

# Exploring Filipino Senior High School Teachers' TPACK in Emergency Remote Teaching

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**Abstract:** The study utilized the TPACK model to explore technology integration in emergency remote teaching. It measured the perceived level of TPACK among 45 Filipino senior high school teachers and identified the challenges related to emergency remote teaching. The results of descriptive survey indicated that teachers rated themselves highly in CK (M=4.38, SD=.62), PK (M=4.12, SD=.65), PCK (M=4.16, SD=.73), TCK (M=4.11, SD=.74). Average ratings were indicated for TK (SD=3.75, SD=.85), and TPACK (M=3.88, SD=.78). Qualitative descriptions of constraints and adjustment due to ERT were also described in relation to the different forms of TPACK. The study concludes that teachers need more help in learning how to harmonize content, pedagogy, and technology – rather than just learning what and how to use technology tools.

**Key Words:** TPACK, ERT, technology integration


## 1. INTRODUCTION

COVID-19 pandemic, an emergency global concern in public health started in China and sooner affected every country in the world, forced educational institutions to immediately shift to online and remote learning as a replacement for on-site delivery (Tria, 2020). In the Philippines, laws and government advisories prohibited face-to-face classes since the outbreak of the pandemic (DepEd, 2020). Most schools responded through emergency remote teaching (ERT), a temporary shift of instructional delivery focused on providing a quick setup for delivering learning in crisis situations (Hodges, Moore, Lockee, Trust, & Bond, 2020). As a response to crisis situation, ERT is characterized by technological (lack of devices and Internet connectivity), pedagogical (gaps in digital literacy, appropriateness of online learning for specific types of learners, limited online teaching and learning resources, learners' disengagement) and social challenges (limited teacher-student interactions, risk of inequality and vulnerability for the disadvantaged, readiness of families and parents to support online

learning) (Ferri, Grifoni, & Guzzo, 2020)

The shift from classroom to ERT placed new demands on teacher and exposed the need to upgrade teachers' competencies in technology integration. Prior to the opening remote K-12 classes, there were massive teacher training delivered to address their lack of readiness and competencies for distance and online teaching (Magsambol, 2020; Tadalán, 2021). A government survey indicated a low number of public school teachers being ready for distance learning: K-3 (30%), Grade 4-6 (28%), Junior High School (32%), Senior High School (8%), multigrade (2%) (DepEd, 2020). Problems related to access to computer and internet connectivity further compounded the readiness problem with: 13% of the teachers not having laptops or desktop at home; 41% of those with laptop or desktop at home have no internet connection; 10% have no internet signal in their area (DepEd, 2020).

Amidst the challenges, schools continue to upgrade both facilities and teachers' skills to



maximize available technological tools for the multiple delivery systems, which include: blended learning, distance learning (modular distance learning, online distance learning, TV/Radio-based instruction), homeschooling, and limited face-to-face instructions in low-risk areas (DepEd, 2020). For online and distance learning to be successful, teachers need to be prepared and become competent decision makers in designing the use of technology in their classrooms (Hughes, Cheah, Shi & Hsiao, 2020). Teachers need to know how to communicate digitally, integrate technology tools, design online instruction, assess students' understanding, and support student learning in an online environment (Williams, Schroer, Gull, Miller & Axelson, 2020). Related to this, there is also a need to understand how teachers navigate through the challenges of integrating technology in an emergency remote teaching context and environment to inform teacher support and professional development programs.

Technological and Pedagogical Content Knowledge (TPACK) provides a framework for understanding teacher knowledge needed for effective teaching with technology (Mishra & Koehler, 2006). It emphasizes the importance of understanding how technology relates to pedagogy and content (Koehler & Mishra, 2009). The framework argues that effective technology integration requires an understanding of the transactional relationship between content (CK), pedagogical (PK), and technology knowledge (TK) (Koehler & Mishra, 2009). Below is a brief description of the primary forms of knowledge and the intersections between them (Koehler & Mishra, 2009):

*Content Knowledge (CK)* - concepts, theories, frameworks, evidence and proof, and as well as practices and approaches for developing and establishing knowledge of a content area or subject matter

*Pedagogical Knowledge (PK)* - methods and processes of teaching and learning

*Technology Knowledge (TK)* – ways of thinking about and working with technology, tools and resources (ranging from high- to low-technologies)

*Pedagogical Content Knowledge (PCK)* – how to transform the subject matter for teaching, find multiple ways of representing content, adapting learning materials to students' prior knowledge

*Technological Content Knowledge (TCK)* – use of specific technology to change the way learners grasp and practice concepts in a given content area

*Technological Pedagogical Knowledge – TPK* understanding how the use of particular technologies change teaching and learning processes

*Technological Pedagogical Content Knowledge (TPACK)* – how to meaningfully and skillfully teach with technology

Competence in teaching with technology goes beyond competence in using latest tools (Koehler & Mishra, 2005). Integration of technology requires clear understanding of the complex web of relationship between users, technologies, tools, and practices. Using TPACK, the study explores technology integration in emergency remote teaching among Filipino Senior High School teachers. Specifically, it aims to answer the following:

1. What is the perceived level of TPACK among teachers engaged in emergency remote teaching during the pandemic?
2. What are the challenges related to emergency remote teaching in senior high school?

## 2. METHODOLOGY

The study employed a descriptive survey design. There were 45 participants from private ( $n=34$ ) and public ( $n=11$ ) schools recruited from the schools wherein the authors worked and have access to. The distribution of participants by subject areas is as follows: Science ( $n = 12$ ), Mathematics ( $n = 7$ ), English ( $n = 6$ ), Information Technology ( $n = 5$ ), Business ( $n = 3$ ), Social Sciences ( $n = 2$ ), Filipino ( $n = 2$ ), Health ( $n = 1$ ), and Not specified ( $n = 7$ ). The mean age is 29.31 years ( $SD=8.05$ ), and average years of teaching is 5.64 ( $SD=4.46$ ). All participants reported using internet-based tools.

### TPACK Survey

The survey instrument, based on the TPACK framework, included 24 items designed to measure what online teachers should know and be able to do related to the TPACK domains (Archambault & Crippen, 2009). Responses were scored using a 5-point Likert scale (1=poor, 5=excellent). The



Cronbach alphas reported during the instrument development were: PK=.77; TK=.88; CK=.76; PCK=.79; TCK=.69; TPK=.77; TCK=.78 (Archambault & Crippen, 2009).

The TPACK Questionnaire was transformed into an online survey using Google Forms. Open ended items inquiring about challenges related each of the TPACK domains, and as well, as demographic profile were included.

Quantitative data were analyzed using descriptive statistics, while qualitative data were content analyzed for descriptive themes (Creswell, 2014).

### 3. RESULTS AND DISCUSSION

#### TPACK Knowledge

Table 1 shows that the participants rated themselves to be highly knowledgeable about their content areas (CK, M=4.38, SD=.62) and their teaching methods (PK, M=4.12, SD=.65), while rating themselves as average in terms of knowledge of technological tools for instruction (TK, M=3.75, SD=.85). Consistently, the participants also rated themselves highly in terms of knowing how to teach their content areas (PCK, M=4.16, SD=.73), and understanding how to utilize specific technologies to facilitate subject-matter learning (TCK, M=4.11, SD=.74). They rated themselves average in relation to their understanding of how the use of technologies in particular ways can facilitate teaching and learning (TPK, M=3.79, SD=.81). And in relation to their knowledge of meaningful and skillful teaching with technology, they rated themselves as average as well (TPACK, M=3.88, SD=.78).

Table 1. Descriptive Summary of TPACK Scores

Knowledge	M	SD
Content Knowledge (CK)	4.38	.62
Pedagogical Knowledge (PK)	4.12	.65
Technological Knowledge (TK)	3.75	.85
Pedagogical Content Knowledge (PCK)	4.16	.73
Technological Content Knowledge (TCK)	4.11	.74
Technological Pedagogical Knowledge (TPK)	3.79	.81
Technological Pedagogical Content Knowledge (TPACK)	3.88	.78

#### TPACK-related Challenges

As the participants cope with the demands of ERT, they indicated challenges that they faced as they planned out meaningful combinations of content, technology, and pedagogy to facilitate effective teaching and student learning. The descriptions of the constraints and adjustments due to ERT are presented in relation to the different knowledge forms in TPACK:

##### Content Knowledge (CK)

CK refers to teachers' knowledge about the nature and coverage of the subject matter to be learned or taught (Koehler & Mishra, 2009). Participants reported challenges related to (see Table 2): (1) inconsistent, inappropriate, and limited teaching and learning materials; (2) varying levels of student prior knowledge; (3) adjusting content and standards:

Table 2. Challenges related to CK

Categories	Exemplar Statements
Inconsistent, inappropriate, and limited teaching and learning materials	"...there are certain topics/terms that sometimes have different meanings/definitions in books and websites." "We need more books... which are contextualized in our country so that student can relate more when answering problems." "...availability of resources."
Varying levels of student prior knowledge	"Not all students are at the same level of content knowledge, so it is hard to teach in a differentiated manner when the class is mixed..." "...how to simplify content for learner's understanding..."
Adjusting content and standards	"...dynamic changes in the curriculum in order to ensure learning continuity" "...adapting content and adjusting requirements so they can be done online..." "...so many topics to cover in a very limited time"

##### Pedagogical Knowledge (PK)

PK refers to teachers' knowledge of how students learn, classroom management, lesson planning, and student assessment (Koehler & Mishra, 2009). Table 3 includes the challenges related to pedagogical knowledge: (1) learning to teach remotely; (2) engaging students while they learn remotely; and (3) redesigning assessment strategies.



Table 3. Challenges related to PK

Categories	Exemplar Statements
Learning to teach remotely	<p><i>"I'm having a hard time deciding the best possible approach for students since they learn differently from each other"</i></p> <p><i>"The training I received...is based on face-to-face instruction"</i></p> <p><i>"Past active strategies seem to be ineffective now due to the pandemic"</i></p> <p><i>"It is difficult to know which teaching strategies are best to use or fit for the students, since conducting online classes have their limitations..."</i></p>
Engaging students while learning remotely	<p><i>"...some students be it synchronous or asynchronous meetings are unresponsive, making it more difficult to the teacher to know how to help the class..."</i></p> <p><i>"Face-to-face learning is better than online classes. Online class limits students' participation..."</i></p>
Redesigning assessment strategies	<p><i>"...circumstances are different, some assessment strategies may not be that effective or accessible..."</i></p>

### Technological Knowledge (TK)

TK refers to how teacher think about and utilize technology, tools, and resources productively at work and in daily life (Koehler & Mishra, 2009). In Table 4, technological knowledge-related challenges include: (1) unfamiliarity with technology tools and resources; (2) lack of troubleshooting skills; (3) limited access to equipment and resources; and (4) connectivity issues.

Table 4. Challenges related to TK

Categories	Exemplar Statements
Unfamiliarity with technology tools and resources	<p><i>"...needs more training, lectures in addressing technical problems..."</i></p> <p><i>"difficulty in identifying hardware problems and technical support for applications and software concerns..."</i></p> <p><i>"the applications are new so they don't want to explore it"</i></p>
Lack of troubleshooting skills	<p><i>"...having trouble fixing the audio connection, sometimes videos being played can't be heard by the students..."</i></p> <p><i>"...device/gadget malfunctioning during synchronous classes..."</i></p>
Limited access to equipment and resources	<p><i>"...limited equipment for teaching..."</i></p> <p><i>"I do not have funds to get better hardware..."</i></p> <p><i>"There are a lot of really nice applications but they are asking for money."</i></p>

Connectivity issues	<p><i>"slow/lack of internet connection for the students..."</i></p> <p><i>"problem with internet connection"</i></p>
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### Pedagogical Content Knowledge (PCK)

PCK refers to the concepts, processes, and procedures in teaching, learning, curriculum planning, and assessment in order to transform a subject matter for teaching and facilitating learning (Koehler & Mishra, 2009). Table 5 contains the PCK challenges related to: (1) contextualizing content; (2) identifying teaching strategies to best teach content; (3) difficulty in assessing and monitoring student learning; (4) managing virtual classrooms; (5) addressing diversity in learning needs and styles.

Table 5. Challenges related to PCK

Categories	Exemplar Statements
Contextualizing content	<p><i>"it is often difficult to relate concepts with other subjects"</i></p> <p><i>"it is hard to make them appreciate the subject and how useful it will be in the future..."</i></p> <p><i>"how to put into practice the content of the curriculum..."</i></p>
Identifying strategies to best teach content	<p><i>"My lack of expertise and knowledge in the subject that I teach is my biggest challenge."</i></p> <p><i>"...how to be keen enough to identify different learning styles of students, for them to realize the importance of each lesson..."</i></p>
Difficulty in assessing and monitoring student learning	<p><i>"It is hard to have feedback from students if they is confusion, compared with face-to-face you can easily observe their expressions and body language"</i></p> <p><i>"Some students will say they understand the instructions, but their outputs shows otherwise..."</i></p>
Limited teacher support	<p><i>"It's harder to guide the students due to lack of time, and as teachers were are trying to avoid overwhelming the students with online notifications"</i></p> <p><i>"It is hard to attend to student one-by-one in the new setup"</i></p>
Addressing diversity in learning needs and styles	<p><i>"It is very hard to send feedback on student performance...and correct misconceptions with self-learning modules..."</i></p> <p><i>"...difficult to make students unlearn a wrong approach in problem solving..."</i></p>

### Technological Content Knowledge (TCK)

TCK refers to teachers' understanding of what specific technologies are most effective for subject-matter learning, and how both technology and



content can change and influence each other (Koehler & Mishra, 2009). In Table 6, the challenges related to TCK include: (1) lack of ability to use technological representations; (2) limited awareness of available technological tools; (3) perceptions about the mismatch between technological tools and nature of subject-matter.

Table 6. Challenges related to TCK

Categories	Exemplar Statements
Lack of ability to use technological representations	<i>"I am not techie....I just rely on my Powerpoint presentations and just used Google Docs/Forms during these online classes..."</i> <i>"not enough training..."</i>
Limited awareness of available technological tools	<i>"I am not familiar with different applications..."</i> <i>"Not all teachers know how to use technology that we have now..."</i> <i>"No in-depth training..."</i>
Perceptions about the mismatch between technological tools and nature of subject-matter	<i>"Some content cannot be taught effectively through technology, like for example, dribbling the ball, serving the shuttlecock"</i>

#### Technological Pedagogical Knowledge (TPK)

TPK refers to how teachers understand the interface between teaching and learning. In particular, it is about understanding how teaching and learning can change when technologies are used and applied in particular ways (Koehler & Mishra, 2009). Table 7 describes the challenges related to TPK as related to: (1) addressing student disengagement, (2) lack of knowledge on how to use technological tools for online teaching; and (3) access and connectivity as barriers to online student participation

Table 7. Challenges related to TPK

Categories	Exemplar Statements
Addressing student disengagement	<i>"It is hard to encourage students who do not want to learn"</i> <i>"Students are sometimes unwilling to joining discussion/activities"</i> <i>"...students would have lots of alibi..."</i> <i>"it's hard to motivate students to work on activities because they have to do it alone..."</i>
Lack of knowledge on how to use	<i>"...not trained for the online learning, so it is hard..."</i>

technological tools for online teaching	<i>"Lack of knowledge on how to use digital tools"</i> <i>"Not familiar with different available applications that can be used during discussions"</i>
Limited access and connectivity as barriers to online student participation	<i>"...limitations related to access to gadgets and internet limit opportunities for all students to interact and participate smoothly in activities..."</i> <i>"...uncertain if students were able to learn well since not all have good internet connection..."</i>

#### Technological Pedagogical Content Knowledge (TPACK)

TPACK refers to knowledge about effective and skillful teaching with technology of a subject-matter (Koehler & Mishra, 2009). In Table 8, the challenges related to TPACK refer to:

Table 8. Challenges related to TPACK

Categories	Exemplar Statements
Lack of knowledge and training about online teaching	<i>"...not trained for this modality of teaching, so almost everything is learned from scratch..."</i> <i>"We need to use or develop a more accurate approach that is suited for online teaching and learning..."</i> <i>"I am not well knowledgeable about computer and its applications to online classes"</i>
Choosing the right technological tools to address teaching and learning problems	<i>"...don't know if there is an application that can be very useful in teaching math..."</i> <i>"I have not explored programs or software that will help me with assessment..."</i> <i>"Due to a large variety of online assessment tools, it is sometimes overwhelming to choose a very suitable assessment tool..."</i>
Validity of online assessment as evidence of learning	<i>"It is hard to know if students are really the ones who do their outputs"</i> <i>"It is a challenge to know whether the students' answers are authentic and really coming from their own learning"</i>

## 4. CONCLUSIONS

Although the participants facilitated learning in emergency remote teaching contexts, they rated themselves highly in content and pedagogy-related knowledge domains. Knowledge about technology-related domains were on an average level. On the other hand, the reported challenges related to each TPACK domains describe what should be addressed in an emergency remote classroom, and what professional development support should be prioritized. The disruption that the pandemic caused on education



and schooling, and as well, teaching and learning revealed the need to equip and upgrade teachers for effective teaching with technology. Emergency remote teaching or even online learning is more than just learning to use technological tools and applications. The emphasis on professional development should not be about learning what technology to use nor how to use specific tools. It should about helping teachers understand how their knowledge of content, pedagogy, and technology can be effectively and efficiently harmonized to facilitate meaningful and engaging online distance learning within emergency remote and the “better” normal teaching.

### Limitations and Future Research

The study is exploratory and descriptive. Its findings should be interpreted with caution, particularly those related to the ERT challenges. Although online forms used provided context information for describing challenges as related to the different TPACK, the results merely provides general descriptions. Likewise, generalizability of findings is also limited since sample were selected from limited number of schools from one urban area.

Future studies should consider: exploring the use of TPACK to guide professional development reflective practice among teachers, and utilizing alternative data collection strategies to relate and contextualize teaching challenges with teacher knowledge through in-depth interviews, online observation, analysis of online modules, or a review of lesson plans.

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