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TPACK in times of Emergency Remote Teaching: Status of Newly-Hired Public School Teachers

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Abstract. *This study aimed to evaluate the status of newly-hired public school teachers in terms of their TPACK Components and Emergency Remote Teaching (ERT) as indicated in their e-learning readiness, perceived effectiveness, attitude, satisfaction, and anxiety. Quantitative research particularly the correlational research design was employed in this study. Thirty-four(34) purposefully selected newly hired public school teachers were the participants of the study. Results showed that among the TPACK components, those that have technology integration were among the areas where teacher-participants need major improvement. Their ERT Readiness scores showed 55.5% of the teacher-participants scored low in e-Learning Readiness, 55.9% scored moderately in perceived effectiveness, 73.5% were neutral in terms of attitude towards ERT, 58.8% moderately satisfied with ERT implementation, and 61.8% showed no anxiety. Findings showed a moderately positive and significant correlation between perceived effectiveness and attitude ($r=.56$, $p<0.01$); satisfaction and readiness ($r=.35$, $p<0.05$), satisfaction and perceived effectiveness ($r=.34$, $p<0.05$), attitude and anxiety ($r=.34$, $p<0.05$), but strongly positive and significant correlation between satisfaction and attitude ($r=.69$, $p<0.01$). Moreover, in terms of relationship between TPACK Components and ERT Indicators, a positive and significant correlation were also showed between perceived effectiveness and PK ($r=.58$, $p<0.01$), CK($r=.50$, $p<0.01$), PCK($r=.48$, $p<0.01$), and TCK($r=.40$, $p<0.05$); and attitude between PK($r=.47$, $p<0.01$) and PCK($r=.39$, $p<0.05$The overall ERT readiness, where 56% of the teacher-participants scored low, is a product of the availability of ICT infrastructures in public schools, EdTech training, and pedagogical approaches in distance learning. It is recommended that the formulation of DepEd policies and programs are geared towards addressing these issues.*

Keywords: *TPACK, Emergency Remote Teaching, Technology Integration, e-learning readiness, perceived effectiveness, attitude, satisfaction, and anxiety.*

Introduction

With the onslaught of COVID-19 Pandemic, educational institutions in the entire world were forced to embrace Emergency Remote Teaching (ERT). On the part of teachers, they are likewise obligated to level-up and innovate their teaching practices particularly on technology integration; and to do it effectively, they are guided by the theoretical framework of Mishra and Koehler (2006) called the Technological Pedagogical and Content Knowledge (TPACK). However, prior to COVID-19 Pandemic, vast majority of public school teachers are not formally trained to conduct distance learning modality much so on ERT. Their teacher education training is focused more on the traditional face-to-face teaching instruction. Hence, to fill-in such gap in terms of perspectives of newly-hired public school teachers, the researcher is geared toward assessing the status and relationship of their TPACK components and ERT readiness.

TPACK is a theoretical framework which provides an analytical lens towards understanding the dynamic constrains and the transactional blend of content, pedagogy, and technology into the meaningfulness of teaching and

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learning (Mishra & Kohler, 2006). This highlights the importance of how technology relates to content knowledge and pedagogy (Kohler& Mishra, 2009) as cited by (Navarro, *et al.*, 2021). There are seven (7) components derived from the blend of the three forms, below are the summary explanations of these components:

1. *Content Knowledge* (CK) - expertise in terms of concepts, theories, frameworks, and practices and approaches about the actual subject matter that is supposed to be learned or taught.

2. *Pedagogical Knowledge* (PK) - in-depth knowledge about the process, practices, and methods of teaching and learning.

3. *Technological Knowledge* (TK) - skills and ability to adapt on standard and digital technologies.

4. *Pedagogical Content Knowledge* (PCK) - understanding appropriate teaching approaches, strategies, and/or methods applicable to a specific discipline and learners' developmental stage.

5. *Technological Content Knowledge* (TCK) - expertise on how to use technology in creating experiential representation to a specific content.

6. *Technological Pedagogical Knowledge* (TPK) -able to employ appropriate technology to a specific teaching method and understand that technology may change how teachers teach.

7. *Technological Pedagogical Content Knowledge* (TPACK) –intuitive understanding of the complex blend of the three forms by way of teaching content using appropriate pedagogy and technology.

Instead of just learning what or how to use specific technological tools, teacher training must be focused on harmonizing content, pedagogy, and technology since these three are very vital (Navarro, *et al.*, 2021). Study findings of Jaipal & Figg (2010) also revealed that emphasis to teacher support must be on the aspect of instructional design (guidance in planning) and implementing specific technology-enhanced lessons. The Structural Equation Model developed by Gozum & Demir (2021) showed that TPACK components are directly and positively affected by the TPK and TCK components. However, they pointed that TPK, TCK, and TK should be evaluated together; because examining only the individual TK, or TPK and TCK separately without examining the TPACK result as whole might create controversial circumstances to an institution's teaching training programs. Findings of Pamuk, et al (2013) argued that the relationships among TPACK components are poorly defined and more complex. Core components (TK, PK, CK) had direct impact to TPACK development but the effect of core components is indirect to the secondary components (TPK, TCK, PCK).Pamuk, et al (2013) suggested that power of relationships among TPACK components and their respective hierarchy must be included in modeling and revising TPACK. Varying results of TPACK components is likewise credited to various context such as the subject, school level and education culture. Thus, the transfer of knowledge from each of the TPACK components must be addressed deliberately so that specific teacher training suits to their individual need and opportunities (Schmid, *et al.*, 2020).It is evident also that the complex interplay on the knowledge of each TPACK components is a predictor to teachers' self-efficacy beliefs (Abbitt, 2011; Lehtinen & Viiri, 2016).

Because of the ongoing impact of COVID-19 Pandemic, emergent TPACK training model is developed to illustrate the current learning process of both pre-service and in-service teachers, to set systematic response, and to meet the demand on cloud- and web-based sustainability and online classroom systems (Cheng, *et al.*, 2022).Technology development is changing rapidly and the need for technology learning to teachers must constantly be honed and developed. Thus, for TPACK theory to thrive in the post-pandemic era, alternative teaching

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approaches which are geared toward catering students' 21st century skills are highly recommended (Santos & Castro, 2021).

Hodges, et al. (2020), who formalized the term "Emergency Remote Teaching (ERT)", poised that ERT is a temporary shift to alternative mode of teaching delivery due to crisis circumstances such as natural calamities and public health emergency. Its main objective is not to create another robust educational ecosystem; instead, it is aimed at providing temporary access to instruction and instructional support in order to mitigate the abrupt change to the new set-up out from readily available resources given the current situation being faced. Moreover, critical to the success of ERT is on harmonizing teaching and learning strategies with more flexibility towards national curriculum (Rasmatadila, *et al.*, 2020). Thus, curriculum modification and streamlining are necessary when ERT arises. In the context of Philippines K to 12 curriculum, Most Essential Learning Competencies (MELC) were in place as a response in addressing the challenges of the current pandemic and as a mechanism in ensuring learning continuity specially to disadvantaged learners (DepEd, 2020). Case study of Chuah & Mohamad (2020) highlighted that the teachers' main struggles in terms of ERT is on how far they are in doing extra effort to design lesson exemplars that are far more reachable by learners who are in different learning environments at home, which at some point, may not be conducive for learning. Hence, flexibility in students' experiences, facility and delivery of appropriate teaching instruction, and lessening the face of uncertainty, perturbation and despondency by way of coordination to various sectors are key ingredients in modeling successful conduct of ERT (Abdulrahim & Mabrouk, 2020).

Policy provisions and memoranda regarding the implementation of ERT in the Philippines are anchored at implementing clear guide on the basic education learning continuity plan ensuring that teaching & learning is still at full force while also protecting the health, safety, and well-being of learners, teachers, and school administrators (DepEd, 2020). DepEd had provided options in implementing ERT such as distance learning (online, modular, educational TV, and/or radio-based instruction), blended learning, and face-to-face learning in low risk areas; however, preferred learning modality depends upon the result of the assessment that every school underwent. 2020national survey of DepEd showed that 8.8Mof the parents preferred modular distance learning, 3.9M blended learning, 3.8M online distance learning, 1.4Meducational TV, 900Kradio-based distance learning, and almost 500Kother learning modality (DepEd, 2020). Furthermore, it was only in the later months of 2021 where face-to-face learning was implemented (DepEd, 2021).Preparation of self-learning modules (Agayon, *et al.*, 2022; Bayuca, 2021; Dangle& Sumaoang, 2020; Felisimo & Michell, 2021; and Gueta & Janer, 2021), internet connectivity (Sari & Nayir, 2020; Tarrayo, Paz, & Gepila, 2021), technical and human resources (Albó, *et al.*, 2020; Sari & Nayir, 2020), student engagement (Ezra, *et al.*, 2021; Petillion & Stephen, 2020),and parental involvement (Cahapay, 2021; Jothinathan, *et al.*, 2021; Raguindin, *et al.*, 2021; Safriyani, *et al.*, 2022; and Ferri, *et al.*, 2020) are among the challenges experienced by public school teachers in the conduct of ERT.

There are a number of teachers' traits to which ERT becomes effective. On top of it is readiness, whichis measured based on the availability of e-learning infrastructures and the ability of teachers in using and managing learning management systems (Alqabbani, *et al.*, 2021; Martin, *et al.*, 2019).Study of Ventayen (2018) showed that DepEd teachers are ready for online learning; however, ICT infrastructures still need major development (Nuncio, *et al.*, 2020; Galeon, *et al.*, 2019; Arinto, 2016).Second is the teachers' satisfaction with their ERT experiences as such is crucial specially in continuing the use of high-impact e-learning. Also, teachers' satisfaction proved to be essential factor in influencing their ability to employ a learning management system and their perceived quality performance (Yengin, *et al.*, 2011 as cited by Alqabbani, *et al.*, 2021).Another is teachers' perceived level of effectiveness towards the implementation of ERT. Report of Valsaraj, *et al.* (2021) showed that teachers' opinion on the perceived effectiveness of online teaching before and after ERT indicated that online teaching cannot replace classroom teaching, but it does supplement the classroom, and teachers do not consider online teaching as the only avenue for future mode of learning delivery. Beattie, *et al.* (2021) also concluded that teachers perceived ERT as less effective

as compared to face-to-face instruction. Fourth is the attitude, which is categorically referred to as personal viewpoint or opinion of teachers towards the conduct of ERT. In capturing the entirety of teachers' attitude, psychometric features such as the affective, behavioral, and cognitive dimension have to be put in context (Toraman, *et al.*, 2021). Findings of Salayo, *et al.* (2020) showed positive attitude and strong acceptance towards online learning. Last is the anxiety level of teachers. Studies showed existence of teachers' anxiety during ERT implementation (Aragasi & Pangandangan, 2021; Talidong & Toquero, 2020;Li, *et al.*, 2020). Significant contributions to the anxiety level are the abrupt change to usual routines, fears due to pandemic; and even occurrence of typhoons (Pan, 2020; Rocha, *et al*, 2021). Meanwhile, Li, *et al.* (2020) revealed that the condition on the prevalence of anxiety was not optimal. Also, teachers' have shared low anxiety level but showed reservations on the possibility of being infected with the virus(Aragasi & Pangandangan, 2021). Information source, worried level, fear level, and behavioral status are considered as significant factors on the overall management of anxiety (Li, *et al.*, 2020).Hence, occurrence of anxieties is still susceptible since the pandemic is not year over.

The rigor of teacher education training on most of the newly-hired public school teachers is inclined toward the practice of traditional method of teaching, and the emphasis of distance education and ERT is lesser to none. Evaluation of TPACK competent is likewise necessary as there are new and emerging TPACK models being tacked because of the ongoing challenge of COVID-19 Pandemic. It is then imperative to evaluate the perspective on how these newly-hired teachers were able to deliver their mandate.

Methods and Materials

Quantitative research particularly the correlational research design was utilized in examining the status and relationship of teacher-participants in terms of their TPACK components and ERT Readiness. A correlational research design is suitable when relationships of two or more variables are examined (Creswell, 2012). There were a total of 34 newly-hired public school teachers who are officially selected as participants of the study. 3 of it are from the kindergarten, 9elementary,11junior high school, and 11senior high school teachers of Balilihan District, Division of Bohol, Philippines. Newly-hired teachers are categorically defined as those who have 0-to-3-year teaching experience in publicschools. Purposive sampling technique was employed in selecting the participants since the researcher intended to choose newly-hired public school teachers.

The research instrument used is consist of three parts. First, the demographic characteristics of teacher-respondents. Second, the TPACK components which was adopted with no modification from Santos & Castro (2021). It has a total 37 questions wherein 4 questions were catered for TK, 7 PK, 4 CK, 5 PCK, 4 TCK, 6 TPK, and 7 TPACK. Third is the perceived ERT readiness adopted with no modification from Alqabbani, *et al.* (2021) which consisted of 5 sections intended to evaluate the teacher-respondents' e-learning readiness, perceived effectiveness, attitude, satisfaction, and anxiety level towards ERT implementation.

Descriptive statistics particularly the mean was also employed in presenting the summarized results of TPACK components. The frequency and percentages were used in describing the ERT indicators. Spearman's rho correlation coefficient was utilized in analyzing the correlational relationship between each ERT Readiness categories. For results to be considered as statistically significant, a p-value of ≤ 0.05 was used. SPSS Statistical software version 25 was used in analyzing the data.

Ethical Considerations

Consent from each of the teacher-participants was obtained first prior to the actual conduct of the survey. The purposes of the study and research objectives were included in the survey. Privacy and confidentiality of the

data were strictly observed all throughout the conduct of the study. Results were presented in summary form only, and the name and school where the teacher-participants are presently connected were excluded.

Results

Table 1 shows the summary for the participant's mean scores of each TPACK Components. Participants rated themselves to be highly knowledgeable in terms of their teaching methods and strategies (PK, M=3.44, SD=0.57), content expertise (CK, M=3.32, SD=0.58), and how they teach their content areas (PCK, M=3.37, SD=0.53). However, they rated themselves to be averagely knowledgeable with their skills and abilities on technological tools for instruction (TK, M=3.16,

Table 1. Descriptive Summary of TPACK Components

Component	Mean	SD	Verbal Interpretation
Technology Knowledge (TK)	3.16	0.50	has some knowledge
Pedagogical Knowledge (PK)	3.44	0.57	has strong knowledge
Content Knowledge (CK)	3.32	0.58	has strong knowledge
Pedagogical Content Knowledge (PCK)	3.37	0.53	has strong knowledge
Technological Content Knowledge (TCK)	3.16	0.59	has some knowledge
Technological Pedagogical Knowledge (TPK)	3.18	0.64	has some knowledge
Technological Pedagogical Content Knowledge (TPACK)	3.10	0.61	has some knowledge

SD=0.50), how to utilize appropriate technologies for a specific subject area (TCK, M=3.16, SD=0.59), proper integration of technologies for a meaningful teaching and learning (TPK, M=3.18, SD=0.64). Lastly, in terms of their knowledge on the complex blend of teaching content using appropriate pedagogy and technology (TPACK, M=3.10, SD=0.61), participants likewise rated themselves to be averagely knowledgeable.

Table 2. Frequency and Percentages in terms of the Levels of Readiness, Perceived Effectiveness, Attitude, Satisfaction, and Anxiety among Newly-hired Public School Teachers during the shift to ERT (N = 34)

Variable		*f*	%
E-Learning Readiness(scoring range 0 – 17)			
Low	(Score = 0 – 5.6)	19	55.9
Moderate	(Score =5.7 – 11.27)	13	38.2
High	(Score =11.28 – 17)	2	5.9
Perceived Effectiveness(scoring range 11 – 55)			
Low	(Score = 11 – 25.6)	0	0
Moderate	(Score =25.7 – 40.7)	19	55.9
High	(Score =40.3 – 55)	15	44.1
Attitude(scoring range 6 – 30)			

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Negative	(Score = 6 – 14)	8	23.5
Neutral	(Score =15 – 22)	25	73.5
Positive	(Score =23 – 30)	1	3
Satisfaction(scoring range 5 – 25)			
Low	(Score = 5 – 11.6)	3	8.8
Moderate	(Score =11.7 – 17.2)	20	58.8
High	(Score =17.3 – 25)	11	32.4
Anxiety(scoring range 0 – 21)			
No	(Score = 0 – 4)	21	61.8
Low	(Score = 5 – 9)	12	35.3
Moderate	(Score = 10 – 14)	1	2.9
Sever	(Score = 5 – 21)	0	0

As indicated in Table 2, the newly-hired teachers' e-Learning Readiness is low among 55.9% of the participants, while there are only 5.9% had high level. Also, 55.9% of the participants showed moderate level while 44.1% who indicated high level of Perceived ERT Effectiveness. Meanwhile, the attitudes of the participants towards ERT were mostly neutral (73.5%), only 23.5% indicated negative attitude and 3% positive attitude. 58.8% of the participants showed moderated satisfaction towards ERT, while 32.4% high and 8.8% low satisfaction. Lastly, anxiety results revealed that 2.9% had moderate anxiety as compared to 35.8% that had low anxiety, and 61.8% that had no anxiety.

Table 3 shows the correlations between the ERT Indicators namely the e-Learning Readiness, Perceived Effectiveness, Attitude, Satisfaction, and Anxiety. Spearman's Rho correlation revealed a significant weak positive correlation between e-Learning Readiness and Satisfaction ($r = 0.35$, $p < 0.05$), while no correlation was obtained with Anxiety. Moreover, there was also a significant moderate correlation between Perceived Effectiveness and Attitude ($r = 0.56$, $p < 0.01$), a significant weak correlation between Perceived Effectiveness and Satisfaction ($r = 0.34$,$p < 0.05$);however, no correlation was obtained for the Anxiety. Lastly, a strong correlation was obtained between Attitude and Satisfaction ($r = 0.69$, $p < 0.01$), while a moderate correlation was obtained for Anxiety ($r = 0.34$, $p < 0.05$).

Table 3. Correlation ***r*** among e-Learning Readiness, Perceived Effectiveness, Attitude, Satisfaction, and Anxiety among Newly-hired Public School Teachers during the shift to ERT

	Readiness	**Perceived Effectiveness**	**Attitude**	**Satisfaction**	**Anxiety**
Readiness	---	0.32	0.30	**0.35***	0.08
Perceived Effectiveness		---	**0.56****	**0.34***	0.06
Attitude			---	**0.69****	**0.34***

Satisfaction	---	0.24
Anxiety		---

**Correlation is significant at the 0.05 level (2-tailed)*
***Correlation is significant at the 0.01 level (2-tailed)*

Discussion

The results showed that the teacher-participants have strong TPACK knowledge related to content and pedagogical components; however, their TPACK knowledge related to technological components and the complex blend of teaching content using appropriate pedagogy and technology are not strong enough. This goes to show that teacher-participants need further improvement in aspects related to technology integration. Findings are in accordance with De Vera, et al. (2021)revealed that novice teachers have lacking competencies related to online instructional preparations; and teachers need to upgrade and expand their digital competence to ensure that there is an effective delivery of teaching and learning (Torrato, 2022).In fact, even prior to the shift to distance learning, technology integration is already a compelling issue in the classroom setting (Dotong, *et al.*, 2016).Another contributing factor why TPACK knowledge related to technological components is not strong enough is the lack of technology infrastructure built in most of the public schools here in the Philippines(Nuncio, *et al.*, 2020; Garcia, *et al.*, 2019; Galeon, *et al.*, 2019; Arinto, 2016; &Espinosa, *et al.*, 2011).

In terms of ERT Readiness, results showed that the majority of the teacher-participants (56%) scored low in e-Learning Readiness. This might be due to the sudden shift to ERT thus the majority of them are not prepared during in its first implementation. Report of Valsaraj, *et al.* (2021), showed that teachers' opinion on the perceived effectiveness of online teaching before and after ERT indicated that online teaching cannot replace classroom teaching; ICT infrastructures are again among the significant factor why a majority of the teacher-participants scored low in e-Learning Readiness (Nuncio, *et al.*, 2020).

While Beattie, *et al.* (2021) concluded that teachers perceived ERT as less effective as compared to face-to-face instruction, results in this study showed that 56% of the teacher-participants obtained a moderate score and 44% scored high in terms of ERT Perceived effectiveness. Even with the lack of proper planning during a time of emergency, teachers still perceived their teaching to be effective. Moreover, 74% of the teacher-participants are neutral with respect to their attitudes towards ERT. The result is in consonant with Salayo, et al. (2020)showed positive attitude and strong acceptance towards distance learning.

Furthermore, results showed that 60% of the teacher-participants are satisfied with the ERT implementation. Yengin, et al. (2011) as cited by Alqabbani, et al. (2021), stressed that teachers' satisfaction proved to be an essential factor in influencing their ability to employ a learning management system and their perceived quality performance. Lastly, 62% of the teacher-participants showed no sign of anxiety; and 35% showed a low sign of anxiety. The result is parallel to Li, *et al.* (2020) which revealed that the pandemic condition was not optimal with respect to the prevalence of anxiety.

Among the five significant correlational relationships between each ERT indicators, only the relationships between the (1) perceived e-Learning readiness and attitude towards ERT, and (2) attitude towards ERT and level of

ERT satisfaction showed a moderately strong positive correlation. The result obtained in this study is the same with a similar study conducted by Alqabbani, et al. (2021).

Conclusion

This study reveals that the aspect in technology integration needs to be focused as it shows as among the technological components of TPACK that is not fully mastered by the teacher-participants. During the conduct of ERT as an outright response to COVID-19 pandemic, it manifested teacher's e-learning readiness, perceived effectiveness, satisfaction, attitudes and anxiety. The overall ERT readiness, where 56% of the teacher-participants scored low, is a product of the availability of ICT infrastructure in public schools, EdTech training, and pedagogical approaches in distance learning. Thus, it is recommended that the formulation of DepEd policies and programs are geared towards addressing these issues.

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