivation, preparedness, strength, behavior and attitude [6]. Career adaptability dimensions include concern (envisioning and preparing the future), control (skills in decision making), curiosity (self-curiosity and getting to know various work options) and self-confidence (believing in one's ability to face challenges) [5]. Specifically, concern refers to one's concern in having the career into the future by preparing own self in every situation that might happen. Control refers to one's control by being responsible in shaping the self accordingly with the work demands. Curiosity is the drive to having a knowledge about the job so it can affect behavioral and role changes according to the work demands. Confidence refers to believing in one's self and having a hope in

solving complex career problems. Career adaptability is regarded as the key to achieve success in the current ever growing modern society. People with high career adaptability can make a good decision in improving their career environment and prepare themselves for all the changes that might happen in that environment [2]. According to career construction theory, career world is shaped through personal and social construction [4]. Later, people will adapt to finish their tasks by anticipating, transitioning, and handling work pressures both in expected and unexpected conditions.

The need for adaptations in working environment is highlighted by the global COVID-19 pandemic, happened in 2020, especially in educational sector. People in school were forced to face a new challenge. To reduce the spread of COVID-19, the education institution switched the face-to-face learning to e-learning using available educational platforms [7], [8]. This phenomenon resulted crisis-response migration with online learning as the educational platform. At the beginning of the COVID-19 pandemic, online learning was seen as difficult not only by students but also by teachers.

Both teachers in Indonesia and Malaysia reported difficulties in shifting learning process from face to face to online learning, especially due to teachers' limited ability in using digital technology devices. Teachers sometimes have limited experience in using digital technologies for teaching [9], whereas deciding on learning methods that are appropriate and relevant for online learning highly depends on the teachers' skills and mastery of the information and communication technologies [10]. For this reason, the shift from face-to-face to online learning is seen as a source of stress for teachers [11].

The COVID-19 pandemic highlighted unprecedented challenges that forced teachers to adapt to online learning environment [12]. This change in environment also created problems for teachers' career. Learning processes were hindered, as also the services given to students due to difficulties in having direct contact. Moreover, stress were heightened since teachers were demanded to master various skills in short period of time. Within the online learning process, the emerging question is how do teachers' competencies and training in digital competencies contribute to teachers' mastery in facing challenges [12]. During the mentioned situation, teachers were encouraged to have career adaptability. With career adaptability, teachers are more ready to handle unexpected career-related tasks [4]. Hence, the environmental shift demands in teachers' working mechanisms can be handled well.

In online learning, teachers need to have various competencies such as technical competencies, online environment management, and online interaction [13]. Career adaptability in online learning is greatly influenced by teachers' ability to integrate materials and teaching with technology, or what is known as the technological, pedagogical and content knowledge (TPACK) framework. It is implied that online learning is highly dependent on technology. Online learning can be achieved through online chat, video conferencing using Zoom or Google Meet, or a combination of both [14]. Although online learning had several advantages during the pandemic, such as convenience, accessibility [15], and flexibility [16], there are still disadvantages and unresolved issues related to online learning.

Various issues faced during online learning were identified such as the lack of facilities support, unprepared teacher in organizing e-learning, and difficulties in delivering material. The available facilities were found not meet the requirements of online learning such as bad internet connectivity [8]. Many teacher were unprepared in organizing e-learning which represented in teachers' inability in using technology [14]. Teachers also met various challenges in delivering material such as how to explain materials online [14], inefficiency [15], more time taking [16], and difficulties in teaching practical subjects [17].

Three things that need to be achieved in online learning are related to the online learners, materials (contents), and the teachers [18]. In terms of the online learners, teachers need to understand their students' hope, preparedness, identities and their participations. In terms of materials, there are four things need to be addressed: i) the need to develop the materials, ii) the need for multimedia integration, iii) the need to implement learning strategies in materials development, and iv) considerations for materials development. Teachers are responsible to prepare and plan the materials for online classes. Learning materials are not simply copied from face-to-face learning to online learning. Teachers still need to integrate the content, pedagogical considerations, and technology while designing online classes [19]. Teachers need to have a knowledge on which technology is appropriate for online learning activities. Lastly, from the teachers' perspective, teachers need to transition from face-to-face to online, manage time, and adjust the teaching styles [18].

Based on these explanations, it is clear teachers' ability in integrating learning materials, pedagogical methods and technology related to TPACK is very encouraged. Technological, pedagogical, and content knowledge (TPACK) is the knowledge that is needed by the teachers to create effective technological integration to learning process. TPACK framework emphasizes the relations between teachers knowledge with the contents, pedagogical methods, and technology to create an effective learning environment [19].

TPACK development by teachers is important to create effective learning with technology. The TPACK framework is explained by the interaction of three fundamental knowledge: content, pedagogy and

technology. Moreover, there is interaction between the components, pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technology, pedagogy, and content knowledge (TPACK). The interaction between all the components produces the kind of knowledge needed to achieve better technology integration during the learning process [9].

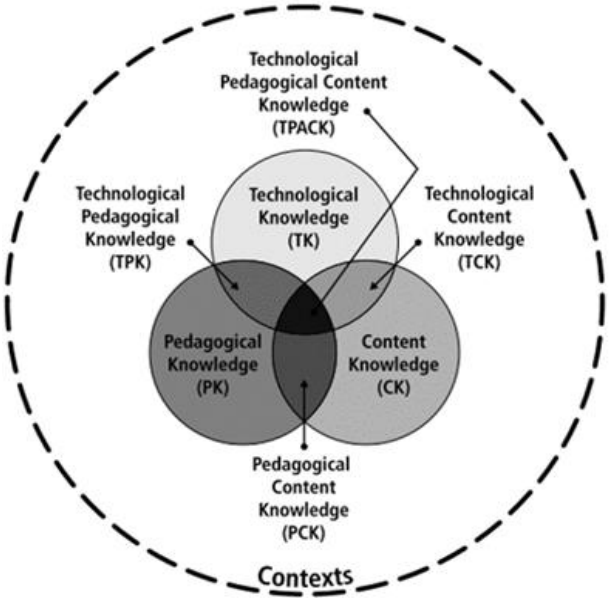

Figure 1. Technological pedagogical content knowledge (TPACK) framework [9]

TPACK framework was built upon seven elements and explained seven teachers' knowledge domains as the heart of a good learning process [9], [19]. TPACK domains are depicted in Figure 1.

a. Content knowledge (CK) or knowledge related to content is teachers' knowledge regarding course materials that are being taught or learned. Teachers need to understand the depth of fundamental knowledge of the subject they are teaching. Teachers also need to have an understanding on how each subject might have different characteristics for each content. When the teachers fail to have a deep knowledge, students are affected by receiving incorrect information.
b. Pedagogical knowledge (PK) pedagogical knowledge is teachers' knowledge on teaching and learning processes, practices, and methods. These knowledges include knowledge in class management, evaluation, development, teaching plans and students' learning process.
c. Technological knowledge (TK) is knowledge on using technology and information. Teachers need to have a vast understanding in informational technology to be able to implement them productively in their workplace and daily life settings, to know when informational technology can help achieve goals and to keep adapting to informational technology growth and changes.
d. Pedagogical content knowledge (PCK) is teachers' skills in interpreting learning materials, in looking for various ways of presenting the materials and in adjusting the materials with students' previous knowledge. Pedagogical content knowledge is different for each content area, since it integrates content and pedagogy for the goals of developing better teaching practices for each content area.
e. Technological pedagogical knowledge (TPK) refers to knowledge on how various technologies can be used for teaching and understanding that technology use can change teachers' teaching methods in class.
f. Technological content knowledge (TCK) refers to how technological knowledge can make novel specific representations. This knowledge shows how teachers can understand and change students' ways of concept learning and understanding within one content area.
g. Technological pedagogical content knowledge (TPACK) refers to knowledge needed by teachers to integrate technology in teaching within every content area. Teachers need to have intuitive understanding on complex interaction between three fundamental knowledge (CK, PK and TK) by presenting contents using the appropriate methods and pedagogical technologies.

The ability to adapt is very important for teachers, especially when they have to face unpredictable changes, such as the shift from face-to-face to online learning. Other factors that support teachers' adaptability in learning are their mastery of technological, pedagogical, and content knowledge (TPACK). It

is important to learn how TPACK is related to and can influence teachers' professional adaptability. Knowing that both play a big role in supporting learning success and that online learning skills are still needed and continue despite the subsided pandemic, this research aims to investigate the influence of technological, pedagogical, and content knowledge (TPACK) on teachers' career adaptability.

Based on the previous explanations, this research purpose is to examine how technological, pedagogical, and content knowledge (TPACK) affects teachers' career adaptability by assessing the influence of technological, pedagogical, and content knowledge (TPACK) on teachers' career adaptability dimensions in Indonesia and Malaysia.

2. METHOD

2.1. Research design

This research employed a quantitative approach with a survey design. The research population are teachers spread in Yogyakarta-Indonesia and teachers in Peninsula Malaysia. Research sampling was acquired with criteria as follows: i) Junior and senior high school teachers in Yogyakarta (Indonesia) and Tanjung Malim (Malaysia); ii) willing to join in the research. This research involved 457 respondents ranging from 20-77 years old of age (M=35.545, SD=12.270). Respondents consisted of 304 Indonesian teachers (66.5%) and 153 Malaysian teachers (33.5%). Females made up the most respondents (n=336, 73.5%) compared to males (n=121, 26.5%). The sociodemographic of subjects can be seen in Table 1.

Data collection was conducted using survey method in the form of research scales. The instruments were administered online using the Google Forms. At the beginning of the survey, respondents were instructed to read the informed consent consisting of the study description, objective, participation risk, privacy management, respondents' criteria, and compensation.

Table 1. Sociodemographic of subjects (N=457)

Variables	Distribution	*n*	%
Gender	Male	121	26.50
	Female	336	73.50
Nationality	Indonesia	304	66.50
	Malaysia	153	33.50

2.2. Instruments

In this research, the Career Adaptability Scale (CAAS) and TPACK were employed. For Indonesian respondent, the Indonesian version of CAAS dan TPAK were used. Meanwhile the Melayu version were utilized for respondents from Malaysia.

2.2.1. Career adapt-ability scale (CAAS)

CAAS consists of 24 items with a total of four subscales [5], namely concern (e.g item 1: thinking about what my future will be like), control (e.g item 7: keeping upbeat), curiosity (e.g item 13: exploring my surroundings), and confidence (e.g item 19: performing tasks efficiently). Each subscale has six items and uses a 5-point Likert scale (5=strongest to 1=not strong). Career adaptability score was measured by calculating mean score from each dimension. The adapted CAAS-Indonesia [20] was used to measure career adaptability in Indonesian respondents. Meanwhile the adapted CAAS-Bahasa Melayu [21] using the back-to-back translation method [22] was employed in Malaysian respondents. Those two scales were found reliable and had a fit internal structure using confirmatory factor analysis. The specification of CASS is depicted in Table 2.

Table 2. Specification of CAAS-Indonesian and Malaysian form

Dimension	Items	Reliability of CAAS-Indonesian	Reliability of CAAS-Malaysian
Concern	1-6	.84	.86
Control	7-12	.85	.85
Curiosity	13-18	.83	.88
Confidence	19-24	.84	.89

2.2.2. TPACK scale

Technological, pedagogical, and content knowledge (TPACK) which consists of 24 items from Archambault and Crippen [23] was adapted into Indonesian and Malaysian by researchers according to the translation and cultural adaptation guidelines [24]–[26]. This scale measures respondents' evaluation on how

vast their knowledge in doing their tasks related to teaching. The responses consist of five options from (1) highly disagree to (5) highly agree. Each dimension in the TPACK consists of 3-4 items developed from definitions TPACK from Koehler and Mishra [9], and Shulman [27]. The distribution of TPACK items based on the respective subscales, along with Cronbach's alpha values of both nations are presented in Table 3.

Table 3. Distribution of TPACK Items and Reliability Indexes for Indonesia and Malaysia

Subscales	Items	α (Indonesian)	α (Malaysian)
Pedagogical knowledge	3, 10, 18	.811	.807
Technological knowledge	1, 7, 17	.841	.854
Content knowledge	2, 4, 13	.791	.824
Technological content knowledge	15, 20, 22	.819	.844
Pedagogical content knowledge	6, 9, 19, 21	.794	.831
Technological pedagogical knowledge	8, 12, 14, 16	.863	.877
Technological Pedagogical content knowledge	5, 11, 23, 24	.820	.879

2.3. Data analysis

The data was analyzed using partial least square structural equation modeling (PLS-SEM). This technique was chosen due to its compatibility in testing the association between new constructs, where there was a lack of support from previous studies. This research focused on the influence of TPACK elements, especially the 7th domain to four career adaptability dimensions. The 7th domain was chosen since it was the domain that integrates all three: pedagogical knowledge, content, and technology mastery. In evaluating the model, PLS-SEM viewed the model using the measurement model (how measured variables represent the construct) and structural model (how constructs are associated with each other) [28]. In PLS-SEM, the measurement model is also known as the outer model and the structural model is often referred to inner model. In this research, the outer model was evaluated using convergent validity, discriminant validity, and composite reliability. Meanwhile, the inner model was examined using path coefficient, coefficient determination, and predictive relevance.

3. RESULTS AND DISCUSSION

Based on hypothesis testing using PLS, the model outer results analysis can be explained from convergent validity, discriminant validity, and composite reliability. In term of convergent validity, second-order confirmatory analysis showed that most of the career adaptability and TPACK components have factor loadings > .70. Only one TPACK item has a factor loading below .70, which is item 5 ("I am able to modify my teaching styles based on students' knowledge and skills") with factor loading .692. This result indicated measurement constructs of this research have a convergent validity. Meanwhile in term of discriminant validity, cross loadings value for each career adaptability and TPACK components are bigger than their cross loadings with other dimensions. Based on these results, it is concluded that the research constructs have met the discriminant validity. Then, from terms of reliability, results of the composite reliability analysis are presented in Table 4, which shows each construct has a good composite score above .9.

Table 4. Composite validity scores

Construct	Composite reliability (rho_a)
Concern	.919
Control	.901
Curiosity	.923
Confidence	.912
TPACK	.857

The inner model results analysis can be explained from path coefficient, coefficient determination (R^2), and predictive relevance. As shown in Table 5, path coefficients analysis showed that TPACK influences all career adaptability dimensions (concern, control, curiosity, and confidence) directly, with positive direction and the effects are significant. These results were based on the positive sign of the path analysis coefficient and its value was bigger than 1.96 (t statistics > 1.96), with p-value < .05. More details on path analysis results are presented in Table 5. The coefficient of determination analysis of TPACK on all Career Adaptability dimensions showed a low score on control and medium on the other three (concern, curiosity, and confidence). The results are shown in Table 6. Based on the analysis conducted, Q^2 value was generated as a whole to gather information about the model's predictive relevance. This information can be seen in Table 7. Q^2 value measurements were calculated with the following formula:

$Q^2=1-(1-R_1^2)\ (1-R_2^2)\ (1-R_3^2)\ (1-R_4^2)$
$Q^2=1-(1-0.271)\ (1-0.244)\ (1-0.135)$
$(1-0.260)$
$Q^2=1-(0.729)\ (0.756)\ (0.865)\ (0.740)$
$Q^2=1-0.352774472$
$Q^2=0.647$

Based on the calculation, it was inferred that the Q^2 value on structural model is .647 ($Q^2>0$) which indicates the model has a predictive relevance and contribution as much as 64.7% of the TPACK on Career Adaptability. Structural model of TPACK on career adaptability is depicted in Figure 2.

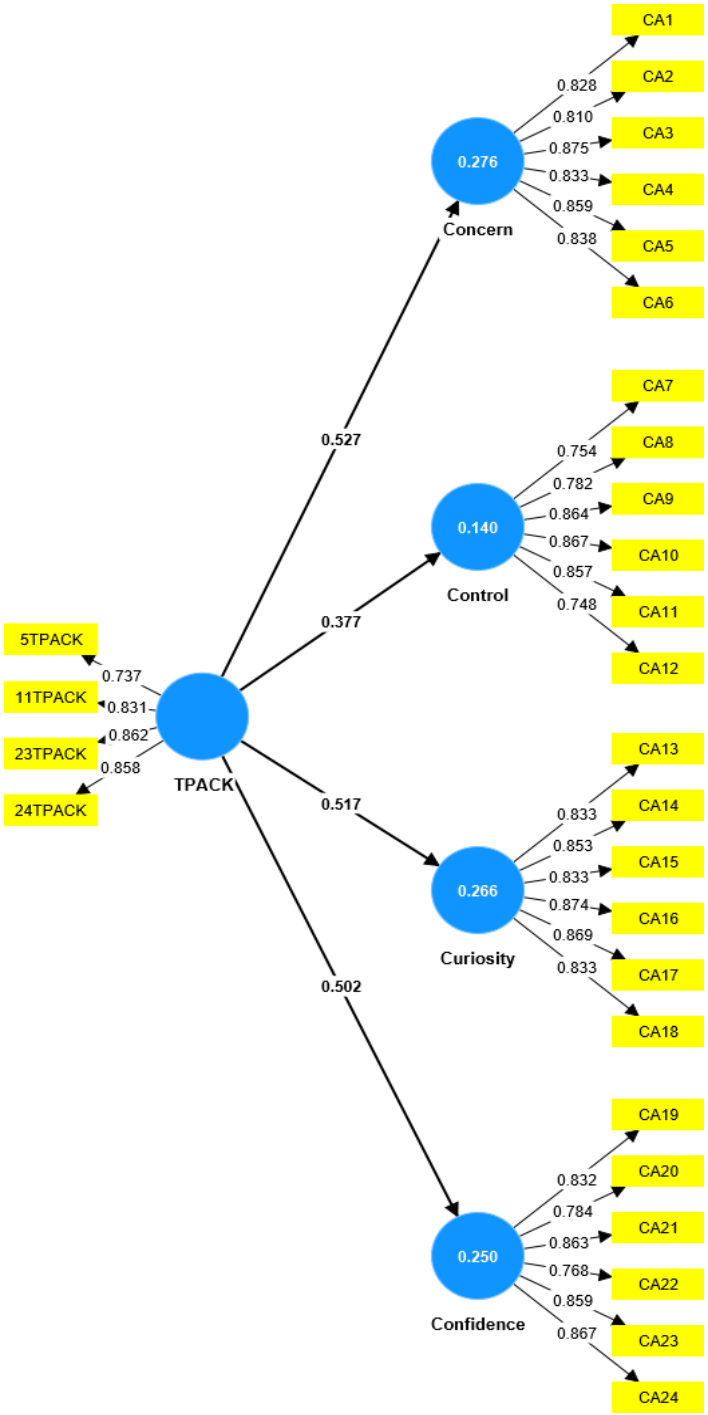

Figure 2. Structural model of TPACK on career adaptability

Table 5. Path coefficients of TPACK to career adaptability

Path	Original sample (O)	T statistics (|O/STDEV|)	P values
TPACK -> Concern	.527	16.086	.000
TPACK -> Control	.377	9.182	.000
TPACK -> Curiosity	.517	15.036	.000
TPACK -> Confidence	.502	14.303	.000

Table 6. R^2 Value of TPACK effects on career adaptability

Dimension	R-square	R-square adjusted
Concern	.278	.276
Control	.142	.140
Curiosity	.267	.266
Confidence	.252	.250

Table 7. Predictive relevance value (Q2)

Dimension	Q^2
Concern	.271
Confidence	.244
Control	.135
Curiosity	.260

This research argues that TPACK will have a role in predicting teachers' career adaptability in Indonesia and Malaysia. Working environment change has a significant implication on career characteristics and complexity as well as work demands [29], [30]. With the change, technology mastery is a very crucial matter to consider. COVID-19 pandemic had given workers a consequence, teachers included, to limit their interaction with other people. Teachers were faced with the challenge to manage online learning and to maintain communication by giving students their needed learning support [12]. Teachers' digital competency and their opportunities to learn digital competency have a significant role in determining teachers' ability to adapt with online learning after the school closure during the pandemic [12]. Teachers' competency related to technological mastery in managing their professional tasks is known as TPACK, teachers' digital competency that integrates technology and pedagogical development to create contents or materials that are going to be taught to the students.

Based on path coefficient analysis from Part Least Square, it was found that TPACK has a significant positive influence on all four career adaptability dimensions. These results were based on the positive sign of the path analysis coefficient and its value was bigger than 1.96 (t statistics>1.96), with p-value < .05. These results indicated that TPACK has a significant role for teachers' competency in Indonesia and Malaysia in handling issues related to challenges of integrated digital technology and pedagogical mastery. The need to continue learning process despite the limitation of teachers and students' interaction made technology use in learning as the inevitable choice. To improve teaching quality, integrating content and pedagogy with technology has become a main priority for teachers [31]. Teachers who have high TPACK competency will also have an efficacy to face career challenges and will be able to handle them well.

People use four sources of self-regulation (concern, control, curiosity, and confidence) to adapt with previously unknown complex problems, career-building transitions, and unplanned obstacles and phenomenon [32]. People could not always rely on organizational support mechanisms for career success, but they need to rely on their personal ability, career ability and their subjective career experiences [33].

In addition to the influence of TPACK, results also showed the value of this influence on concern as much as 27.6%, control 14%, curiosity 26.6%, and confidence 25%. The TPACK R^2 on each dimension of career adaptability is considered medium in strength (concern, confidence, curiosity) and weak (control). The coefficient of determination (R^2) reflects the level or part of latent constructs in explaining variances and therefore measures "good of fit" regression on manifest items gathered empirically [34].

Control dimension refers to individual need to give influence on career issues that are being the focus of concern [3]. Control also refers to individual ability to make decisions and be responsible on self-development according to their work. The small contribution of TPACK on control dimension implied that teachers' digital competency has not been enough for them to control and take responsibilities for their work and career issues. This is also much related to teachers' low belief in their ability to integrate technology, content, and pedagogy. Sudden career shift and rapid technology mastery demands make it difficult for teachers to take responsibilities in their decision making on things that are needed to be done in the learning process.

Individual belief in their ability and personal competence to handle challenging situation and stressful events is one important factor in career adaptability [35]. The possibility of limited belief in one's ability in mastering this technology causes digital competency such as TPACK only has a small impact on decision making responsibilities in handling career issues. On the other hand, TPACK has a medium influence on concern, curiosity, and confidence. With this TPACK contribution, it implies that someone who has high TPACK will have a career adaptability competency. Someone with good career adaptability is someone who cares about their future, is able to take control, always trying to prepare for the future and has a curiosity in exploring their abilities and possibilities in the future and is able to improve their self-confidence to pursue what they want [5]. The higher someone's career adaptability, the lower their turnover intention, the higher their performance, and the higher their career satisfaction and yearly income [36].

Predictive relevance analysis (Q^2) generated value as much as .657, with Q^2>.5 which according to [37], implied that TPACK on career adaptability model has a predictive relevance. This score can be read as the structural model of the career adaptability is built from 64.7% of TPACK and 26.3% from other unexplained variables. Model measurements with Partial Least Square showed that TPACK has a significant role in predicting teachers' ability in adapting themselves with various career challenges faced today and in the future. Career adaptability is a personal source of strength and capacity that can be used by individuals to solve unique, complex and unclear problems created by developmental tasks, work transitions and work traumas [5].

Looking further, TPACK that underpins teachers' career adaptability during the transition from face-to-face to online learning during the COVID-19 pandemic has further implications for mental health. It was found that career adaptability negatively predicts mental health problems [38]. Thus, a high adaptability career lowers the risk of experiencing mental problems. Other findings found that career adapability is indirectly related to life satisfaction [39].

4. CONCLUSION

Research results showed that TPACK has a role in predicting all four career adaptability dimensions. TPACK contributes medium strength in predicting concern, curiosity, and confidence with weak strength in predicting the control dimension. TPACK on career adaptability model also has a predictive relevance. Therefore, teachers need to improve their TPACK knowledge to be able to adjust themselves with various career challenges. Meanwhile, schools need to facilitate support for teachers especially in giving them opportunities and facilities to develop technology, content, and pedagogy integration mastery. Since TPACK mainly focus on the teaching elements, future researchers are suggested to investigate the role important psychological construct such as personality and motivation the studying the impact of TPACK on career adaptability. This could enhance the model as personal factors have been injected.

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