Graduate Instructors' Technostress of Engaging in Emergency Online Teaching During the COVID-19 Pandemic

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Abstract

This study investigates graduate instructors' technostress before and during the COVID-19 pandemic, and the relationship between instructors' technostress with their TPACK competencies and institutional-colleague support, respectively. Results show a significant increase in instructors' technostress level during the COVID-19 online teaching period (t (27) = -5.74, p<.01). Instructors' TPACK competencies were significantly and negatively correlated with their technostress, while the institutional-colleague support was not significantly associated with their technostress. The findings suggested that institutions may consider providing pedagogy courses, including TPACK competencies, to help graduate instructors decrease technostress.

Keywords: technostress, online teaching, TPACK, higher education

Introduction

In early 2020, most educational institutions in the United States rapidly transitioned from face-to-face instruction to online teaching due to the COVID-19 pandemic. According to Hodges et al. (2020), while this method is currently called "online teaching," it is not planned online teaching but rather a crisis-promoted emergency remote teaching, which differs from online teaching before the pandemic. This teaching method is new to most instructors, and the use of technology has become a necessity rather than an option (Özgür, 2020; Panisoara et al., 2020), which may have led to stress deriving from technology use during online teaching (Joo et al., 2016). Technostress, first introduced by Brod (1984), is defined as "a modern adaptation disorder resulting from the inability to use current computer technologies effectively" (Özgür, 2020, p. 1). While technostress research has been conducted extensively across different workplace settings, studies investigating educators' technostress are still rare (Çoklar et al., 2017). Among the few studies, Boyer-Davis (2020) discovered that college faculty suffered significantly more technostress during the pandemic than before the pandemic. Estrada-Muñoz et al. (2020) also found that during the pandemic, instructors' stress and anxiety associated with the application of educational technology grew exponentially over time. These implied that more studies are needed to understand educators' technostress to better support them in navigating the emergency online teaching.

Across the different groups of educators, graduate instructors received very little concern in educational research. But in reality, graduate instructors have become a significant teaching force for supporting undergraduate education in the United States (Douglas et al., 2016), and the preparedness of graduate instructors could directly impact the quality of education (Fong et al., 2019). Despite its significance, the support and training provided to them were quite limited (Luft et al., 2004), and few studies have been conducted to evaluate the impact of this support provided (Fong et al., 2019; Wyse, 2010). To better understand graduate instructors' teaching conditions in the United States, this study investigates their technostress levels before and during the COVID-19 pandemic and examines the factors that led to their technostress and ways to cope with it.

Literature Review

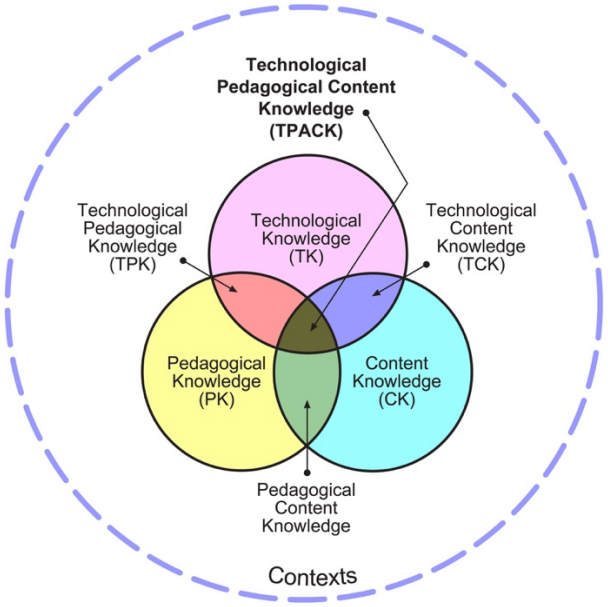
Numerous scholars have investigated factors influencing faculty's technostress in teaching. Previous literature has noted that personal and environmental factors are major ones resulted in instructors' technostress (Matthews et al., 2004; Özgür, 2020).

Personal Factors

In a study, Fuglseth and Sorebo (2014) discovered that the instructors' low-level individual ability (e.g., technological literacy, mental competencies) was an essential reason for their technostress. Some other personal factors, such as instructors' negative beliefs and resistance to applying computer technology into their teaching, were also identified by researchers (Harahap & Effiyanti, 2015). Likewise, a recent study by Zeeshan et al. (2020) examined the technostress of university faculty due to their lack of pandemic preparedness and sudden transition to online teaching during the pandemic in Pakistan. They discovered that in addition to technical issues such as internet connections, power disruptions, camera and voice quality, instructors' personal factors (including fear of using technology in class) were resulted in their technostress during the pandemic. Panisoara et al. (2020) also claimed that instructors' intrinsic motivation could effectively reduce their technostress.

Among a number of personal factors, Joo et al. (2016) proposed that teachers' competencies to teach with technology (developed from the Technological Pedagogical Content Knowledge - TPACK) are highly related to their technostress in teaching. TPACK is a framework that introduces the relationships between three basic components of knowledge (technology, pedagogy, and content) (Koehler & Mishra, 2008, 2006). Meanwhile, at the intersection of the basic knowledge are the four overlapping domains elaborate on integrating the three circles (Mishra & Koehler, 2006). In total, seven components are included in the TPACK framework (see Figure 1). Briefly, Technology Knowledge (TK) refers to the knowledge about various technologies (Schmidt et al., 2009), and Content Knowledge (CK) is the "knowledge about actual subject matter that is to be learned or taught" (Mishra & Koehler, 2006, p.1026). Pedagogical Knowledge (PK) refers to the methods and processes of teaching (Schmidt et al., 2009), and Pedagogical Content Knowledge (PCK) is the content knowledge that deals with the teaching process (Shulman, 1986). Technological Content Knowledge (TCK) is related to the knowledge of how technology can create new representations of specific content (Schmidt et al., 2009), and Technological Pedagogical Knowledge (TPK) refers to the knowledge of how various technologies can be used in teaching. Technological Pedagogical Content Knowledge (TPCK) refers to the knowledge required by teachers for integrating technology into their teaching in any content area (Schmidt et al., 2009). Many studies have been conducted to apply the TPACK framework into understanding teachers' knowledge of integrating technology into teaching (e.g., Archambault & Crippen, 2009; Hughes et al., 2020). However, since our current study focused on understanding the influence of technology-related self-efficacy for online teaching during the pandemic, only TK, TPK, and TCK were used to examine graduate instructors' technostress.

Figure 1.
The Components of the TPACK Framework (graphic from http://tpack.org/)



Environmental Factors

Previous studies (e.g., Fuglseth & Sorebo, 2014; Ragu-Nathan et al., 2008; Salanova et al., 2013) found a lack of environmental support, such as technical support, information- and communication-technology use facilitators, can result in technostress. Additionally, Al-Fudail et al. (2008) noted that the lack of fit between teachers and the technological environment, specifically, the unbalance between demands of the technological environment and teachers' abilities, as well as teachers' needs and supplies, cause instructors' technostress.

Joo et al. (2016) proposed that school support is an external factor, and the external regulation could enhance instructors' stress to a large extent (Panisoara et al., 2020). Panisoara et al. (2020) also emphasized that the school context has a significant impact on teachers' technostress. Vladut and Kallay's (2010) study found that increased school demand for technology use creates technostress among instructors. Dong et al. (2020) also identified administration support that denotes infrastructure and technical assistance and collegial support from colleagues as critical environmental factors related to teachers' use of technology.

In summary, the above research findings suggest that the major reasons for teachers' technostress include teachers' personal and environmental factors. Dong et al. (2020) framed a structural model showing the relationships among teachers' technostress, TPACK, computer self-efficacy, administration support, and collegial support. They found that TPACK can help teachers deal with psychological stress caused by technology use and suggest strengthening teachers' TPACK skills through school support and increasing teachers' computer self-efficacy. Özgür (2020) also noted a negative relationship between teachers' technostress levels and school support and TPACK competencies. TPACK negatively affects teachers' technostress, and teachers' technological integration competencies could significantly decrease teachers' technostress levels caused by ICT use during the education-training process.

Overall, limited studies have been conducted to investigate technostress among graduate instructors, the associations between their personal factors, mainly TPACK competencies and

their technostress, and the relationship between the support they have received from institutions and colleagues with their technostress; not to mention their emergency online teaching during the pandemic (Estrada-Muñoz et al., 2020). This study will contribute to the current literature and investigate graduate instructors' technostress during the pandemic.

Method

The Research Questions

1. Is graduate instructors' technostress significantly different before and during the COVID-19 pandemic when emergency online teaching began?
2. Are there any associations between instructors' TPACK competencies and their technostress regarding emergency online teaching?
3. Are there any associations between institutional-colleague support and instructors' technostress regarding emergency online teaching?

Data Collection and Participants

An online survey (see Appendix) with validated instrument items was used to answer the proposed research questions. Participants were asked to rate each item on a five-point Likert scale, ranging from one (strongly disagree) to five (strongly agree). First, participants were asked to rate their stress levels before and after classes were conducted in the online setting. A 7-item scale adopted from Panisoara et al. (2020) was used to measure technostress. An 8-item scale from Chai et al. (2011) was used to measure instructors' TK and TCK, while 4-item scale each from Panisoara et al. (2020) and Valtonen et al. (2017) were used to measure instructors' TPK and TPCK, respectively. Participants' institutional-colleague support was measured by a 6-item scale from Dong et al. (2019). The last section of the survey was about the demographic information of the participants.

The online survey was distributed to graduate instructors in a public university in the U.S. in February 2021, and 31 responses were collected. After excluding the invalid responses, 28 participants were included in this study. Descriptive demographics of the students who completed the survey are demonstrated in Table 1.

Table 1.
Participant Demographics Information

	Value	*n*	%
Demographics			
Gender	Male	8	28.6%
	Female	16	57.1%
	non-binary/not to disclose	4	14.3%
School/Department	College of Education	21	75.0%
	School of Engineering	4	14.3%
	College of Natural Sciences	3	10.7%

Data Analysis

Survey responses were analyzed using R. First, mean (M) and standard deviation (SD) were calculated to get an overall understanding of graduate instructors' technostress levels, their TPACK competencies, and institutional-college support. Then, paired-sample t-tests were used to compare their technostress before and during the pandemic. Pearson's correlation analyses were conducted to investigate relationships between instructors' technostress and their TPACK competencies, and between technostress and their institutional-colleague support.

Results

Instructors' Technostress Levels Before and During the Pandemic（RQ1）

As shown in Table 2, descriptive statistics demonstrate that instructors' technostress levels before COVID-19 pandemic (M = 2.71, SD = 0.81) were lower than when courses were transferred online (M = 3.43, SD = 0.99). The paired samples t-test result indicates that instructors' technostress levels were significantly higher after switching to online teaching (t (27) = -5.74, $p < .01$). Its effect size is 0.79 (95%CI [0.73, 0.85]), a notably large effect size (Cohen, 1992). This result suggests that graduate instructors felt much more technostress when the courses were transferred from in-person to online format.

Table 2.

Paired Samples t-test of Graduate Instructors' Technostress Before and During the COVID-19 Pandemic (n = 28)

		Mean	SD	t
Pair	Before the pandemic	2.71	0.81	-5.74**
	During the pandemic	3.43	0.99	

** $p<.01$

The Association Between Instructors' TPACK Competencies and Their Technostress Levels (RQ2)

Descriptive statistics show that instructors had different competency levels in each TPACK dimension (see Table 3), with TPK, TPCK, TK, and TCK in descending order. A Pearson's correlation between instructors' TPACK and their technostress about emergency online teaching (M = 2.75, SD = 0.98) was also conducted. As shown in Table 4, graduate instructors' technostress about emergency online teaching negatively correlated with their TK, TPK, TCK, TPCK. The effect sizes (0.49, 0.37, 0.41, 0.4) indicate that a moderate amount of the variability in instructors' technostress was explained by their TPACK competencies. These findings suggested that when graduate instructors have a higher level of TPACK competency, their technostress could be lower.

Table 3.
Descriptive Statistics of Graduate Instructors' TPACK Competency Level

Dimensions	Mean	SD
Technological Knowledge (TK)	3.90	0.93
Technological Pedagogical Knowledge (TPK)	4.07	0.72
Technological Content Knowledge (TCK)	3.50	0.82
Technological Pedagogical Content Knowledge (TPCK)	3.96	0.81

Table 4.
Pearson's Correlation for Graduate Instructors' TPACK and Technostress

Variable	Technostress
Technological Knowledge (TK)	-0.70**
Technological Pedagogical Knowledge (TPK)	-0.61**
Technological Content Knowledge (TCK)	-0.64**
Technological Pedagogical Content Knowledge (TPCK)	-0.63**

** $p<.01$

The Associations Between Institutional-colleague Support and Instructors' Technostress (RQ3)

Regarding environmental support, instructors received nearly equal support from institution (M = 3.81 SD = 0.59) and colleagues (M = 3.82, SD = 0.98). 22 (78.6%) participants "agreed" or "strongly agreed" that their college or school provides enough infrastructure and resources for them to do well with online teaching, while 15 (53.6%) participants "agreed" or "strongly agreed" that their college or school provides clear guidelines about online teaching. Regarding support from colleagues, 21 (75.0%) "agreed" or "strongly agreed" that they and colleagues made a connected effort to integrate technology into online teaching; 17 (60.7%) agreed or "strongly agreed" that they received encouragement from colleagues when they encountered difficulties integrating technology into their online teaching.

However, Pearson's correlation analysis indicated that there were no significant correlations between the institutional (r =0.12, p>.05) and colleague support (r =0.253, p>.05) with instructors' technostress about emergency online teaching.

Discussion

Technostress Levels and TPACK Competencies

Our study analyzed graduate instructors' technostress levels before and during the pandemic. It discovered that graduate instructors' technostress levels significantly increased when the courses were transferred from an in-person to an online format during the pandemic. In previous studies, the demand for a technological environment in the teaching context was an important factor that triggered instructors' technostress (AI-Fudail & Mellar, 2008; Panisoara et al., 2020). In this study, the transition from a familiar teaching format (i.e., in-person teaching) to online teaching during the COVID-19 pandemic was an external regulation and requirement for the graduate instructors, and they had little time to prepare themselves for this change in the teaching environment. Hence, it is not surprising that the graduate instructors experienced higher technostress levels after switching to online teaching.

Additionally, their technostress levels were significantly negatively correlated with their TPACK competency levels. As Özgür (2020) pointed out, instructors' technostress levels are determined by their abilities and competencies in using technology, and teachers' TPACK competencies greatly decrease their technostress levels. The significant negative correlations between graduate instructors' technostress levels and their TPACK competency levels found in the current study align with the previous literature showing that teachers' TPACK competencies could contribute to decreasing their technostress levels. This finding indicates that graduate instructors' TPACK competencies play an important role in helping them cope with technostress, a result similar to those in previous studies (e.g., AI-Fudal & Mellar, 2008; Joo et al., 2016). Among the TPACK dimensions, TK was found to be most negatively correlated with graduate instructors' technostress (see Table 4); thus, improving graduate instructors' technological literacy could help decrease their technostress. Also, because TK was not content- or subject-related, a general technology training workshop on integrating technology into teaching could benefit graduate instructors.

Institutional-colleague Support and Instructors' Technostress

Our findings suggested that only half of the graduate instructors agreed or strongly agreed that their college or school provides clear guidelines for online teaching, indicating that they did not get enough support from their institutions. The graduate instructors who participated in our study also pointed out the importance of getting support from peers, suggesting collaborative work among graduate instructors on integrating technology into teaching. However, our findings indicated that the support graduate instructors received from institutions and colleagues did not significantly correlate with their technostress. The significant correlations between graduate instructors' TPACK competencies and their technostress, and no significant correlations between the supports graduate instructors received from the environment and their technostress, suggested that the personal factors played a more influential role in determining graduate instructors' technostress. Thus, a more effective and practical way to reduce graduate instructors' technostress could be to improve their TPACK competencies.

Current literature has suggested that the pedagogy course can consistently increase graduate instructors' confidence and attitudes toward teaching (Fong et al., 2019). The findings of our study could contribute to the current literature and expand their suggestion that the TPACK competencies should be an essential component in the pedagogy course for graduate instructors. Dong et al. (2020) proposed that institutions should create more opportunities for

teachers to accumulate hands-on experience and provide timely feedback to improve teachers' perceived knowledge and abilities and reduce their technostress (Xie et al., 2017). They also suggested that mutual collaboration among colleagues effectively enriches instructors' development of TPACK better than providing sufficient infrastructure and technical training. Based on our findings, we also indicated that for the graduate instructors, the collaboration-based learning in a pedagogy course could also benefit them to gain knowledge and reduce technostress.

Conclusion

Graduate instructors provide instruction for many university classes. They have become an increasingly indispensable part of the teaching group; however, the current literature has not thoroughly investigated these young instructors' technostress. Our findings suggest that developing graduate instructors' TPACK competencies is a viable way to reduce technostress caused by the rapid move to online teaching. This study has practical implications for institutions supporting graduate instructors, in particular, providing courses for graduate instructors to improve their teaching ability and TPACK competencies. This study has limitations. Because it is small in scale and the participants were recruited from one university, our conclusions need to be further tested in larger-scale studies and other higher education contexts.

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Appendix

Survey

1. Please rate your stress level before Spring break 2020, when classes were conducted in a face-to-face setting. (Extremely high/High/Medium/Low/Not at all)
2. Please rate your stress level after Spring break 2020, when classes were conducted in an online setting. (Extremely high/High/Medium/Low/Not at all)
3. Please respond to the items below based on your feelings about the emergency online teaching during COVID-19 pandemic. (strongly disagree/disagree/neutral/agree/strongly agree)
    a. I feel stressed while adapting myself to online teaching.
    b. I find it difficult to use digital technology effectively for online teaching due to my limited time availability
    c. I feel stressed by the high technical requirements that are necessary for online teaching.
    d. I find it difficult, with my current skills, to constantly improve the act of online teaching
    e. I feel that online teaching complicates my teaching activity.

f. It is hard for me to concentrate on teaching with the use of different digital tools in the online setting.

g. I hesitate to incorporate other digital tools during online teaching for fear of making mistakes.

h. I am worried that online teaching will compromise student learning quality.

4. Please answer the following questions about your technological knowledge for teaching online.

a. I know how to solve my own technical problems for online teaching.

b. I can learn technology easily to serve the purpose for online teaching.

c. I keep informed about new digital technologies about online teaching.

d. I have the technical skills to use technology effectively for online teaching.

5. Please answer the following questions about your technological pedagogical knowledge for teaching online.

a. I can help my students use online learning environments (e.g., Canvas, Google applications) effectively.

b. I can design lessons/courses that enhance the online teaching approaches.

c. I can use appropriate digital conferencing technologies (e.g., Zoom, Skype, Google Meet, WebEx etc.), which allow me to communicate and interact synchronously with other colleagues or students.

d. I can use online tools to assess students' knowledge.

6. Please answer the following questions about your technological content knowledge for teaching online.

a. I know digital technologies which I can use to illustrate difficult contents in my online course.

b. I know websites with content materials for studying my online course.

c. I know how to decide on the technologies that will enable students to learn the contents of my online course in a meaningful way.

d. I can use the software that are created specifically for my online course. (e.g., e-dictionary/corpus for language; Geometric sketchpad for Math; Data loggers for Science).

7. Please answer the following questions about your technological pedagogical content knowledge for teaching online.

a. In teaching a specific online course, I know how to use digital technology as a tool for students to plan their own learning.

b. In teaching a specific online course, I know how to use digital technology as a tool for students' collaborative learning.

c. In teaching a specific online course, I know how to use digital technology as a tool for students' creative thinking.

d. In teaching a specific online course, I know how to use digital technology as a tool for students' critical thinking.

8. Please answer the following questions about <u>the ways you have been supported</u> for the emergency online teaching during COVID-19 pandemic.

a. My college/school provides clear guidelines about online teaching, so that I know how to guide student learning

b. My college/school provides sufficient training so that I know how to implement online teaching

c. The requirement and timetable for implementing online teaching is reasonable in my college/school so that I can at my own pace

d. My college/school provides enough infrastructure and resources so that I could do well on online teaching

e. I get encouragement from my colleagues when I encountered difficulties in integrating technology in online teaching

f. My colleagues share useful resources with me for online teaching

g. My colleagues share their experience with me about integrating technology into online teaching.

h. My colleagues and I made a concerted effort to integrating technology into online teaching

9. What is your gender?
10. What college/school are you in?
11. How long have you been teaching in higher education?