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Technology, Pedagogy, and Content Knowledge: An Australian Case Study

Nicolas Gromik [1,*], David Litz [2] and Bing Liu [1]

[1] Department Faculty of Arts and Society, Charles Darwin University, Casuarina, NT 0810, Australia; bing.liu@cdu.edu.au
[2] School of Education, University of Northern British Columbia, Prince George, BC V2N 4Z9, Canada
* Correspondence: nicolas.gromik@cdu.edu.au

Abstract: Teacher Education students, at the bachelor's and post-graduate level, complete programs that expose them to educational theories and best teaching practices. However, the extant literature has repeatedly demonstrated that many preservice teachers (PST) are unprepared to apply such knowledge to real-world educational settings. The problem may be particularly acute when it comes to the use of technology in classrooms. Given increasing government investment in technology and the burgeoning digital industries, teachers can play a critical role in demonstrating the effective use of technology in the course of teaching and learning. This study used a survey based on the Technological Pedagogical Content Knowledge (TPACK) model to evaluate PSTs self-perceived competencies in integrating technology into their teaching practices. Over a span of two years, PSTs enrolled in a unit offering six weeks' professional experience were invited to respond to the survey and rate their cognizance of relevant teaching practices. Respondents indicated some familiarity with TPACK, but significant gaps were also evident. Moreover, despite the lack of significant differences among age groups in PSTs perceived ability to apply the TPACK model, noticeable differences were observed in their experiences regarding gender and prior employment.

Keywords: technological pedagogical content knowledge; preservice teachers; technology integration; online learning; Industry 4.0

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1. Introduction

Preservice teachers (PST) gain knowledge of educational theories, pedagogical practices, and content areas, but little is known about their ability to apply such knowledge after their graduation. Stephenson [1] conducted a literature review that revealed concerns about the competencies of PSTs. The evidence suggested a potential gap between their acquisition and retention of knowledge about the teaching practice. That gap appears to impact competencies both in content delivery and in familiarity with technology integration [2].

Teachers' understanding of the effective use of technology for certain types of learning is important. However, according to Koehler et al. [3], teachers "often lack the knowledge to successfully integrate technology in their teaching..." ([3], p. 101). A literature review by Wang et al. [4] confirms that teachers require further expertise in the use of technology in classrooms to prepare students for digitally-based careers. The authors also suggested that teacher training programs must review their approach to technology by demonstrating its effective use in all subjects and even professional experience [5]. The issue has become more important with COVID-19, which required a rapid shift to online teaching and learning through available technology, thus becoming a potential harbinger of future transitions. Badiozaman [6] highlights how the recent shift toward online teaching has required teachers and PSTs to deliver more effective online content to improve learning through a medium with many challenges (e.g., uneven access to technology and lack of continuous and stable online connections).

Using personal lectures and teaching experiences, the authors noticed some courses in which technology did not appear to be included in their units. It is as if PSTs were supposed to gradually absorb the knowledge of technology integration and transfer it across various units; as if, by magic, technological knowledge is applied to classroom practices after graduation. COVID-19 clearly showed that most teachers were not prepared for a sudden transition to online learning and lacked vital competencies in technology integration and delivery [6]. After observation and reflection on the current situation at Charles Darwin University (CDU), this study attempted to underline the need to understand PSTs awareness of Technological Pedagogical Content Knowledge (TPACK)—the cross-fertilization and transference among these elements—and of their ability to effectively integrate technology [4]. The TPACK questionnaire was provided to PSTs for them to fill out, enabling them to self-assess and report on how effectively they integrate technology to improve teaching methods and content delivery and enhance optimal technology-based teaching practices. After receiving Ethics Approval [H21014] for the TPACK survey from Schmidt et al. [7], the survey was uploaded to and formatted on Qualtrics for online delivery—either to computers or mobile phones.

Specifically, this study was formulated with the following research questions:

1. To what extent do undergraduates in a teaching program see themselves as prepared to apply the TPACK model?
2. How do demographic variables, such as gender, age, degree specialization, and employment experience, influence participants' preparedness to apply the TPACK model?
3. Do participants recognize and agree that lecturers demonstrate effective ICT use in their delivery and practice?

2. Literature Review

Shulman's [8] interest in bridging the gap between pedagogical and content knowledge stemmed from his reading of Father Walter Ong's manuscript, *Ramus*, *Method*, *and the Decay of Dialogue*, which explains that in the medieval university, ". . . instead of separating content and pedagogy (what is known from how to teach it), no such distinction was made at all" (p. 6). Shulman [8] concluded that those who examine the skills, abilities, and competencies of PSTs must understand the interaction among subject matter, curriculum, and pedagogical knowledge. He argued that PSTs should have ownership over the content matter so that they are empowered to engage learners in higher-order thinking [1,8]. Teachers must also understand the transformation necessary to turn content knowledge into more meaningful and absorbable information, delivered through engaging activities led by or centered on students [9]. Koehler et al. [3] extended Shulman's integrative approach to include pedagogical uses of technology [10,11].

TPACK is a theoretical framework developed by Mishra and Koehler [11] to help teachers conceptualize the integration of technology into all aspects of teaching. Figure 1, also developed by Koehler and Mishra [10], demonstrates TPACK as consisting of three independent components—pedagogical knowledge (P); content knowledge (C); and technological knowledge (T)—as well as three interrelated components: pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological content knowledge (TCK). At the center of the Venn diagram is the interaction among all components, ultimately leading to TPACK. The final component, which is seldom reported, is the context: the school and classroom environment in which TPACK is to be activated and which depends on external factors such as beliefs, funding, and resources [12].

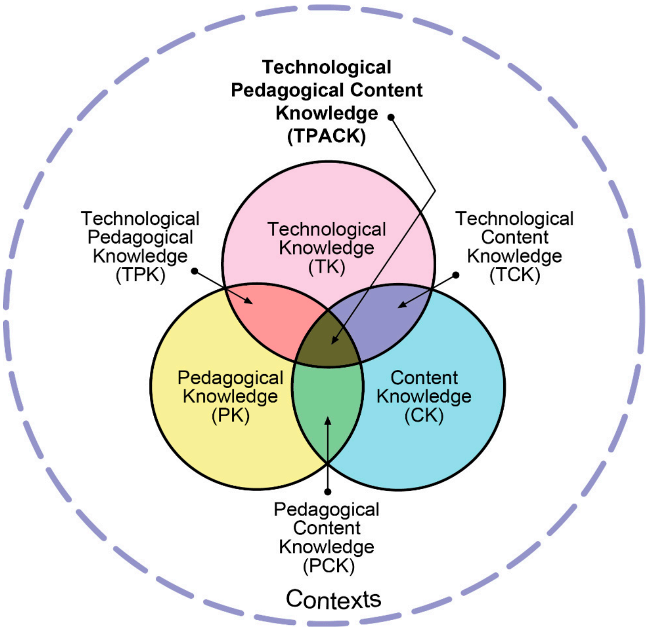

Figure 1. Technological Pedagogical Content Knowledge [10]. Reproduced with the permission of the publisher, ©2012 by tpack.org.

The goal of TPACK is to demonstrate to PSTs the processes and knowledge needed to integrate technology into their teaching and learning strategies [11,13]. Niess [14] describes TPACK as a framework meant to help teachers use domain-specific knowledge and strategies to guide students' learning with appropriate information and communication technologies and to build necessary knowledge for designing, planning, and delivering effective learning experiences by integrating technology into teaching/learning enterprises. However, before exploring interrelations among pedagogy, content, and technological knowledge, this paper explores PSTs exposure to pedagogical theory and content knowledge.

2.1. Pedagogical Knowledge

Lauermann and König [15] define pedagogical knowledge as proficiency in motivation, classroom management, lesson planning, and differentiated instructions. Depending on the strategy of a program, pedagogical knowledge may also comprise inclusive curricula, assessment, and reporting [16,17].

Higher education institutions in Australia actively engage PSTs in learning pedagogical theories through classroom instruction, exposure to authoritative educational literature, and hands-on internships. In Australia, PSTs are introduced to a wide range of pedagogically sound literature, such as the studies by Killen [18] and Kivunja [19] to name just a few. PSTs also learn through internships (or professional experiences), during which they are assisted by mentor teachers to interpret and apply theories within a concrete educational context. Based on an in-depth case study, Loughran et al. [20] suggest that PSTs can learn effective teaching practices through these combined strategies. Lancaster and Bain [21] seem to concur that PSTs are generally prepared to develop and apply pedagogical knowledge to specific topics.

2.2. Content Knowledge

The Australian Institute for Teaching and School Leadership requires graduates to be proficient in specific content, and the Australian Curriculum, Assessment, and Reporting Authority emphasizes content knowledge [18]. Cavanagh and Prescott [22] explain that domestic PSTs are constantly exposed to content knowledge and transform their professional experiences into opportunities to apply both prior knowledge and expert knowledge gained through higher education. By content knowledge, we mean PSTs familiarity with the subject matter and their ability to categorize content into sequential learning parts so that students can progress toward higher engagement with specific foci on themes to build comprehensive understanding [16,23]. A study conducted in Germany with 243 PSTs in mathematics indicated that classroom preparation generally plays a suitable role in developing graduate students' content knowledge base [24].

2.3. Technological Knowledge

Referring to both pedagogical and content knowledge, Niess [14] summarizes the issue of technological expertise rather poignantly: "[Teachers] have not been prepared to engage in strategic thinking for knowing when, where, and how to use domain-specific knowledge and strategies for teaching with [new] technologies" ([14], p. 308). It is beyond the scope of this paper to address all of Niess's [14] concerns. We must first evaluate students' knowledge of technology integration and then define a strategy for demonstrating the effective application of technology for enhanced learning outcomes.

Technology encapsulates all forms of hardware, software, and peripherals being used by teachers or students in classrooms [16,25]. According to a repeated study, most Australian PSTs reported having access to technology (99.4%) and the internet (96.5%) ([13], p. 119). Finger et al. [13] conclude that, while these results indicate that PSTs access technology, they do not indicate the level of their expertise in integrating technology into their teaching practices. Niess [14] concurs and explains that, though more people have greater access to technology than ever before, teachers have limited knowledge about integrating technology into their students' learning experiences. Okojie et al. [26] suggest that teacher preparation institutions should demonstrate "how the technology selected fits into the objectives of the lesson, methods of instruction, evaluation, feedback, and follow-up initiatives" ([26], p. 67). The authors explain that technology integration should be part of PSTs training in pedagogical theories and applications, as well as subject matters [26]. Deng et al. [27] arrived at a similar observation, stating that, while the participants in their study had some ICT integration capabilities, lesson planning and pedagogical application were found to be areas requiring further development. The ultimate objective is to demonstrate the use of technology to provide students with better learning experiences, help them develop technological skills, and prepare them to be independent, lifelong problem solvers.

2.4. Various TPACK Interactions

After defining each individual component, Mishra and Koehler [11] explored intersections among pedagogical and content knowledge (PCK), technological pedagogical knowledge (TPK), and technological content knowledge (TCK). The authors explained that PCK reflects a teacher's ability to know which "teaching approach fits the content" and their knowledge of the best way to arrange content to maximize learning and retention ([11], p. 1027). TPK, meanwhile, constitutes an understanding of the various technologies available—hardware; software; or peripherals—and which one's best suit a given teaching approach [11]. Finally, concerning TCK, Mishra and Koehler [11] explained that constantly emerging technologies provide students and teachers with ever-greater opportunities to access content and create interpretations of that content [28]. The authors define the intersection among all these components as the area representing better teaching and integration of technology to maximize learning and exposition of content [11]. This is the locus for a "thoughtful interweaving of all three key sources of knowledge" ([11], p. 1029).

The present research was developed because little is known about local undergraduates' understanding of TPACK, their strategies for integrating technology into the teaching process, and the trajectory of colleges in rectifying current professional practices, encouraging graduates' more effective independent reasoning, and defining novel approaches that lead students to effectively use technology. The first step in addressing the situation is to understand the current level of TPACK awareness among PSTs who have completed some of their placements (professional experiences). Following Niess [14], this study aims to help elucidate the best way to train PSTs to integrate technology into their classrooms, thereby preparing students for Industry 4.0, an industrial environment that requires students to possess "creativity-focused technology fluency." ([29], p. 187).

3. Method

3.1. Institutions

Located in the Northern Territory of Australia, CDU is recognized as a distance education provider, with 62% of participants studying online [30]. The Faculty of Arts and Society (FAS) is one of the main faculties with the highest number of undergraduates—2085 enrolled students. FAS offers Arts and Education courses, with units primarily delivered online or through face-to-face lectures and tutorials. Instruction is offered in both primary and secondary teacher training. The university's key statistics reported for 2020, which were available at the time of writing, indicate a significant presence of female students on campus (2019 = 69.6%; 2020 = 70.9%) [30]; internal university data seem to indicate the following enrollment per gender for 2021: F = 944, M = 247. This accords with broader statistics indicating that, across Australia, 71.7% of teachers were female [31]. In the Northern Territory, that figure rises to 78.7% ([32], p. 22). This research design anticipates that the gender ratio in this study will be in line with these figures.

3.2. Participants

As indicated above, PSTs enrolled in FAS education courses primarily study online. They are scattered throughout Australia and abroad (NT residing = 30%, outside NT = 47%, international = 23%) [30]. Teacher Education students complete three-to-four professional experience internships at schools near their residences (within 40 min by car). Participants in the unit selected for study have completed two prior successful placements and are required to complete two more, including the unit that was involved in this research (total = 4). This unit's cohort was selected because of the hypothesis that their prior study and training would have allowed them to develop a higher awareness of TPACK. Twenty-two respondents participated in this study (M = 9, 45%; F = 11, 55%).

3.3. Survey and Research Questions

The current study emerged from our observation as researchers and teacher trainers that undergraduates in the teaching program were not necessarily cognizant of best ICT integration in their pedagogical practices [33]. Conversations with colleagues indicated that undergraduates were exposed to the TPACK model; therefore, the goal was to assess the degree of familiarity with TPACK. The survey was selected because (1) the model seems to be taught in teacher-preparation units; (2) this research team wanted to evaluate the impact of TPACK-related lectures on undergraduates' ability to integrate ICT into their teaching; and (3) research indicates that the TPACK survey is reliable and valid [34].

The original TPACK survey included 75 items [7,16], which were reduced to 46. Questions about technological knowledge (TK) were presented first, followed by those on content knowledge (CK), which was further broken down into mathematics, social studies, science, and literacy. Then, questions on pedagogical knowledge (PK), followed by PCK, TCK, and TPK, were included. The survey concluded with a range of questions on combined technological, pedagogical, and content knowledge that are the elements of TPACK. The final questions pertained to the observed applications of TPACK and included three open-ended questions. The survey was adapted to include demographic-related questions such as gender, age, and employment status. In addition, demographic items, survey responses were based on a four-point Likert scale ranging from Strongly Agree (1) to Strongly Disagree (4).

Consequently, and as mentioned previously, the specific research questions that were addressed in this study were as follows:

1. To what extent do undergraduates in a teaching program perceive themselves as prepared to apply the TPACK model?

2. How do demographic variables, such as gender, age, degree specialization, and employment experience, influence participants' preparedness to apply the TPACK model?
3. Do participants recognize and agree that lecturers demonstrate effective ICT use in their delivery and practice?

3.4. Data Collection

This research was conducted over two years (2020 and 2021) and remains ongoing. A similar data collection process were adopted by Uribe and Vaughan [35]. Of the 219 enrolled students, 22 volunteered to complete the survey. While this participation rate represents 10% of the pool of potential participants, Edmonds and Kennedy [36] explain that smaller sample sizes align with the research strategy of a single-case method (see also [37]). Meanwhile, Koh, Chai and Tsai [25] assert that 20 responses per TPACK item seems adequate for analysis (see also [38] for a similar sample size).

The authors contacted Professor Schmidt for his permission to use the TPACK survey. Professor Mishra was also contacted to gain permission for including the TPACK image in this paper. Professors Schmidt and Mishra gracefully granted their permissions. After the Human Research Ethics Committee (CDU-HREC) within the Office of Research Innovation (ORI) permitted this research to proceed (H21014), the TPACK survey [7] was converted to a digital survey distributed and managed by Qualtrics. A plain English statement of this research and a consent form were uploaded on the learning management system (LMS), with a link to the digital survey. An invitation to voluntarily complete the survey was sent through the unit's LMS, and two follow-up emails were sent to remind the participants that their survey responses would contribute to the improvement of the overall unit. Undergraduate students with professional experience from the selected unit had one full term to complete the survey. Thereafter, the survey was closed, and the data were collected, sorted, and cleaned for analysis. IBMs SPSS 26 software were used to analyze both descriptive and inferential data.

4. Data Analysis

The data in this study are quantitative in nature, with a focus on Charles Darwin University, a regional Australian university. The findings, which are not generalizable, reveal PSTs familiarity with and understanding of TPACK concepts within both their university studies and their professional experiences. Given that this is preliminary exploratory research, it was beyond the scope of the project to include an interview component.

5. Findings

The preliminary review showed that two respondents partially answered the survey questions, and these responses were removed, as suggested by Gemici et al. [39] (see also [40]). The next issue were concerned with missing data: two respondents failed to complete 9 of the 46 survey items that dealt with instructors' modeling of TPACK. Among the strategies suggested, mean imputation [41,42] and constant replacement methods were reviewed. The constant replacement method are that of "replac[ing] the missing data point with a simple fixed estimate of the unobserved value" ([39] p. 238). Additionally, some respondents did not complete some survey items regarding role modeling (RM). Missing items in this category were accepted, as RM was perceived to reflect lecturer practices, not students' awareness of the TPACK model.

The data analysis yielded frequencies, means, and standard deviations. Based on the observations on the institution and the impact of gender on the educational sector, further investigation was conducted to analyze item correlations, such as the impact of age, gender, or employment on TPACK model awareness (see [25] for a similar analysis).

Data reporting began with a Cronbach's alpha analysis, which contrasted with previous TPACK results obtained by Schmidt et al. [7] (see Table 1). For each set of questions, Schmidt et al. [7] reported adequate Cronbach's alphas above 0.7. With SPSS, certain items could be removed from the list to increase the Cronbach's alpha score. However, though Cronbach's alpha score was not the method used for analysis in this study, it was retained so that the results of this study are aligned with those of Schmidt et al. [7] and because some thematic grouping comprised just three questions. (Contrastingly, the grouping of technological pedagogical knowledge [TPK] comprised nine items.) The overall Cronbach's alpha of 0.78 indicates that the internal reliability of the TPACK-related 46-item survey was good [25,43].

Table 1. TPACK Result: Cronbach's Alpha Comparison.

	Mean	**Std. Deviation**	**Cronbach's Alpha Reliability**	**Schmidt et al. (2009)**
Tk	1.83	0.550	0.89	0.86
Mk	2.07	0.681	0.83	0.82
SSk	3.13	0.752	0.79	0.83
Sk	2.00	0.541	0.90	0.78
Lk	1.77	0.460	0.81	0.83
Pk	2.01	0.427	0.80	0.87
PCk	2.18	0.489	0.77	0.87
TCk	2.19	0.402	0.73	0.93
TPk	1.79	0.279	0.68	0.86
TPACK	2.16	0.365	0.50	0.89

N = 20.

The evidence above primarily indicates that the Cronbach's alpha values are in line with the findings of Schmidt et al. [7]. Moreover, nearly all values ranged between 0.71 and 0.91, which is fairly high to good, according to Taber ([43], p. 1278). Regarding the Cronbach's alpha value of 0.50 in TPACK, values below 0.7 may "be expected because of the diversity of the constructs being measured" ([44], p. 675). Additionally, a Cronbach's alpha of 0.5 may be considered "reliable" ([44], p. 675), owing to differences in the sample size and other characteristics. For example, in the study of Schmidt et al. [16] respondents primarily seemed to be specialized in early childhood (14.5%) or primary education (79%), with 6.5 percent indicating another major (p. 130). By comparison, the respondents in this survey were enrolled in either a primary (N = 8) or secondary (N = 9) specialization, with 3 respondents not indicating their study interest.

6. Results

The first research question was analyzed through the evaluation of PSTs descriptive responses to each item in the TPACK survey, including mean and standard deviations and factor loadings (see Appendix A). The latter indicates that all factor loadings are above 0.8, which "is considered to be. . .excellent" ([45], p. 36).

While the evidence of Cronbach's alpha was previously reported and discussed, Table 1 above also presents individual means for each TPACK factor. The means presented seem to indicate that, for most TPACK factors, responses agreed with various TPACK statements. For instance, respondents tended to share familiarity with the Literacy factor (Lk, M = 1.77, SD = 0.46), as well as the Technological Pedagogical knowledge component (TPk, M = 1.79, SD = 0.27). The TPACK item with the least congruence (strongly disagree) is the item for social studies content knowledge (SSk, M = 3.13, SD = 0.75). Such strong disagreements could reflect respondents' low knowledge of social studies, as this may be a specialist content area.

The data were also reviewed to observe gender-based mean differences (see a similar procedure in [46]). The evidence suggests that both male and female undergraduate students appear to differ in their perceptions of knowledge about social science-related familiarity. For instance, while male respondents tended to agree (M = 2.77, SD = 0.89), female respondents tended to diverge in their knowledge of social sciences (M = 3.42, SD = 0.47) (see Table 2). On the other hand, PSTs strongly agree that they have familiarity with literacy knowledge (Male, M = 1.78, SD = 0.44; Female, M = 1.76, SD = 0.49), and the respondents seem to respond in a similarly positive fashion regarding their TPACK familiarity.

Table 2. TPACK Gender-Based Perceptions.

		Tk	Mk	SSk	Sk	Lk	Pk	PCk	TCk	TPk	TPACK
Male	Mean	1.6481	2.3333	2.7778	2.0370	1.7778	2.1587	2.4889	2.3651	1.6667	2.3056
	SD	0.50308	0.81650	0.89753	0.63343	0.44096	0.44861	0.37565	0.37871	0.31914	0.41037
	N	9	9	9	9	9	9	9	9	9	9
Female	Mean	1.9697	1.8485	3.4242	1.9697	1.7576	1.8961	1.9273	2.0519	1.8889	2.0455
	SD	0.56676	0.47990	0.47354	0.48200	0.49645	0.38909	0.43149	0.37943	0.20488	0.29194
	N	11	11	11	11	11	11	11	11	11	11
Total	Mean	1.8250	2.0667	3.1333	2.0000	1.7667	2.0143	2.1800	2.1929	1.7889	2.1625
	SD	0.55005	0.68056	0.75238	0.54074	0.46010	0.42707	0.48947	0.40213	0.27900	0.36522
	N	20	20	20	20	20	20	20	20	20	20

Based on the standard deviation (SD) analysis, Table 2 also seems to indicate that female respondents tend to more strongly agree with their perceptions of various TPACK factors as compared to male respondents. Female respondents seemed to converge in their agreement, with the SD ranging from 0.20 to 0.56. Contrastingly, the SD for male respondents ranged from 0.319 to 0.897, indicating that the values converged less towards the mean.

A similar means analysis was conducted among age groups (Appendix B) and among degree specializations (Appendix C). Apart from SSk and Lk, as previously reported, no significant differences among age groups were observed. This could be attributed to the fact that most PSTs start from the same point of relatively limited knowledge of pedagogical theory, content familiarity, and technological expertise. Similarly, PSTs with both primary and secondary specializations seem to either disagree or strongly disagree that they are familiar with social studies content (SSk, M = 3.15, SD = 0.54). Both groups are more likely to agree on their perception of familiarity with literacy knowledge (Lk, M = 1.82, SD = 0.44), as previously indicated. Moreover, respondents with both primary and secondary specializations seem to have similar levels of familiarity with TPACK factors.

7. Correlation Analysis

To understand the extent to which undergraduates perceived their ability to apply the TPACK model, a correlation analysis among TPACK variables and gender, age, and work experience in the education sector was conducted (see Table 3). The analysis indicates that all factors seem to be relatively related, with a negative correlation between technological knowledge and TPACK (r(18) = −0.45, $p < 0.001$). This would suggest that the less technological knowledge the participants possess, the more TPACK familiarity they seem to report. Additionally, a negative correlation between mathematical knowledge and social studies knowledge was observed, r(18) = −0.46, $p < 0.001$.

Table 3. Correlation Statistics.

	Gender	Age	Work Tech. Use	Tk	Mk	SSk	Sk	Lk	Pk	PCk	TCk	TPk	TPACK
Gender	1	−0.18	−0.21	0.29	−0.36	0.43	−0.064	−0.022	−0.31	−0.586 **	−0.39	0.40	−0.36
Age		1	0.026	−0.024	−0.13	−0.16	0.14	0.067	−0.07	−0.040	−0.27	0.016	0.022
Work: Technology Use			1	−0.43	−0.42	−0.07	−0.66 **	−0.38	0.09	0.23	−0.036	−0.24	0.042
Tk				1	−0.10	0.16	0.16	0.061	−0.26	−0.35	0.064	0.15	−0.451 **
Mk					1	−0.46 **	0.69 **	−0.078	0.005	−0.006	0.11	−0.33	0.060
SSk						1	−0.18	0.33	0.025	−0.078	0.002	0.57 **	−0.27
Sk							1	−0.11	−0.076	−0.29	−0.12	−0.15	−0.067
Lk								1	0.043	0.15	0.25	0.58 **	0.13
Pk									1	0.75 **	0.39	0.18	0.67 **
PCk										1	0.63 **	−0.14	0.71 **
TCk											1	−0.22	0.32
TPk												1	−0.11
TPACK													1

* The correlation is significant at the 0.05 level (2-tailed). ** The correlation is significant at the 0.01 level (2-tailed).

As for the three selected groups (gender, age, and work experience), two significant negative correlations were observed—one between gender and pedagogical content knowledge (PCk); r(18) = −0.59; $p < 0.001$; and the other between work experience and scientific knowledge (Sk), r(18) = −0.66, $p < 0.001$. No significant correlation was noticed between age and TPACK factors.

8. Role Modeling

The TPACK survey available online poses a set of questions on *Perceptions of role modeling* (see Table 4, below). The questions, specifically evaluating whether "...education professors appropriately [model] a combination of TPACK concepts and teaching approaches during their lectures" ([7], p. 7). This section includes eight survey questions on modeling in as many content areas as possible. Since undergraduate students at CDU study physical education (which did not reflect in the original TPACK survey), a survey item was added, which added up to nine. The Cronbach's alpha achieved a value of 0.79 with an item's mean of 2.21.

Table 4. Perception of Role Modeling.

		RM—Math	Lit Education Professors	Science Education Professors	Social Stud. Education Professors	Tech Ed. Professors	Ed. Foundation Professors	Professors Outside of Education	PreK-6 Cooperating Teachings	Phys Ed. Professors
N	Valid	18	18	18	18	18	18	18	18	18
	Missing	2	2	2	2	2	2	2	2	2
Mean		2.33	2.17	2.22	2.33	2.17	2.22	1.94	2.17	2.33
Std. Deviation		0.594	0.707	0.732	0.767	0.857	0.732	0.639	0.707	0.767
Variance		0.353	0.500	0.536	0.588	0.735	0.536	0.408	0.500	0.588

Table 5 shows that respondents mostly agreed that their professors appropriately demonstrated the application of TPACK-related skills and knowledge. The areas where respondents indicated doubt whether their professors appropriately modeled their instructions and lectures on TPACK were social studies (N = 6), pre-K6 (N = 6), and physical education (N = 6). It could be deduced that physical education, by its very nature, does not typically involve technology-supported teaching and learning since most lessons target physical activity.

Table 5. Role Modeling Item Responses.

	RM—Mathematics		RM Literacy		RM Science		RM Social Studies		RM Instructional Technology		RM Ed. Foundation		RM Professors Outside of Education		RM PreK-6 Cooperating Teachings		RM Phys. Ed.	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Strongly Agree	1	5%	2	10%	2	10%	2	10%	3	15%	2	10%	4	20%	3	15%	2	10%
Agree	10	50%	12	60%	11	55%	9	45%	11	55%	11	55%	11	55%	9	45%	9	45%
Disagree	7	35%	3	15%	4	20%	6	30%	2	10%	4	20%	3	15%	6	30%	6	30%
Strongly Disagree	0	0%	1	5%	1	5%	1	5%	2	10%	1	5%	0	0	0	0	1	5%
Missing	2	10%	2	10%	2	10%	2	10%	2	10%	2	10%	2	10%	2	10%	2	10%

Two correlation analyses were conducted to analyze interactions between the RM of survey items and gender, RM, technology, educational work experience, and TPACK elements. Table 6 indicates a correlation between RM and certain pedagogical content knowledge items (PCk), with TPACK items as a group.

Table 6. Correlation of Role Modeling with TPACK Concepts.

	Role Modeling	Tk	Mk	SSk	SK	Lk	Pk	PCk	TCk	TPk	TPACK
RM	1	−0.239	0.137	0.042	0.087	0.239	0.352	0.567 *	0.312	−0.013	0.537 *
Tk		1	−0.108	0.165	0.167	0.061	−0.261	−0.353	0.064	0.159	−0.451 *
Mk			1	−0.464 **	0.699 **	−0.078	0.005	−0.006	0.115	−0.333	0.060
SSk				1	−0.187	0.331	0.025	−0.078	0.002	0.578 **	−0.275
Sk					1	−0.118	−0.076	−0.292	−0.127	−0.155	−0.067
Lk						1	0.043	0.150	0.256	0.583 **	0.133
Pk							1	0.750 **	0.390	0.188	0.67 **
PCk								1	0.639 **	−0.144	0.71 **
TCk									1	−0.221	0.326
TPk										1	−0.119
TPACK											1

*. The correlation is significant at the 0.05 level (2-tailed). **. The correlation is significant at the 0.01 level (2-tailed).

RM correlations seem to indicate some causal influence from the observation of professors' demonstrations and familiarity with PCk and the TPACK constructs. Namely, lecturers are more likely to demonstrate appropriate integration of teaching practices, content, and technologies into their teaching. However, the evidence seems to suggest that participants did not observe significant or memorable integration of technology into the dissemination of the content (math, science, social studies, and literacy).

9. Discussion

A regional university located in Australia's far north, CDU provides distance education to undergraduates from various parts of the nation (from remote areas to urban ones). The percentage of participants who chose to study online (62%) seems to align with that in the study of Redmond and Peled [47], who reported that 70% of their sample elected to study externally. Owing to CDUs location and the variety of students who study online, the present research was conducted to ascertain PSTs familiarity with the TPACK model. At the time of this research and writing of this project, no published work appeared on how CDU prepared teachers. To improve the quality of teacher training units, this research was structured to collect evidence from various learners with professional experience in one unit.

This research employed a small sample size, which is not uncommon in the field. For instance, Gill and Dalgarno [48] conducted interviews with six undergraduates. Maor [49] explored digital pedagogies with a sample of 40 respondents collected over 2 years [49], and Tan et al. [50] conducted multimodal research on TPACK literacy using 220 respondents, including 76 from China, 91 from Indonesia, and 53 from Australia ([51], p.292).

While various sources support the observation that education is mostly a career path for females, a sizable proportion (45%) of the sample was male. This concords with research by Reyes et al. [51], who found that 53.8% of their respondents were male. The correlation analysis suggested few causal linkages among age, gender, work experience, TPACK familiarity, and TPACK RM.

Regarding TPACK knowledge, the findings were decidedly mixed. Some results were heartening. For instance, on a scale of 1–4—where 1 represented "strongly agree" and 4 "strongly disagree"—1.65 was the mean for the statement; "I am thinking critically about how to use technology in my classroom". Similarly, the mean was 1.6 for the statement, "I can adapt the use of technologies that I am learning about to different teaching activities", and 1.65 for the statement, "I can choose technologies that enhance teaching approaches for a lesson". These results suggest that, on average, students believe that they are thinking about how to use and select technology in a classroom for a beneficial effect. Yet more intriguingly, the findings are more positive except for the items of competence in content knowledge, none of which rose above 1.7 and most of which hovered slightly above 2.00 (with decidedly more negative results for social studies, as previously discussed). Nearly all the items for classroom management, curricular development, and the like rose above 2.1. (For instance, the statement "I know how to organize and maintain classroom management" elicited a mean of 2.20). This would suggest that students are slightly *more* confident in their abilities to apply technological knowledge in classrooms than to apply their skills for classroom management and conveying content. While this does not clearly show confidence in their technological abilities, the results are not as dire as might have been predicted based on existing research.

Meanwhile, the mean for the statement "I keep up with important new technologies" was 2.15 and 2.00 for the statement "I know about a lot of different technologies". Therefore, while students express general confidence in their ability to evaluate and deploy technologies for classroom use, they appear less confident in their *general* technological savviness. They are also somewhat less confident in their ability to work at the intersection of technological, pedagogical, and content knowledge. For all these items (such as the statement, "I can teach lessons that appropriately combine literacy, technologies, and teaching approaches"), the mean rose slightly above 2.0. However, further research is required to know whether students tend to doubt their abilities in these areas more or whether they were simply confused about the concept of combining technological, pedagogical, and content knowledge. Namely, these items may have simply appeared more daunting. Either way, the results suggest that students would benefit from greater familiarity not simply with technological classroom approaches but with the idea of TPACK integration.

Finally, one of the most intriguing findings was the negative correlation between technological knowledge and TPACK familiarity, r (18) = -0.45, $p < 0.001$. This seems to suggest that PSTs are not immune to the so-called Dunning-Kruger effect, whereby individuals with less competence in an area tend to be more confident of their ability to solve problems in that area [52]. "This meta-ignorance (or ignorance of ignorance) arises because lack of expertise and knowledge often hides in the realm of the 'unknown unknowns' or is disguised by erroneous beliefs and background knowledge that only appear to be sufficient to conclude a right answer" ([52], p. 247). Without further testing and observation, we cannot say conclusively that this effect comes to bear on teacher evaluations of their technological competence.

10. Limitations

The most obvious limitation of this study is its sample size. The requirements set by the ethics policy of the National Health and Medical Research Council (NHMRC) may have negatively impacted the survey return rate. As stipulated by the NHMRC [53], "... a person's decision to participate in research is to be voluntary..." ([53], p. 16). This, arguably, may have allowed students to simply disregard a survey (which is different from indicating "no consent"). The policy places researchers in distance education institutions at risk of not collecting sufficient evidence to conduct robust quantitative analyses.

Additionally, the response rate may have been influenced by survey fatigue. Abraham et al. [54] review the Pre-service Teacher Professional Experience survey and its instrument design to observe that longer instruments tend to increase survey fatigue. Students may receive many surveys, which explains their lack of response. Finally, arguably, students in distance-education universities may suffer from low interest in responding to research surveys. For instance, in their study conducted at an Australian southern state regional campus, Reyes et al. [51] reported that the faculty had 4000 students at the time of writing. However, just 39 PSTs completed the full survey in this study.

A second limitation is related to the pandemic. This research was designed in 2019, before the outbreak of COVID-19. By 2020, COVID-19 had broken out and, among other things, impacted the mental health of many Australians. This event could not be foreseen, and this research team did not consider adding health-related items to the TPACK survey. The mental health of educators during the COVID-19 period is a growing research area. For instance, Fisher et al. [55] reported that among the 13,829 survey respondents, 27% experienced significant symptoms of depression and 21% reported symptoms of anxiety ([55], p. 460). Such evidence indicates that future TPACK researchers can consider items related to pandemic-induced anxiety and other mental health issues. The outcome of the pandemic is that Australia, like many other countries, is experiencing a teacher shortage, an area of research that validates further studies in teacher preparation and professional knowledge application [56].

Additionally, further research is needed on the effect of the pandemic on the use and practice of technology. For instance, Juanda et al. [57] investigated the impact of the pandemic on TPACK, as COVID necessitated a shift from on-campus education to online learning. Their concerted finding was that, not only are many teachers not technology savvy, but PSTs access to technology may be limited owing to low-quality products and/or poor internet bandwidth.

While the participants seemed to respond positively to the questions on their ability to integrate technology into their teaching, the extent of this expertise was not evaluated, and this places substantial limitations on the findings. König et al. [58] explain that PSTs need not only extensive knowledge and skills but also confidence in integrating technology into their teaching. The real issue is not competencies in technology and hardware operation; rather, PSTs need more training in software use and the selection of the most effective age/level-appropriate apps and websites to facilitate students' content retention.

11. Recommendations for Further Research

While the findings offer a broad overview of respondents' familiarity with the TPACK model, this ongoing research will continue to explore potential factors that impact respondents' experiences during their teacher training program. Most research utilizes Qualtrics as software to design surveys and collect data [59]. Meanwhile, the evidence suggests that better digital survey design can increase the sample size and return rates [60]. Since the current research is ongoing, further review of Qualtrics-based survey design is warranted [61].

The CDU annual report for 2020 indicated a 28% increase in online enrollment between 2019 and 2020 [30]. Lorenza and Carter [62] explain that online teaching is a newly required skill and that teachers may not be appropriately trained to proceed with it. Such evidence reveals the need for further research on PSTs ability to apply their technological competence as it relates to the acquisition of content and the development of effective ICT pedagogy within a rapidly changing environment. Likewise, online learning offers other challenges, such as distance-learning fatigue, which is related to the COVID-19 impact on mental health [63]. While CDU does not overly rely on Zoom lectures, Rahmi and Zilka [64] report that "Zoom fatigue" may lead to poor concentration.

Zhang and Tang [65] reviewed TPACK literature, focusing on recent adaptations like TPACK-CORP, TPACK-IDDIRR, and TPACK-COIR, which guide Pre-Service Teachers (PSTs) in exploring, experimenting with, and interpreting the TPACK Model. They note that teachers perceive Interactive White Boards (IWBs) differently, although there is a concern that IWBs might lead to passive student engagement. Teo et al. [66] argue that IWBs have questionable pedagogical utility, suggesting a preference for other technologies like educational apps. This points to the need for further TPACK research, particularly in the use of alternative technologies like Excel or SPSS, to enhance investigative and data reporting skills, crucial for lifelong learning.

Additionally, Mishra [67] contextually relabeled elements in the TPACK model by defining CK as "contextual Knowledge" ([67], p. 77). The original authors do not seem to explore the context any further, though the context should be investigated in the future (see [66] for a similar opinion). In Australia, as in other countries, contexts could include remote and regional areas where First Nation (indigenous) communities continue to thrive. Similarly, urban demographic contexts may have shifted from predominantly Caucasian to more diverse migrant communities. Teo et al. [66] also add that the notion of context could reflect employers' expectations and Industry 4.0. Understanding the context is significant, as teachers need to effectively integrate technology into educational contexts and deliver effective and authentic learning opportunities to prepare students for employment and for becoming effective active citizens. Auld and Djabibba [68] suggest, "students should be provided with opportunities to construct texts where their knowledge and culture are naturally embedded into the final digital product so they have a clear understanding of how their world view and the use of technology can be included in the curriculum" ([68], p. 63).

Given Auld and Djabibba's [68] explanation about students owning technologies, another factor that is related to indigenous knowledge of various digital tools and may impact contexts is teachers' prior demographic and cultural experiences and beliefs [69]. PSTs may need to explore technology integration using a multi-focal lens that includes multi-ethnic understanding and application of technology to achieve more culture-centric representations.

The present study should be expanded in future research in several other ways. Most obviously, because this assessment relied on self-reporting in a survey format, expanding it into a full-bodied case study would be ideal, incorporating a variety of data. For instance, it would be useful to interview PSTs concerning their previous experiences with technology as well as their ability to deploy technology during their professional experiences.

When evaluating PSTs technological competence and confidence, it would be helpful to combine self-reporting with more objective data points, such as grades in particular courses, the number of technological courses taken, and assessments written by instructors on particular assignments that integrate technology into content and/or pedagogical knowledge. Given appropriate resources for future research, classroom observations would offer additional valuable insights.

Before offering more specific recommendations for refining teaching program strategies, conducting surveys and interviews among professors/instructors would be crucial. Among other things, the issue of context becomes particularly germane: to what extent are professors supported in their attempts to integrate technology into classroom practices? How do budgetary restraints affect them? How does the largely online nature of CDU affect their ability—in positive or negative ways—to instruct future teachers in the use of technology? Ultimately, it would be ideal to add a comparative component to this study, particularly by incorporating a mix of online and traditional teacher training institutions. Likewise, additional cross-cultural and contextual analyses would be beneficial to compare results across different regional/international institutions, cultures, and settings.

12. Implications for Policy and Practice

Integrating technology into pedagogical practices is essential, particularly as the lack thereof severely hinders students' preparedness for technologically-driven job sectors. Teachers perform an enormous disservice to their students when they fail to prepare those students for jobs in sectors that rely on technology. Moreover, attempts are needed to address problems in technological adaptation, though the mean for technological items in this TPACK survey does not fall below 1.5 (which would indicate cohesive, strong agreement that PSTs are well-prepared in these areas). While more research is doubtlessly needed, predicting where the problems with the technological training of PSTs lie is not difficult. To ensure that education professors/instructors receive ongoing training in newly emerging software and apps relevant to their field, it is crucial. Also, funding is urgently required to support the enhanced incorporation of technology into the training of teachers.

Many schools have sought partnerships with private entities in the technological sector to support more robust technology-driven teaching and learning. Teacher training programs might be wise to adopt this approach. After all, a strong case could be made that tertiary educators serve primary and secondary students best by training teachers not simply to use new technologies but to learn how to explore emerging technologies and comfortably adopt new approaches. This is a fertile area for public-private partnerships.

These observations may have great implications for the following two reasons:

(1) Pandemics may continue to emerge, requiring both students and educators to deliver online content, and (2) with greater access to more efficient and ubiquitous tech-

nologies and learning [70], learners are developing greater specific digital skills. Such an evolving digital learning and teaching environment may require reconsidering TPACK components to align with increasingly younger learners' access to and awareness of digital-based learning possibilities, which may necessitate a restructure of Higher Education lecturer knowledge and reflection on the impact of technology on teaching methodologies and approaches.

13. Conclusions

Prior research offers few insights into PSTs ability to integrate technology into all aspects of their teaching. However, teachers should impart discrete technological skills to their students and train them to become confident, lifelong users of technology and tech-savvy problem solvers. Therefore, this study attempted to understand how PSTs at CDU in Australia's Northern Territory perceive their own ability to integrate technology into their teaching. As a major site of teacher training that—through its combined online and in-person approach—reaches students throughout Australia and even abroad; CDU makes for an ideal site of study.

To focus on the integration of technological knowledge with content and pedagogical knowledge, this research employed a survey developed by Schmidt et al. [7] based on the TPACK model developed by Mishra and Koehler [11]. Overall, the survey results suggest that students are slightly more confident in their technological knowledge and ability to deploy technology in the classroom than they are in their content areas. This was a heartening finding, though more research is needed to gain a multi-dimensional understanding of PSTs facility with TPACK and direct efforts to sharpen CDUs approach to technology integration into its teaching program.

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Conflicts of Interest: The authors report there are no competing interests to declare.

Appendix A

Table A1. Survey Results: Mean and Standard Deviation.

	Valid	Mean	Std. Dev.	Loading
Tk1—I know how to solve technical problems I face	20	1.75	0.639	0.93
Tk2—I update my knowledge of important new technologies	20	2.15	0.813	0.95
Tk3—I can easily learn technology	20	1.50	0.607	0.91
Tk4—I frequently test technology	20	1.80	0.834	0.98
Tk5—I know about many different technologies	20	2.00	0.649	0.92

Table A1. *Cont.*

	Valid	Mean	Std. Dev.	Loading
Tk6—I have skills to use technologies	20	1.75	0.444	0.97
Mk1—I have sufficient knowledge about mathematics	20	2.05	0.759	0.93
Mk2—I can use a mathematical way of thinking	20	2.00	0.795	0.98
Mk3—I adopt various ways and strategies to develop my understanding of mathematics	20	2.15	0.875	0.97
SSk1—I have sufficient knowledge about social studies	20	3.15	0.671	0.99
SSk2—I can use a historical way of thinking	20	3.20	0.894	0.98
SSk3—I use various ways and strategies to develop my understanding of social studies	20	3.05	0.999	0.98
Sk1—I have sufficient knowledge about science	20	2.00	0.562	0.94
Sk2—I can use a scientific way of thinking	20	2.05	0.605	0.96
Sk3—I have various ways and strategies of developing my understanding of science	20	1.95	0.605	0.96
Lk1—I have sufficient knowledge about literacy	20	1.70	0.470	0.97
Lk2—I can use a literary way of thinking	20	1.85	0.587	0.96
Lk3—I use various ways and strategies of developing my understanding of Literacy	20	1.75	0.550	0.89
Pk1—I know how to assess students' performance in a classroom	20	2.00	0.562	0.94
Pk2—I can adapt my teaching based upon what students currently understand or do not understand	20	1.85	0.587	0.92
Pk3—I can adapt my teaching style to different learners	20	1.90	0.641	0.97
Pk4—I can assess students' learning in multiple ways	20	2.00	0.562	0.93
Pk5—I can use a wide range of teaching approaches in a classroom setting	20	2.00	0.649	0.94
Pk6—I am familiar with students' common understandings and misconceptions	20	2.15	0.671	0.88
Pk7—I know how to organize and maintain classroom management	20	2.20	0.696	0.96
PCk1—I can select effective teaching approaches to guide student thinking/learning in mathematics	20	2.10	0.553	0.97
PCk2—I can select effective teaching approaches to guide student thinking and learning in Literacy	20	2.15	0.671	0.97
PCk3—I can select effective teaching approaches to guide student understanding/learning in Science	20	2.15	0.587	0.98
PCk4—I can select effective teaching approaches to guide student thinking and learning in Social Studies	20	2.40	0.681	0.94
PCk5—I can select effective teaching approaches to guide student thinking and learning in Phys. Ed.	20	2.10	0.852	0.95
TCk1—I know about technologies that I can use for understanding and doing mathematics	20	1.95	0.686	0.94
TCk2—I know about technologies that I can use for understanding and doing Literacy	20	2.10	0.718	0.94
TCk3—I know about technologies that I can use for understanding and doing Science	20	2.10	0.641	0.94
TCk4—I know about technologies that I can use for understanding and doing Social Studies	20	2.30	0.657	0.94

Table A1. *Cont.*

	Valid	Mean	Std. Dev.	Loading
TCk5—I know about technologies that I can use for understanding and doing Physical Education	20	2.25	0.716	0.97
TCk6—I can choose technologies that enhance the teaching approaches for a lesson	20	1.65	0.489	0.95
TCk7—I can choose technologies that enhance students' learning for a lesson	20	1.75	0.444	0.96
TPk1—My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom	20	2.00	0.649	0.98
TPk2—I am thinking critically about how to use technology in my classroom	20	1.65	0.489	0.90
TPk4—I can adapt the use of the technologies that I am learning about to different teaching activities	20	1.60	0.503	0.97
TPk5—I can select technologies to use in the classroom to enhance what I teach, how I teach, and what students learn	20	1.80	0.410	0.95
TPk6—I can use strategies that combine content, technologies, and teaching approaches about which I learned in my coursework in my classroom	20	1.95	0.394	0.97
TPk7—I can assume leadership in helping others coordinate the use of content, technologies, and teaching approaches at my school and/or district	20	2.00	0.562	0.96
TPk8—I can choose technologies that enhance the content for a lesson	20	1.70	0.470	0.91
TPACk1—I can teach lessons that appropriately combine mathematics, technologies, and teaching approaches	20	2.05	0.605	0.96
TPACk2—I can teach lessons that appropriately combine literacy, technologies, and teaching approaches	20	2.10	0.553	0.93
TPACk3—I can teach lessons that appropriately combine science, technologies, and teaching approaches	20	2.10	0.553	0.98
TPACk4—I can teach lessons that appropriately combine social studies, technologies, and teaching approaches	20	2.40	0.598	0.94

Appendix B

Table A2. Comparison between age differences and TPACK perceptions.

Age		Tk	Mk	SSk	Sk	Lk	Pk	PCk	TCk	TPk	TPACK
21–23	Mean	1.8000	2.0000	3.7333	1.8667	1.8000	2.1429	2.2400	2.3429	1.8667	2.1500
	SD	0.46248	0.00000	0.36515	0.29814	0.44721	0.24744	0.26077	0.25951	0.14487	0.22361
	N	5	5	5	5	5	5	5	5	5	5
24–26	Mean	2.0833	2.5000	2.0000	2.0000	1.6667	2.1429	2.4000	2.2857	1.7222	2.3750
	SD	0.35355	2.12132	1.41421	1.41421	0.47140	0.20203	0.28284	0.40406	0.54997	0.17678
	N	2	2	2	2	2	2	2	2	2	2
27–30	Mean	1.6667	2.6667	3.3333	2.2222	2.0000	1.8095	2.0000	2.0476	1.8519	2.0833
	SD	0.00000	0.66667	0.33333	1.07152	0.00000	0.78680	0.87178	0.67512	0.12830	0.14434
	N	3	3	3	3	3	3	3	3	3	3
31–34	Mean	1.8611	1.7222	2.8333	1.8889	1.5000	1.9048	2.1000	2.2381	1.6111	2.0833
	SD	0.88454	0.49065	0.65828	0.17213	0.65828	0.25017	0.57619	0.52424	0.37019	0.51640
	N	6	6	6	6	6	6	6	6	6	6
41+	Mean	1.7917	2.0000	3.2500	2.1667	2.0000	2.1071	2.2500	2.0000	1.9444	2.2500
	SD	0.45896	0.00000	0.50000	0.33333	0.00000	0.65335	0.50000	0.00000	0.11111	0.50000
	N	4	4	4	4	4	4	4	4	4	4
Total	Mean	1.8250	2.0667	3.1333	2.0000	1.7667	2.0143	2.1800	2.1929	1.7889	2.1625
	SD	0.55005	0.68056	0.75238	0.54074	0.46010	0.42707	0.48947	0.40213	0.27900	0.36522
	N	20	20	20	20	20	20	20	20	20	20

Appendix C

Table A3. Comparison between degree specialization and TPACK perceptions.

Course Specialization		Tk	Mk	SSk	Sk	Lk	Pk	PCk	TCk	TPk	TPACK
Primary	Mean	1.9583	2.0833	3.3750	2.2083	1.7917	1.8929	1.8250	2.0714	1.8611	2.0313
	SD	0.64703	0.68429	0.41547	0.53266	0.50198	0.48143	0.43342	0.45175	0.22023	0.31161
	N	8	8	8	8	8	8	8	8	8	8
Secondary	Mean	1.6667	1.8519	2.9630	1.7037	1.8519	2.1270	2.4889	2.2698	1.7531	2.3056
	SD	0.50690	0.41201	0.58794	0.42310	0.41201	0.42525	0.40139	0.40054	0.32288	0.42898
	N	9	9	9	9	9	9	9	9	9	9
Total	Mean	1.8039	1.9608	3.1569	1.9412	1.8235	2.0168	2.1765	2.1765	1.8039	2.1765
	SD	0.57806	0.55129	0.54157	0.53014	0.44281	0.45424	0.52859	0.42417	0.27647	0.39295
	N	17	17	17	17	17	17	17	17	17	17

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