ICT Teaching Practices from a TPACK Perspective – A View from a Regional Australian University

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Abstract

Three distinct clusters were identified from a survey study of a sample of 127 unit coordinators from a regional Australian University. The clusters emerged after a survey that explored perceptions of pedagogical practices that incorporated the use of Information Communication and Technology (ICT). The key components of the survey were based on seven constructs derived from the Technological Pedagogical and Content Knowledge (TPACK). For future investigations of TPACK application in university contexts, a three-cluster configuration of teacher-practitioners is proposed that requires empirical confirmation. The relevance of the findings of the inquiry and their implications on universities that conduct ICT intensive courses were also discussed, especially in relation to improving teaching practices.

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Introduction

This article is an exploratory analysis of how lecturers in an Australian regional university perceive the impact of Technological Pedagogical and Content Knowledge (TPACK) in their teaching practice. This inquiry addresses one main question: How do educators use Information Communication Technology (ICT) in a context where the interaction of technology and pedagogy serves as fundamental component of educational delivery? Using findings from a survey that mapped the teaching practices of unit (subject) coordinators, this inquiry undertakes cluster analysis in order to better understand perceived TPACK practices of university lecturers.

This exploratory inquiry is divided into four sections. Aside from providing the theoretical lens of TPACK, the initial section provides a description of the unique Australian regional context and how ICT plays a fundamental role in educational delivery. The second section provides an explanation of the methodological approach. An elaboration on the scope and limitations is included in this section. The third explores perceptions of TPACK practices of university lecturers. The final section provides a discussion of the findings and its implications to teaching practice.

Background

The research reported in this article was from 2010 and 2011. The Regional University) had 19,099 and 20,119 students enrolled in each of these years. Of these students, there were approximately 20% enrolled to study on-campus and 80% off-campus. Students who chose to study on-campus resided in or near Armidale, a regional centre in New South Wales, and attended lectures, workshops and tutorials in a face-to-face setting. Off-campus students studied from their home, from a distance. They received all their study materials through a Learning Management System (LMS). When studying in off-campus mode, study materials were in the form of html pages, downloadable PDF documents, podcasts, videos, discussion boards, chat rooms, blogs, wikis and through a variety of other interactive materials. In this period of time, the School of Education (SoE) had just over 4,000 students enrolled in each of the years with a larger percentage enrolled in off-campus mode than the university as a whole. In 2010, there were 14.84% enrolled in off-campus mode and in 2011, 13.74%. This meant that most of the teaching in the SoE was to off-campus students. Therefore, it was imperative that there be effective teaching through the use of technology.

Literature Review: TPACK in an Australian Context

What is TPACK?

Koehler and Mishra theorized the Technological Pedagogical and Content Knowledge or TPACK to illustrate what they claim to be the types of knowledge teachers need to teach effectively with technology (2005). The foundation of TPACK is arguably based on Pedagogical Content Knowledge (PCK) that was formulated by Shulman. Shulman posited that effective teachers possess knowledge to use pedagogy appropriately in bringing about effective learning and teaching in their respective subject or content areas (Shulman, 1986). Koehler and Mishra contend that TPACK should ideally be a synthesis of teachers' technological knowledge (TK), pedagogical

knowledge (PK), and content knowledge (CK). More importantly, they argue that TPACK needs to recognise the interactions between technological pedagogical knowledge (TPK), technological content knowledge (TCK) and pedagogical content knowledge (PCK) (Koehler & Mishra, 2005).

The amount of research and publications on the area of TPACK has been steadily increasing in the last decade (Wu, 2013). Empirical research has traditionally been focused on pre-service educators and determining how they perceive TPACK in their teaching practice. Koh et al. derived five constructs, namely Technological Knowledge, Content Knowledge, Knowledge of Pedagogy, Knowledge of Teaching with Technology and Knowledge from Critical Reflection while carefully analysing pre-service teachers' perceptions of technology and pedagogy interaction in a Singapore context (Koh, Chai, & Tsai, 2010). Angeli and Valanides further extend the analyses by proposing the notion of Information Communication Technology-Technological Pedagogical Content Knowledge (ICT-TPCK) while empirically testing variants of this model on pre-service teachers in a European context (Angeli & Valanides, 2009). A careful review of extant literature on TPACK consistently identifies seven constructs that have emerged as a basis for what can be argued as quintessentially representative of the interaction of technology, pedagogy and content. These are: (1) Technological Knowledge – describes the ability to operate digital devices and using software; (2) Pedagogical Knowledge – alludes to the knowledge of methods of learning and teaching; (3) Content Knowledge – refers to knowledge of the subject matter; (4) Technological Pedagogical Knowledge (TPK) – depicts knowing how technology can be appropriately used in teaching methods; (5) Technological Content Knowledge (TCK) – suggests knowledge of how technology can represent the subject matter; (6) Pedagogical Content Knowledge (PCK) – represents knowing how appropriate teaching methods can be applied for different subjects; and (7) Technological Pedagogical and Content Knowledge (TPACK) – is expressed as knowing how technology and pedagogy can be used fittingly for effective learning in different subjects (Mishra & Koehler, 2006).

Teaching Teachers for the Future (TTF) Project

It is an expectation that, in Australia, students will leave school with the necessary ICT skills and knowledge to enable them to be productive members of the community (Doyle & Reading, 2012). The "Teaching Teachers for the Future" (TTF) initiative was a national project designed to build the Information and Communication Technology in Education (ICTE) capacity of pre-service teachers in Australian institutions. The project was led by Education Services Australia (ESA) who partnered with the Office for Learning & Teaching (OLT), the Australian Institute for Teaching and School Leadership (AITSL), the Australian Council of Deans of Education (ACDE) and the Australian Council for Computers in Education (ACCE). All 39 teacher education institutions in Australia were involved. The project specifically targeted systematic change in the ICTE proficiency of graduate teachers across Australia by building the ICTE capacity of teacher educators and developing resources to provide rich professional learning and digital exemplar packages. An important aspect of this project was the institutional mapping of curriculum, pedagogies and assessment with awards available to pre-service teachers, especially focusing on Technological, Pedagogical Content Knowledge (TPACK) and the use of ICT in the educative process.

The Regional University Context

In May 2011, when the Mapping of Pre-Service Teacher Education units was undertaken, the Regional University had 79 academic staff (excluding casual appointments) and 2,654 students (552 on-campus and 2,102 off-campus). A major rewrite of awards began in 2011 to address the Australian Curriculum Requirements and to reconfigure the placement of professional experiences within the award. This rewrite provided an ideal opportunity to consider the place of ICTE and to address the lack of explicit teaching of TPACK.

The mapping was designed to represent the status of the units as at that time. The Semester 1 units were audited as taught in Semester 1 2011 but Semester 2 units were audited as taught in Semester 2 2010. The audit focus was on all pre-service teacher education awards offered by the Regional University. These awards involved 125 different units of study taught within the SoE, some of which were taught in more than one award. When there were important differences between the way a unit was taught to on-campus and off-campus students, the two units were audited separately. Each unit had a unit coordinator. Some academic staff coordinated more than one unit. The total number of academics involved in the mapping process, as unit coordinators, was 51.

Policies and projects that were designed to impact teaching decisions at both the school and university level also informed the mapping in terms of the integration of ICT into both curriculum and the delivery of that curriculum at the regional university. The Policies investigated were: “University Strategic Plan 2007-2010”, “University Assessment Policy”, “University Graduate Attributes Policy”, “Principles of Online Teaching at the Regional University”, “Regional University Learning Resources Policy” and “Regional University Assessment Policy”. The Projects investigated were: “Open2Learning” and “Teaching and Learning Connection with Technology”.

Implementation

The Mapping Audit Instrument (Appendix A) was developed from the Curtin University Audit Instrument. There were eight criteria used in the Regional University mapping to provide information about both “ICT Aspects of the Unit Delivery” and “ICT Knowledges”.

ICT aspects of Unit Delivery

- Curriculum (ICT use contextualised in the curriculum)
- Pedagogy (ICT strategies used to support the pedagogy)
- Assessment (ICT used as part of the Assessment process)
- Resources (ICT tools provided as part of the resources)

ICT Knowledges

- Technological Knowledge (Teaching about ICTs)
- Technological Content Knowledge (Teaching about ICTs relevant to specific content)

- Technological Pedagogical Knowledge (Teaching about the affordances of using ICT to support pedagogy)
- Technological Pedagogical Content Knowledge (Teaching about TPACK that transforms learning)

For each criterion, there were four levels: Undeveloped, Fundamental, Proficient and Innovative. The descriptors for each level were based on the descriptions of levels of development used in Strategic Dimension Two (Program: Curriculum, Assessment and Practicum) of the "Leading ICT in Education Practices" (Lim, Chai, & Churchill, 2010) capacity building toolkit and were refined in consultation with SoE academic staff. An evidence column was included to record the evidence to demonstrate the level of development recorded.

A three-step process was used to collect the information from the unit coordinators. First, the Information Communication Technology Pedagogy Officer (ICTPO) pre-populated the Instrument with any available information for a specific unit from the Regional University Course and Unit Catalogue. Second, the ICTPO emailed the Instrument to the unit coordinator with a cover sheet explaining the mapping purpose and process. Finally, the ICTPO met with the unit coordinator to follow up on the Instrument entries and to clarify the evidence provided in relation to the nominated level.

The process was first trialled with unit coordinators who were academics involved directly with the TTF Project and some minor adjustments were made to the expressions used in the descriptors for the different levels of the eight criteria.

Significance of the study: Focus on Practitioners in an Australian Regional Context

This inquiry engages with current debates on TPACK. The significance of this study was to interrogate TPACK from current teacher practitioners (i.e. university lecturers) and from a regional Australian perspective that relies heavily on ICT for the delivery of educational instruction. Most of the current research and publications in TPACK from 2002 to 2011 centre on pre-service teachers (54.2%) while university or college teaching have not received equal attention receiving only (8%) (Wu, 2013, p. E75). Harris et al. have suggested the need to plot how teachers perceive the ways in which they employ TPACK in their teaching practice:

> Given the similar underlying assumptions of the interdependence of TPACK's conceptual components described earlier, we argue that tool and resource use—both digital and non-digital—can similarly not be separated from content/theme and activity structure. Therefore, TPACK-related activity types for teachers' use should be conceptualized and presented in terms of their specific disciplinary discourses, and in conjunction with their technological affordances. (Harris, Mishra, & Koehler, 2009, p. 405)

Methodology

Research Participants

A total of 127 unit coordinators[1] teaching at the SoE, the Regional University, participated in the survey. The survey included 18 items. Two main researchers elicited responses from research participants and coded these into the data. For the purpose of this inquiry, only 10 of these items were used: Two items are grouping variables (categorical), namely: (1) the targeted level for the course (i.e. primary, lower secondary, upper secondary, secondary or applicable to all levels); and (2) the predominant mode of teaching implemented for the course (i.e. on-campus, off-campus or blended learning). The other eight items were polytomous variables measured from a four point Likert Scale that ranged from Undeveloped-Fundamental-Proficient-Innovative. These eight items were:

Items that test knowledge of TPACK:

(1) ICT use contextualised in the Curriculum;
(2) ICT strategies used to support the Pedagogy;
(3) ICT used as part of the Assessment process;
(4) ICT tools provided as part of the Resources;

Items that test the practice of TPACK:

(5) Teaching about ICTs;
(6) Teaching about ICTs relevant to specific content;
(7) Teaching about the affordances of using ICT to support pedagogy; and
(8) Teaching about TPACK that transforms learning.

Data Collection and Analysis

The analytical approach used for this inquiry was cluster analysis. This approach commonly employed in market research is described as a method of data mining where information would be divided into analogous groups or clusters that consist of "objects that are similar to one another and dissimilar to objects in other groups" (Berkhin, 2006, p. 26). Cluster analysis has also been employed to "perform data reduction" with the end of identifying "natural" groupings within a large set (Chan, 2005, p. 153). This method has also been has termed as "the art of finding groups in data" (Kaufman & Rousseeuw, 2005, p. 5). For this inquiry, the collected data would be explored for the possibility of identifying latent characteristics that are not fairly obvious:

> Cluster analysis is a multivariate statistical technique for grouping cases of data based on the similarity of responses to several variables/subjects. The purpose of cluster analysis is to place subjects/objects into groups, or clusters, suggested by the data, such that objects in a given cluster are homogenous in some sense, and objects in different clusters are dissimilar to a great extent. In cluster analysis, the groups are not predefined but are rather suggested on the basis of the data. (Verma, 2013, p. 318)

Two-Step Cluster Analysis

[1] The unit of analysis in this inquiry is the unit coordinator. In the teaching context at the University, individual academics may take on multiple roles as unit coordinator.

The Statistical Package for the Social Sciences (SPSS) was used to analyse the data collected from this inquiry. In particular, the SPSS TwoStep Cluster Component which "handles both continuous and categorical variables" as well as providing the data procedure the "capability to automatically find the optimal number of clusters" was employed for this exploratory analysis (SPSS Inc., 2001, p. 3). In conducting the TwoStep Cluster Analysis, a 5% noise handling restriction was implemented. This was done in order to minimise the dilution of "useful information provided by other variables" due mostly to "non-informative variables" or outliers that could deleteriously impact the clustering of data (Kaufman & Rousseeuw, 2005, p. 14)

Table 1
Frequency distribution- Unit of analysis (N=127)

		Number	Percent %
Course Level	Primary	47	37
	Lower Secondary	10	7.9
	Upper Secondary	5	3.9
	Combined Secondary	30	23.6
	Applicable to all levels	35	27.6
	Total	**127**	**100**
Mode of Teaching	On Campus	12	9.4
	Off Campus	58	45.7
	Combined (On/ Off)	57	44.9
	Total	**127**	**100**
ICT use contextualised in the curriculum	Undeveloped	60	47.2
	Fundamental	45	35.4
	Proficient	21	16.5
	Innovative	1	0.8
	Total	**127**	**100**
ICT strategies used to support pedagogy	Undeveloped	26	20.5
	Fundamental	62	48.8
	Proficient	30	23.6
	Innovative	9	7.1
	Total	**127**	**100**
ICT used as part of the Assessment process	Undeveloped	53	41.7
	Fundamental	42	33.1
	Proficient	23	18.1
	Innovative	9	7.1
	Total	**127**	**100**
ICT tools provided as part of the Resources	Undeveloped	54	42.5
	Fundamental	48	37.8
	Proficient	20	15.7
	Innovative	5	3.9
	Total	**127**	**100**
Teaching about ICTs	Undeveloped	59	46.5
	Fundamental	40	31.5
	Proficient	24	18.9
	Innovative	4	3.1
	Total	**127**	**100**
Teaching about ICTs relevant to specific content	Undeveloped	62	48.8
	Fundamental	32	25.2

	Proficient	29	22.8
	Innovative	4	3.1
	Total	**127**	**100**
Teaching about the affordances of using ICT to support pedagogy	Undeveloped	68	53.5
	Fundamental	28	22
	Proficient	24	18.9
	Innovative	7	5.5
	Total	**127**	**100**
Teaching about TPACK that transforms learning	Undeveloped	108	85
	Fundamental	18	14.2
	Proficient	1	0.8
	Innovative	0	0
	Total	**127**	**100**

Results

From our analysis, we were able to identify the emergence of three clusters from the 127 unit coordinators who participated in the survey. The three clusters are groups of unit coordinators who appear to "coalesce" in terms of teaching practices in relation to TPACK. The sizes of the clusters were as follows: Cluster One – 35 (27.6%); Cluster Two – 52 (40.9%) and Cluster Three – 40 (31.5%) (see Figure 1)

Figure 1 approximately here

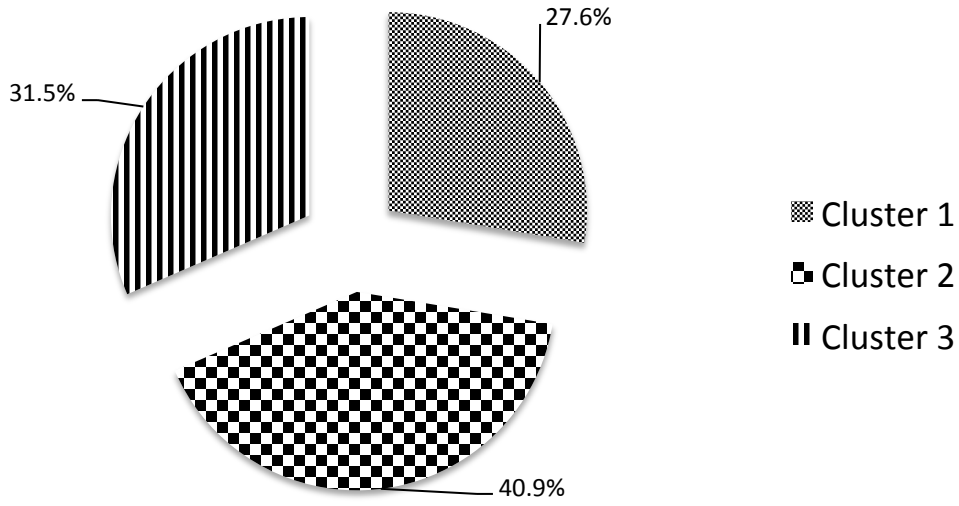

Figure 1: Three emerging clusters from the data analysis

Are these three clusters distinct from each other?

We undertook a series of Analysis of Variance (ANOVA) tests in order to determine whether the three clusters that emerged are indeed distinct from one another. Using ANOVA as an omnibus test, we evaluated the null hypothesis that there were no

statistically significant differences in the three generated clusters. Post hoc tests were conducted for the analyses that yielded significance levels.

Teaching about TPACK that transforms learning

A one-way Analysis of Variance (ANOVA) was used to test for differences among three identified clusters in relation to the question "Teaching about TPACK that transforms learning". Responses to the question differed significantly across the three clusters, $F(2, 126) = 14.395$, $MS_e = 1.776$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "Teaching about TPACK" controlling for the three clusters are probably different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "Teaching about TPACK that transforms learning" was significantly higher for Cluster 1 ($M = 1.43$, $SD = .558$) than were those in both Cluster 2 ($M = 1.06$, $SD = .235$) and Cluster 3 ($M = 1.05$, $SD = .221$). Pairwise comparison for Cluster 1 with both Clusters 2 and 3 were significant while the pairwise comparison of Cluster 2 and Cluster 3 was non-significant.

ICT use contextualised in the Curriculum

ANOVA was used to test for differences among the three clusters in relation to "ICT use contextualised in the Curriculum". Responses differed significantly across the three clusters, $F(2, 126) = 44.472$, $MS_e = 15.500$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "ICT use contextualisation in the curriculum" among the three clusters are probably different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that ICT contextualisation in the curriculum was significantly higher for Cluster 1 ($M = 2.43$, $SD = .698$) than were those in both Cluster 3 ($M = 1.73$, $SD = .599$) and Cluster 2 ($M = 1.21$, $SD = .498$)

ICT strategies used to support the Pedagogy

Differences among the three clusters were tested with ANOVA in relation to the question "ICT strategies used to support the pedagogy". Responses to the question differed significantly, $F(2, 126) = 46.426$, $MS_e = 18.880$, $p = .00$, $\alpha = .05$. We can conclude that practices of the three clusters regarding "ICT strategies in support of pedagogy" are probably different. Tests of the a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "ICT strategies used to support the pedagogy" was significantly higher for Cluster 1 ($M = 3.06$, $SD = .725$) than were those in both Cluster 3 ($M = 1.85$, $SD = .580$) and Cluster 2 ($M = 1.83$, $SD = .617$).

ICT used as part of the Assessment process

One-way Analysis of Variance (ANOVA) was used to test for differences among the three clusters in relation to the question "ICT used as part of the Assessment process". Responses differed significantly across the three clusters, $F(2, 126) = 62.380$, $MS_e = 27.801$, $p = .00$, $\alpha = .05$. One can conclude that "ICT practices as part of assessment processes" controlling for the three clusters are probably different. Testing the a priori hypotheses using Bonferroni adjusted alpha levels of .0167 (.05/3) indicated that "ICT

practices as part of assessment processes" was significantly higher for Cluster 1 (M = 2.97, *SD* = .822) than were those in both Cluster 2 (M = 1.58, *SD* = .537) and Cluster 3 (M = 1.40, *SD* = .672).

ICT tools provided as part of the Resources

A one-way Analysis of Variance (ANOVA) was used to test for differences among the three clusters in relation to the question "ICT tools provided as part of the Resources". Responses to the question differed significantly across the three clusters, $F(2, 126) = 78.644$, $MS_e = 25.013$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "ICT tools provided as part of the Resources" controlling for the three clusters are probably different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "ICT tools provided as part of the Resources" was significantly higher for Cluster 1 (M = 2.83, *SD* = .664) than were those in both Cluster 3 (M = 1.43, *SD* = .549) and Cluster 2 (M = 1.42, *SD* = .499).

Teaching about ICTs

Differences among the three clusters were tested with ANOVA in relation to the question "Teaching about ICTs". Responses to the question differed significantly across the three clusters, $F(2, 126) = 62.444$, $MS_e = 23.398$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "Teaching about ICTs" controlling for the three clusters are probably different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "Teaching about ICTs" was significantly higher for Cluster 1 (M = 2.77, *SD* = .690) than were those in both Cluster 3 (M = 1.40, *SD* = .672) and Cluster 2 (M = 1.42, *SD* = .499).

Teaching about ICTs relevant to specific content

ANOVA was used to test for differences among the three clusters in relation to "Teaching about ICTs relevant to specific content". Responses to the question differed significantly across the three clusters, $F(2, 126) = 77.248$, $MS_e = 28.314$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "Teaching about ICTs relevant to specific content" controlling for the three clusters are probably different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "Teaching about ICTs relevant to specific content" was significantly higher for Cluster 1 (M = 2.89, *SD* = .5838) than were those in both Cluster 3 (M = 1.40, *SD* = .672) and Cluster 2 (M = 1.38, *SD* = .565).

Teaching about the affordances of using ICT to support pedagogy

One-way Analysis of Variance (ANOVA) was used to test for differences among the three clusters in relation to the question "Teaching about the affordances of using ICT to support pedagogy". Responses to the question differed significantly across the three clusters, $F(2, 126) = 14.395$, $MS_e = 1.776$, $p = .00$, $\alpha = .05$. There is sufficient evidence to conclude that practices regarding "Teaching about the affordances of using ICT to support pedagogy" controlling for the three clusters are probably

different. Tests of the three a priori hypotheses were conducted using Bonferroni adjusted alpha levels of .0167 (.05/3). Results indicated that "Teaching about the affordances of using ICT to support pedagogy" was significantly higher for Cluster 1 (M = 3.00, *SD* = .686) than were those in both Cluster 2 (M = 1.38, *SD* = .565) and Cluster 3 (M = 1.18, *SD* = .385).

The ANOVA and post hoc tests prove that the three clusters that have emerged from the analysis are distinct. Moreover, generating the omega squared ($\acute{\omega}^2$) calculations for each of the tests registers a range of 0.41 to 0.66, all of which are moderate effect sizes. Table 2 provides a summary of the practical significance that the tests are able to produce in relation to statistically significant differences in relation to TPACK practices controlling for the three different clusters.

Theorising three clusters of TPACK practitioners

The results from the cluster analysis and the subsequent ANOVA found three distinct groups as outlined in Figure 1. We theorise that in the context of this inquiry – a regional Australian University – three types of unit coordinators according to their level of TPACK usage emerge. We describe these groups as Cluster 1 – unit coordinators who are able to negotiate between the knowledge and practice of TPACK, Cluster 2 – unit coordinators who are more inclined to state that they practice TPACK more than knowing what it really is and Cluster 3 – unit coordinators who are ambivalent towards the knowledge and practice of TPACK.

Cluster 1: Negotiators of TPACK Knowledge and Practice. Cluster 1, the smallest group with only 27.6% of unit coordinators, clearly demonstrated that they are able to negotiate between knowledge and practice. The ANOVA tests conclusively indicate that those who belong to Cluster 1 recorded the highest standardised scores. We theorise that those who belong to Cluster 1 perceive themselves as individuals who are able to negotiate the knowledge-practice divide in teaching TPACK. Less than 30% of unit coordinators teaching in a university setting that uses ICT intensively are able to negotiate the knowledge and practice of TPACK.

Cluster 2: Practicing TPACK more than knowing more about it. Cluster 2 with 31.5% of unit coordinators, were more inclined towards practice. The ANOVA tests indicate that for the items that attempted to measure the practice of TPACK, those in Cluster 2 registered the second highest standardised scores. We interpret this to mean that this group of unit coordinators practice aspects of TPACK while not necessarily delving deep into knowing the ways in which technology, content knowledge and pedagogy can have greater integration. Almost 30%, or a little over one third of all unit coordinators from the School of Education, in an ICT-intensive university indicate that they practice certain aspects of TPACK; but are not necessarily actively engaging with attempts to know technology integration in greater depth.

Cluster 3: Ambivalence towards knowing and practicing TPACK. Cluster 3, with the majority of the respondents at 40.9% of unit coordinators, were ambivalent towards either knowledge or practice of TPACK. The ANOVA tests reveal that Cluster 3 had the lowest standardised scores compared to the other two clusters. We theorise that unit coordinators in Cluster 3 possess the greatest dissonance between knowing and practicing aspects of TPACK. Almost 41% of unit coordinators teaching

at a university known for using ICT ubiquitously have indicated their ambivalence towards knowing and practicing TPACK. This statistic undoubtedly presents a complex situation to a higher degree institution that actively presents itself as an ICT-intensive learning hub.

Table 2: Effect sizes of Different Clusters

ICT practices	Cluster 1	Cluster 2	Cluster 3	F	*p*	$\acute{\omega}^2$
ICT use contextualised in the Curriculum	2.43	1.21	1.73	44.47	0.00	0.41
ICT strategies used to support the Pedagogy	3.06	1.83	1.85	46.42	0.00	0.42
ICT used as part of the Assessment process	2.97	1.58	1.40	62.38	0.00	0.49
ICT tools provided as part of the Resources	2.83	1.42	1.43	78.64	0.00	0.55
Teaching about ICTs	2.77	1.42	1.40	62.44	0.00	0.49
Teaching about ICTs relevant to specific content	2.89	1.38	1.40	77.24	0.00	0.55
Teaching about the affordances of using ICT to support pedagogy	3.00	1.38	1.18	121.82	0.00	0.66

Effect sizes metric: ω^2 <= .01 (small); ω^2 =.06 (moderate); ω^2 >.16 (large)

Conclusions

> For teacher educators, principals, or even colleagues, it seems worthwhile to listen to and discover more about the teachers with whom we work – before we teach, guide, or collaborate with them. Providing external stimuli, models or opportunities is only one part of engaging an individual in a learning experience (Hughes, 2003, p. 16)

This exploratory inquiry was an attempt for teacher educators at an Australian regional setting to "discover more about the teachers with whom we work with." Using the TPACK framework, our inquiry paved the way for us to identify preliminary models in which we engage in the knowing and practice of integrating technology, pedagogy and content knowledge.

Our empirical research explores TPACK practices of Teacher-Educators (as opposed to most of the empirical research that discusses Pre-Service Teachers). A key insight derived from our analysis is the existence of a disconnect between the knowledge and practice of combining ICT, content and teaching. In exploring TPACK practices of Teacher Educators we "theorise" that in a unique regional Australian university context, three distinct clusters of Teacher-Educator practitioners emerge. These three

distinct clusters represent the "distance" between the disconnect of ICT knowledge and ICT practice. These preliminary findings can be investigated in greater depth: For example, what is the impact of these three clusters to the learning outcomes of students? Or using these three clusters as starting points and with additional data, what could Confirmatory Factor Analysis (CFA) reveal regarding the measurement and structure of University educators' TPACK practices?

One of several implications that our inquiry could surface is that in relation to large-scale investments on resources such as Australia's TTF manifested in time, equipment and professional development for TPACK training, there is a need for a nuanced approach as opposed to a "one-size-fits all" style. In other words, TPACK needs to be "problematised" by policy-makers, university administrators and teacher-educators. Conventional models of TPACK would need to be carefully investigated and contextualized. We have provided evidence that in an Australian regional context, the integration of technology, pedagogy and content knowledge is not that simple and is actually fraught with challenges. Perhaps the biggest challenge that we have uncovered is the need to initially "bridge the disconnect" before massive and probably wasteful investments on ICT (i.e. TPACK) training is undertaken.

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Appendix

Audit Instrument to determine ICT integration into the Curriculum, Pedagogy, Assessment and Resources of the Regional University's School of Education Undergraduate Pre-Service Teacher Courses					
Unit Title:		Code:		Coordinator:	
Audit Item	**Undeveloped**	**Fundamental**	**Proficient**	**Innovative**	**Evidence**
ICT use contextualised in the Curriculum	ICT use not contextualised in the Curriculum	ICT use is contextualised in the Curriculum outcomes or other Curriculum documentation	ICT use is contextualised in the Curriculum outcomes and other Curriculum documentation	ICT use is contextualised in the Curriculum and demonstrates an innovative approach to the Curriculum	
ICT strategies used to support the Pedagogy	ICT strategies not used to support the Pedagogy	ICT strategies used minimally to support the Pedagogy	ICT strategies used to support the Pedagogy where most relevant	ICT strategies used to support the Pedagogy and the use is informed by one or more learning paradigm(s)	
ICT used as part of the Assessment process	ICT not used as part of the Assessment process	ICT used as part of the Assessment process	ICT used authentically as part of the assessment process	ICT used authentically and innovatively as part of the assessment process	
ICT tools provided as part of the Resources	ICT tools not provided as part of the Resources	ICT tools provided as part of the Resources but without customisation of resource(s)	ICT tools provided as part of the Resources and customised to enhance teaching and learning	ICT tools provided as part of the Resources and customised to enhance teaching and learning in an innovative way	
Teaching about ICTs (TK)	No teaching about ICTs	Implicit teaching about ICTs	Explicit teaching about/modelling of ICTs	Explicit teaching about/modelling of innovative ICTs	
Teaching about ICTs relevant to specific content (TCK)	No teaching about the ICTs relevant to specific content	Implicit teaching about ICTs relevant to specific content	Explicit teaching about/modelling of ICTs relevant to specific content	Explicit teaching about/modelling of innovative ICTs relevant to specific content	