An approach for doctoral students conducting a context-specific review of literature in IT, ICT, and Educational Technology

An approach for doctoral students conducting a context-specific review of literature in Educational Technology

Dr Gabriella Pretto and Dr Gina Curró

Centre for Student Success, Victoria University, Melbourne, Australia

Corresponding author: gina.curro@vu.edu.au

Provide short biographical notes on all contributors here if the journal requires them.

An approach for doctoral students conducting a context-specific review of literature in Educational Technology

Since 1980s the rate of change in Educational Technology (EdTech) has been phenomenal. Naturally, this has had an impact on the information-seeking behaviours of doctoral students and other researchers. Initiating a search to locate, manage and evaluate sources in interdisciplinary fields is challenging. Akin to opening a Pandora's Box, the terminology varies among the three fields of Information Technology (IT) and Information and Communication Technology (ICT). Doctoral students trying to classify technology related studies can easily find themselves overwhelmed. This article offers a systematic, practical approach for reviewing and categorising the literature. Key search terms, a list of *eJournals*, and the Institutional Contexts and Specific Usages of IT and ICT are presented, together with a 5 step process to assist doctoral students navigating their way through the literature. The table of contents (and excerpt) from the LR chapter of a thesis is included to illustrate one approach for categorising themes.

Keywords: IT, ICT, Educational Technology, literature review, doctoral research

Subject classification codes: include these here if the journal requires them

Introduction

Today the information/digital/media literacy challenges facing doctoral students are massive. Some of the issues involved for universities developing strategies for academic libraries have been discussed by Walton (2016). When doctoral students are initiating searches, locating and evaluating studies information-seeking behaviours can affect their searching results. The information-seeking behaviours of doctoral students have been investigated by Spezi (2016), who defines search strategies as an iteration process.

> With the ubiquity and pervasive use of networked communications and the Internet in the academic and social life of doctoral students, it is important to understand how this is affecting information behaviour patterns, and particular and particularly information-seeking behaviours. This means exploring issues such as where doctoral students start their research, why they chose to take those initial steps and how they follow through from there. (Spezi, 2016, p. 82)

While digital natives are known for their expertise in searching and evaluating certain resources, when searching requires more sophisticated strategies, they may experience difficulties. Some doctoral students "struggle with searching library resources, particularly when it comes to developing efficient search strategies" (Spezi, 2016, p. 100). Our article has been written in direct response to those specific search challenges. It has been designed with interdisciplinary fields in mind, targeting doctoral students searching and classifying the vast literature in IT, ICT and EdTech. It grew out of a qualitative study into IT teacher pedagogy in Australian tertiary settings (Pretto, 2011). Because the terms IT, ICT and EdTech are used ubiquitously and indiscriminately throughout the literature, classifying studies and finding consistent themes among them can be problematic. As mentioned earlier, there is a great deal of cross-over when the disciplinary fields of IT, EdTech and ICT meet, making the searching, locating, categorising and reviewing the literature a demanding and formidable task.

IT is used as an umbrella term for a range of subjects , and there is confusion in the way concepts and language are used; there is no common language across the discipline (Voogt & Knezek, 2008). IT refers to both computer equipment as well as the name of the discipline. A degree of confusion also exists between IT, the discipline, and with ICT, which is the integration of technology into other disciplines such as Science, Maths and English. Not only is ICT often used interchangeably with IT, because technology is involved there is also a cross-over with a newly emerged area, the discipline of educational technology. According to Koppi & Naghdy (2009), under these circumstances, it is difficult to reach agreement on a single set of disciplines. These diverse, yet similar elements add a layer of complexity when reviewing and classifying the literature, because any investigation in IT actually involves not only three main separate fields of study - IT, ICT

and educational technology - and the relevant key terms associated within each of these fields, but also other technology-related vocabulary adopted by a range of publications.

Consequently, this has resulted in a rich and extensive range of terms and concepts used interchangeably, such as computing, technology-enhanced learning (TEL), e-learning and online learning, as well as new terms being coined, for example, digital technologies, blended learning and m-learning (mobile learning). There seems to be little consistency in the way these terms are used in studies, which poses challenges for researchers attempting the literature review. Mastery of the literature is essential in doctoral research with examiners devoting considerable attention to this assessable area. In an investigation of 2,121 doctoral examination reports, 89% of the comments concerned the literature review (Bourke, Holbrook and Lovat cited in Denholm & Evans, 2007) as it is fundamental to the development of the thesis because it provides structure, context, inspiration and defines the scope of the research (Crowley cited in Denholm & Evans, 2012).

Information Technology and Information Communication Technology

The motivation for the paper came from the challenging experience of conducting a Qual-quan doctoral investigation in the IT and technology related fields, *The Pedagogy of IT Teachers* (Pretto, 2011). Pretto's doctorate analyses the pedagogical and curriculum frameworks in IT teaching, with particular reference to how IT is articulated through practice. Different learning theories, including e-Learning and Constructivism were examined, as well as an exploration of *best-practice* in peer observed teaching, and student perception of what is a *good teacher* and a *good lesson*. Twelve IT teachers in seven Melbourne metropolitan educational institutions were videotaped over 44 hours of lessons, and IT teacher pedagogy was investigated from four different perspectives: the visible

pedagogy of the lesson, teaching style and philosophy, teacher-student interaction and classroom talk.

One of the difficulties reviewing this subject area is the inconsistent and varied use of key terms. Furthermore, the wide ranging use of the term, *IT*, and the resultant confusion with *ICT* in the literature, is compounded by the adoption of words such as *computer* and *technology*, to describe similar concepts, as well as the use of other nomenclature to describe teaching departments and courses. Underwood (2004, p. 136) supports the authors' view arguing that there is a weakness in IT investigations, due to a failure "to use the language and theoretical perspectives common across the discipline". As can be seen in Table 1 below, in Australia the terms IT and ICT are used to express different concepts, depending on the specific discipline and context.

Table 1: Institutional Contexts and Specific Usages of IT and ICT

Commented [VU1]: The table here is in a separate file as per instructions

IT, as it applies in the TAFE/VET sector, is taught as a separate discipline with very basic instruction occurring at Certificate I, II and III, gradually acquiring greater complexity at Certificate IV and Diploma levels. In secondary schools, IT refers to VCE subjects in Years 11 and 12. In addition, when IT is used in the context of curriculum in TAFE/VET, schools and universities, it usually refers to the disciplinary subjects associated with computer software and hardware. That however is not straightforward because the umbrella term, IT, is used to describe the use of the equipment itself e.g. computer hardware and software. Along these lines, ICT is used to describe the way in which computers are used within disciplinary subjects such as Science, Humanities, Maths or Physical Education. However, this is not always the case as evidenced by the use of ICT as a departmental name for IT and multimedia courses in some educational institutions and universities (See Appendix 1: Institutes 2, 4, 6 and 7).

Webb and Cox (2004) claim that ICT is used to describe a discrete subject, as well as one that integrates technology in the curriculum. Consequently, when Phelps (2002) writes about ICT, her interpretation of the term is not clear because insufficient details are provided; as a result, it is not possible to work out the meaning from the context. A number of academics use IT and ICT interchangeably (Gibson, 2001; Hammond, 2004; Schoeny, 2002), while others use ICT to describe the integration of technology within the curriculum (Kirschner & Davis, 2003; Loveless, 2003). For others ICT is a skill requiring high levels of knowledge and technical analysis (Laurillard et al. cited in Balacheff, Ludvigsen, de Jong, Lazonder, & Barnes, 2009). Part of the reason for this indiscriminate use of terms may lie in the fact that ICT is a recent addition to the educational lexicon in Australia and abroad. In England, IT was renamed ICT in the UK national curriculum in 1999 (Hammond, 2004). The term, ICT, and not IT, is used by several Australian university departments (University of Melbourne, Swinburne University of Technology and Griffith University). Therefore, the boundaries between ICT and IT are not often clearly delineated, leading to haphazard and arbitrary usage by educationalists.

Common Terms used in IT

It could be said that as a consequence of the indiscriminate and arbitrary usage of terminology, the IT glossary is rich and descriptive, with related terms such as *computer*, *technology* and *web* used interchangeably. Because scant attention has been paid to the careful and precise use of terminology, research in policy and evidenced-based practice has become problematic (Kennedy et al., 2006). The most frequently used terms are *computer* (Shields & Behrman, 2000, p. 4; Subrahmanyam, Kraut, Greenfield, & Gross, 2000, p. 124), *computer technology* (Becker, 2000, p. 44; Chen, 2000, p. 168) and *computer-based technologies* (Roschelle, Pea, Hoadley, Gordin, & Means, 2000, p. 76). These terms are

used in a generic way to describe hardware, software or teaching and, are often substituted for the terms, IT or ICT. For example, the word *computer* refers to 'greatly enriched learning' (Wartella & Jennings, 2000, p. 31), whereas Resnick (2000, p. 173) uses it to mean 'material for making things'.

To compound the classification dilemma, there are a variety of meanings for *educational technology*, as it often refers to a range of media that includes text, audio, images, animation and streaming video; it may also include more recent electronic tools used in teaching such as mobile phones, tablets/iPads, apps and games. *Educational technology* is interpreted as 'rich and flexible media for representing what students know and what they are learning' (Jonassen, Peck, & Wilson, 1999, p. 12). Chen (2000) and Becker (2000) offer an alternative view of Educational Technology as the inequitable distribution of software and hardware resources; this is a social justice perspective that highlights the equitable allocation of equipment so that individual and groups are not disadvantaged. Others use the term *digital technologies*, *instructional technology* or Web 2.0 to include social media, online games and cloud computing (Laurillard et al. cited in Balacheff et al., 2009; Markauskaite & Wardak, 2015). According to Compton (cited in Berge & Muilenburg, 2013), *m-learning* or *mobile learning* are commonly used to refer to smart phones or other hand-held devices. At times the language choices used to express IT related terms are not even consistent within the same article. Dede (2000, p. 178) for instance, refers to *technology* as hardware earlier in his paper, and then elsewhere in the article describes it as a *learning tool*; the use of the term, *learning tool*, is significant because it is an example of how an author introduces a pedagogical dimension or context to the discussion.

Throughout the literature the term, *technology*, can be found (Moyle & Owen, 2009, p. 7; Norton & Wiburg, 2003, p. xi; Schrader, 2008, p. 457). Younie & Leask (2013) use the term *technology* to refer to the use of electronic tools for teaching, while Laurillard et al. (cited in Balacheff et al., 2009) use the term, *technology-enhanced learning* (TEL), to describe how technology inspires new types of learning experiences and scenarios. Related to this is the use of *blended learning* (Alammary, Sheard, & Carbone, 2014; Bonk & Graham, 2005) to describe the use of digital and online media for use in face-to-face teaching, and *digital learning* according to the Curriculum, Assessment and Reporting Authority (ACARA, 2015). When terms are used in this way, a pedagogical dimension is implied, and this inference requires a closer level of analysis and synthesis for cross-comparative studies.

The selection and use of IT, ICT or other related terms by some authors can also reflect a particular pedagogy. For example, didactic and constructivist models of IT teaching are described by Resnick (2000, p. 174): '[t]ransmitting information from teacher to learner or a process in which learners actively build an understanding of the world based on their experiences and interactions'. These are the two basic theoretical approaches in IT or ICT education and technology related words, for example, the internet, are often used in the same vein. Preston (cited in Leask, 2001, p. 200) describes the *internet* as a *telecommunications centred learning environment*, Montgomery (2000) as *online content*, Selinger (cited in Leask, 2001, p. 93) as *virtual space* and Robertson et al. (2004) as *learning spaces*. Indeed, authors are imaginative in their IT or technology related language choices. Therefore, it is important to align the specific terms with the relevant learning theory, in order to make sense of what is being described and where it is situated in the

literature. This kind of systematic and careful analysis leads to common ideas or related concepts being classified into themes more accurately.

A number of other IT related terms are used to express the same or similar ideas. For example, Selinger (cited in Leask, 2001, p. 83) uses *computer aided learning*, *computer based learning* and *integrated learning systems* interchangeably. By contrast, Brusilovsky (2003) uses the term *adaptive learning* to explain the use of computers as interactive teaching devices, while *Smart Learning* (Pennington, 2014) describes pedagogy enabled by software. Distinguishing clear differences among the terms used becomes vital. Moreover, Broadbent (2002, p. 9) states that *online* refers to *virtual learning environments* and *e-Learning*, whereas Tomei (2005, p. xix) claims it is *learning management environments*, *distance education* or *flexible delivery*. In contrast, Albion's definition of *online* (2002, p. 1) is 'a supplemental website supporting a class to a complete course offered to students around the globe who never meet'. Tomei (2005, p. xv), however, uses *computer assisted instruction*, *computer based training*, and *computer managed instruction* to indicate the absence of teacher instruction or *teacherless classrooms*. The TAFE/VET equivalent of these terms would be *self-paced learning*, as users study online in their own time, pace and location; the TAFE/VET sector overseas are usually refer to polytechnics or community colleges. According to Moore et al. (2011), the inconsistent use of these labels for e-Learning, online and distance learning makes it difficult to conduct cross-study comparisons and build on previous studies. In our opinion, the issue goes beyond a 'relaxed use of terminology' (Moore et al., 2011, p. 129); the lack of attention to careful or precise use of language by educationalists is critical.

Tool is another word commonly used for computer equipment. In a Canadian review of the literature on ICT and technological tools in education from 1995 to 2008, researchers

that found an increasing number of authors substituted tool(s) for more specific terminology. '...[G]iven the need to understand ICT within the constantly changing social and cultural contexts of local and global societies, it is misleading when digital hardware, software and infrastructure are reduced to being called a tool (Arntzen, Krug, & Wen, 2008, p. 6)'. Therefore, in order to avoid this confusion and develop an accurate understanding of these terms, the researcher needs to examine the context and the assumptions underlying the particular interpretation of each author; this is very time consuming and requires close attention to detail, to avoid making assumptions and incorrectly classifying the literature.

IT as an umbrella term for a range of subjects

The discipline of IT is considered an umbrella term for a range of subjects with several areas of specialisation that include networking, website development and programming languages, commonly offered in different faculties. IT is also considered as a signature pedagogy (Gurung, Chick, & Haynie, 2009) because of common characteristics or styles in teaching and learning. When a number of courses in metropolitan Melbourne university and TAFE/VET institutes are compared, one sees a cross-over or similarity between the subjects delivered by the departments of Informational Technology, Multimedia and Engineering (see Appendix 1: Cross-over between IT, Multimedia and Engineering). For example, a number of the subjects offered by the IT department in some educational institutions (Institutes 1, 3, 5, 6 and 7) on web related technologies are also offered by the Multimedia or Engineering departments. The common subjects are web pages, website scripting, HTML and animations. The TAFE/VET Information Technology department in Institute 7 offers similar courses to the Department of Visual Art, Design and Multimedia, while Institute 5 offers comparable web based courses as the departments of Business, Design and Science Engineering and Technology. Moreover, in Institute 1, the

Advanced Diploma in Engineering included competencies such as animation, authoring and creating 3D digital images, and Institute 5 offers web pages and multimedia programming within the Computer Science and Computer Systems Engineering streams.

In addition, Institutes 1 and 4 have one department that offers both IT and Multimedia courses such as School of Art, Design and ICT and Information Technology and Multimedia, respectively. Conversely, the name of the department in Institute 7 is ICT, yet the subjects listed in the handbook are advertised using the term, *IT*. C*omputer* and/or *Information Technology* courses offered within other departments. For example, in Institute 1, the Engineering department are offers a Diploma of Technology (Computing) and the Multimedia department in Institute 6 offers a Diploma of Information Technology (Multimedia Integration). Although not directly discussed, consideration also needs to be given to the fact that library studies or information management is a stream included within IT courses by some universities. The varied use of nomenclature across the educational institutions makes reviewing the literature complex and complicated, especially when attempting to map the literature of a large body of knowledge.

Key search terms and e-Journals

A recent search of e-Journals with the key terms of *IT*, *ICT*, *computer* or *education technology* resulted in more than 5,230 likely sources, which is a substantial number of publications, and locating relevant articles from such a large number of journals can overwhelm experienced as well as novice researchers. When this search was first conducted in 2011, there were 726 e-Journals in total, which shows a 95% or a twenty fold increase in about five years. It can be seen that there are nearly four times as many hits with *computer* or *IT*, twenty times with *ICT* and an eight fold increase using *Educational Technology* as key terms. Refer to Table 2: e-Journal Search of Key Terms, below.

Table 2: e-Journal Search of Key Terms in 2011 and 2016

Commented [VU2]: In a separate file as per instructions

The broad use of the key terms IT, ICT, and educational technology gives rise to an extensive range of e-Journals for researchers, and the need to cast the net widely when searching. 'If a candidate is to make an original contribution to knowledge, then they … will need to read broadly at first then read increasingly deeply and more specifically' (Crowley cited in Denholm & Evans, 2007, p. 210). The need to read broadly in combination with a using a wide IT taxonomy, makes the search process more complicated. As can be seen below (Table 3: Summary of IT Search Terms), the list of search terms is extensive, and by no means conclusive.

Table 3: Summary of IT Search Terms

Commented [VU3]: In a separate file as per instructions

A 5-Step Process

There are a range of approaches to assist doctoral students in their search for relevant sources (Dunleavy, 2003; Evans & Gruba, 2002; Murray, 2006), as well as advice on the specific academic language to use when writing their critiques (Kamler & Thomson, 2014; Ridley, 2012; Swales & Feak, 2012). However, these writers provide generic approaches to literature searches. To date, there is no context-specific method for organising and categorising literature from the field of IT or ET, and therefore, there is no a practical or methodological approach for assisting in the management of such a complex body of knowledge. A number of questions have been used by supervisors and others to guide the doctoral student into sorting the literature. For example, does the IT literature fit into discrete categories? If so, what is the justification for the selection of these categories? Are there discernible themes emerging from the IT literature? Are the gaps in the IT

literature easily identified? Consequently, sorting the IT related terms into relevant categories for the doctoral literature review can be overwhelming.

Furthermore, when beginning to search and locate sources in IT other questions arise. For example, how does one categorise digital technology, online and web based approaches? Is TEL hardware/software, pedagogy or learning environment? In a literature search of the IT/educational technology disciplinary area, the secret lies in *appropriately* narrowing, filtering and classifying themes that exist among the various studies from the range of interrelated disciplines. Before the searching process starts, the researcher is faced with a triple bind: one must find *suitable* key terms, and then make a selection of the *right* journals, in order to locate *relevant* articles. In responding to this dilemma a framework (See Figure 1: The 5-Step Process) is presented below. This process provides IT researchers with a systematic approach to managing and classifying sources into themes. Based on direct experience of the authors, searching and classifying the appropriate IT or technology related literature in a systematic way constitutes a five-step process. Even though the process is presented in five stages, it is a fluid process enabling backwards-forwards movement as required, because the literature searching process is not linear.

Based on the authors' experience surveying the IT literature, the most effective method to resolving the literature review challenge is to adopt a practical, methodological approach involving the following steps:

1) Start from the very general to the specific: survey a wide range of key search terms such as computer, technology, IT and educational technology before applying more specific descriptors that include ICT, e-Learning, TEL, and digital technologies in order to capture the relevant journals and books. Limiting your search terms may hinder the ability to find valuable sources that lie outside usual search parameters, and within the reference lists of those journal articles and books.

2) All technology related journals and books need to be quickly scanned and surveyed; in particular those published within the last 3-5 years, in order to build a reference list that may be filtered by applying more specific search terms. Analysing the title as well as the abstract is important at this stage, and many may be rejected. It is important not to dismiss articles pitched at other educational levels, because the reference list may provide further relevant sources.

3) When refining the selection of articles or books, it is important to skim-read the full article as the title and abstract may not provide a clear indication of the contents. Again it is important to scrutinise the reference list for important sources in order to identify key authors. Writing a brief, one sentence summary of the contents of each source stating its relevance or value to the topic may prove useful in the process of sorting, filtering and culling your list. This could be accomplished in bibliographic software such as *Endnote* and *Mendeley*, on a spreadsheet, or written at the top of hardcopies. With literature searches for doctoral investigations, some researchers may find printouts easier to locate than digital copies, if they are not filed and named correctly.

4) At this stage a close reading of the selected sources takes place with careful attention to the technology or IT related terms. Particular assumptions, learning environment and/or context of the use of terms should be analysed. This can assist in evaluating whether the IT related terms are used with precision. Some authors select particular terms or words carefully, while others are not as scrupulous. This important part of the process ensures valid cross-comparisons among the studies, adding a layer of rigour to the search process. Then the selected literature can be sorted and classified accurately with confidence.

5) Lastly, as soon as the sets of articles, books or chapters are selected, further culling and sorting takes place. The technology related terms are checked for consistency and context, common themes identified in order to ensure a rigor in the classification process. This is an important step because it provides evidence that effective cross-study comparisons for your literature review have been conducted.

An organisational structure for naming and framing the literature

As mentioned earlier, this article emerged from the challenge of searching the literature in an investigation of IT and technology related fields - An investigation into the Pedagogical Framework used in the teaching of Information Technology in the TAFE/VET sector (Pretto, 2011). Her doctorate analyses the pedagogical and curriculum frameworks in IT teaching, with particular reference to how IT is articulated through practice. An excerpt from her thesis below demonstrates the structural organisation of the literature review, as framed in the table of contents. This example constitutes a solution in terms of structural organisation of interdisciplinary sources in IT, ICT and EdTech. When sorting interdisciplinary sources in a literature review, it is important to identify each discrete topic appropriately, and categorise the themes using carefully selected sub-headings, as can be seen in the Table of Contents below.

Table 4: Table of Contents Chapter 2 - Reviewing the Literature in IT

Commented [VU4]: See separate as per instructions

By developing a clearly defined structure the sequencing and ordering of information will be contained. More importantly, the critical debates and assessment of sources to be undertaken for each section will be easier to complete, making the final literature review convincing and clear to the examiner. The above structure serves as an exemplar or model for researchers reviewing the body of knowledge on the topic of IT pedagogy. Furthermore, in order to provide doctoral students with a detailed example of specific studies and how they were critiqued for this section of the thesis, an excerpt from the literature review, 2.9 Signature pedagogies, learning spaces and current practice in IT, is presented overleaf.

2.9 Signature pedagogies, learning spaces and current practice in IT

The literature on Signature Pedagogies has been included in the study, in order to establish whether IT qualifies as a discipline with a shared pedagogical understanding of teaching, in the TAFE/VET sector. Another issue which impacts pedagogy is the design or layout of computer labs, which explains why Learning Spaces also appears in this section. In order to find out what has been trialled successfully prior to this investigation, it was important to review current practice in IT.

Signature Pedagogies

Signature pedagogies are the ways in which disciplines prepare future practitioners with the requisite set of knowledge, skills, behaviours and core values of their chosen profession or field. Ciccone (cited in Gurung et al., 2009, p. xii) argues that the disciplines foster a pedagogy "about the habits of head, hand and heart" and help students think like disciplinary experts. It is a hallmark of professional education that each discipline has developed characteristics forms of teaching and learning that, like the name of a person written in his own hand, are done in the same way from teacher to teacher and institution to institution. These signature pedagogies, as Shulman refers to them, disclose important information about the personality of a disciplinary field – its values, knowledge and manner of thinking – almost, perhaps, its total world view (Calder, 2006, p. 1360).

As the above extract suggests, Shulman (2005a, 2005b) has published a number of papers on signature pedagogies, especially in the areas of law, medicine, engineering and the clergy. The examples he frequently cites are the case dialogue method in law where students are posed increasingly complex hypothetical situations or scenarios, and medical students diagnosing patients on clinical rounds in teaching hospitals (Falk, 2006; Shulman, 2005a, 2005b, 2005c). For Shulman (2005a, 2005b) the general focus is on the characteristics that tell the disciplines apart, while Huber & Morreale (2002) examine discipline-specific scholarship of teaching and learning issues. Pace & Middendorf (2004, p. 3) suggest strategies to identify a "culture of thinking in a specific discipline". They have developed a seven-step framework to assist teachers with the following: identifying bottlenecks in learning, reconstructing steps used by experts in solving problems, explicitly modelling tasks and providing students an opportunity to practice skills. This framework can be applied to a range of disciplines that include astronomy, physiology, history and biology.

Furthermore, Gurung et al. (2009) provide a series of accounts by academics on the manner in which particular disciplines are taught, with a view of investigating their signature pedagogy. These authors have detailed ways in which subjects are taught, such as the lecture and science lab in Physics, the memorization of facts and theorems in Mathematics and role of private lessons and performance in Music, to those more problematic such as the interdisciplinary nature of Human Development and the range of options for graduates in Agriculture from scientist, sales and farming

to other employment in the allied industries of seed, feed and processing. In many of these descriptions, the authors comment on the sharp differences between introductory and upper level courses and how by some miracle the guiding principles and assumptions of the discipline are progressed. Ciccone (cited in Gurung et al., 2009, p. xii) speaks with wonder on how first year French syntax prepares students for literary discussions on Moliere in second year.

According to Chick et al. (Gurung et al., 2009) signature pedagogies in traditional professions such as law and medicine are much more clear cut than those in non-professional areas, such as humanities, fine arts, social science and natural science. Non-vocational is probably a more relevant term to describe those disciplines, because they are still professional despite the fact they may not always translate directly to employment as a lawyer, doctor or priest. Shulman also believes that teacher education is an evolving field, because it is not coherent and has a "chaotic character"; and is an example of "the absence of signature pedagogies" (Falk, 2006, p. 82).

There seems to very little in the literature about a signature pedagogy for IT apart from Christie (cited in Gurung et al., 2009) writing about Computer Science. She explains how a drop in student enrolments, the development of object oriented programming and adoption of educational technologies caused changes to the traditional delivery of the subject (lectures and labs) and led to the introduction of games, multimedia and collaborative learning to "more precisely reflect what computer scientists do" (Gurung et al., 2009, p. 251). Christie (cited in Gurung et al., 2009) suspects there may be no one signature pedagogy because it is still evolving. The computer science community is taking a closer look at what it means to be a computer scientist and how to update the educational system to better train students to think and work like computer scientists do – essentially develop a signature pedagogy for computer science (Gurung et al., 2009, p. 255). Gurung et al. has hinted at the enormous range within each of the disciplines, and as Coppola(1996) points out, those who graduate with PhDs in physical or inorganic chemistry may have limited knowledge of general chemistry. Meanwhile questions have been raised about whether it is desirable to adopt a distinctive pedagogy for history as it is for law and medicine (Calder, 2006, p. 1370), while Shulman (2005a, p. 58) calls for the sharing of signature pedagogies to improve teaching and learning: "The comparative study of signature pedagogies across professions can offer alternative approaches for improving professional education that might otherwise not be considered." Therefore, it would appear that while information in the literature on signature pedagogies exists, there is scant mention of it in relation to IT, other than one strand of the discipline – Computer Science.

Conclusion

In this article the three fields of IT, EdTech and ICT have been discussed in relation to assisting doctoral students in their initial search for sources in order to develop the literature review. Initiating searches, locating and evaluating sources cannot be carried out without efficient information seeking strategies. Using examplars from the literature review of an IT related investigation into evidence-based practice this article presents practical solutions for categorising the literature, so important for developing critique and engaging with the main debates in the fields. IT is discussed as an umbrella term, and key search terms together with a list of *eJournals* have also been included. Furthermore, the Institutional Contexts and Specific Usages of IT and ICT, together with a 5-Step Process or organising framework for reviewing and classifying EdTech related literature are also discussed. As noted throughout the article, searching this literature is complex and complicated because of the interdisciplinary nature existing among IT, ICT and EdTech. The complexity lies in discerning the relevant sources from a large pool of journal and book titles, while using a number of search terms to locate those sources. The challenge becomes more intensive and intricate because the theoretical assumptions underpinning each article require analysis. The authors cannot stress how important it is to carefully examine the ways in which the terms are used in journal articles and books, and to scrutinise the context, assumptions and learning environments in which the terms and phrases are found. To assist the searching process, this article offers researchers a step-by-step guide to enable accurate categorisation of themes and appropriate comparisons of the literature. It offers doctoral students a more rigorous and strategic approach towards developing competence and confidence when undertaking literature review searching in these three fields. To a certain extent, this article is an example of an integrative literature

review (Torraco, 2005) as it provides a detailed account of how the IT related literature came to be identified, analysed, synthesised and critiqued, in the interests of producing new knowledge. As Thomson argues 'the ways in which language names and frames the literature review is significant' (2006, p. 45) and we could not agree more with this view.

References

ACARA. (2015). Digital Technologies: Curriculum. *Australian Curriculum.* Retrieved from http://www.australiancurriculum.edu.au/technologies/digital-technologies/curriculum/f-10?layout=1

Alammary, A., Sheard, J., & Carbone, A. (2014). Blended learning in higher education: Three different design approaches. *Australian Journal of Educational Technology (AJET), 30*(4), 440-454.

Albion, P. (2002). *Seeking A Balance Between Learner Freedom and Comparability of Outcomes In An Online Course*. Paper presented at the ACEC, Hobart, Tasmania.

Arntzen, J., Krug, D., & Wen, Z. (2008). ICT literacies and the curricular conundrum of calling all complex digital technologies "Tools". *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 4*(4), 6-14.

Balacheff, N., Ludvigsen, S., de Jong, T., Lazonder, A., & Barnes, S. (Eds.). (2009). *Technology-Enhanced Learning: Principles and Products*. United Kingdom: Springer Science and Business Media.

Becker, H. (2000). Who's Wired and Who's Not: Children's Access and Use of Computer Technology. *Children and Computer Technology, 10*(2), 44-75.

Berge, Z. L., & Muilenburg, L. Y. (2013). *Handbook of Mobile Learning*. Florence, KY: Routledge.

Bonk, C. J., & Graham, C. R. (2005). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. San Francisco: Jossey-Bass.

Broadbent, B. (2002). *ABCs of e-Learning: Reaping the Benefits and Avoiding the PITFALLS*. San Francisco: Jossey-Bass/Pfeiffer.

Brusilovsky, P. (2003). Adaptive and Intelligent Web-based Educational Systems. *International Journal of Artificial Intelligence in Education, 13*(2-4), 159-172.

Calder, L. (2006). Uncoverage: Toward a Signature Pedagogy for the History Survey. *The Journal of American History* (March), 1358-1370.

Chen, M. (2000). Five Commentaries: Looking to the Future. *Children and Computer Technology, 10*(2), 168-171.

Coppola, B. P. (1996). Progress in Practice: The Synergy Derived from Knowing Pedagogy as well as Chemistry. *The Chemical Educator, 1*(2), 1-11.

Dede, C. (2000). Five Commentaries: Looking To the Future. *Children and Computer Technology, 10*(2), 178-180.

Denholm, C., & Evans, T. (Eds.). (2007). *Supervising doctorates downunder: keys to effective supervision in Australia and New Zeland*. Victoria, Australia: ACER Press.

Denholm, C., & Evans, T. (Eds.). (2012). *Doctorates Downunder: Keys to successful doctoral study in Australia and Aotearoa New Zealand* (2nd ed.). Victoria, Australia: ACER Press.

Dunleavy, P. (2003). *Authoring a PhD: How to plan, draft, write and finish a doctoral thesis or dissertation*. Hampshire, England: Palgrave Macmillan.

Evans, D., & Gruba, P. (2002). *How to write a better thesis* (2nd ed.). Carlton, Victoria. Australia: Melbourne University Press.

Falk, B. (2006). A Conversation with Lee Shulman - Signature Pedagogies for Teacher Education: Defining Our Practices and Re-thinking Our Preparation. *The New Educator, 2*(1), 73-82.

Gibson, I. W. (2001). At the Intersection of Technology and Pedagogy: Considering Styles of Learning and Teaching. *Journal of Information Technology for Teacher Education, 10* (1&2), 37-61.

Gurung, R. A. R., Chick, N. L., & Haynie, A. (Eds.). (2009). *Exploring Signature Pedagogies: Approaches to Teaching Disciplinary Habits of Mind*. Sterling, Virginia: Stylus.

Hammond, M. (2004). The Peculiarities of Teaching Information and Communication Technology as a Subject: a study of trainee and new ICT teachers in secondary schools. *Technology, Pedagogy and Education, 13*(1), 160-185.

Huber, M. T., & Morreale, S. (2002). *Disciplinary styles in the scholarship of teaching and learning.* Washington, DC: American Association for Higher Education and The Carnegie Foundation for the Advancement of Teaching.

Jonassen, D., Peck, K., & Wilson, B. (1999). *Learning With Technology: A Constructivist Perspective*. New Jersey: Prentice Hall.

Kamler, B., & Thomson, P. (2014). *Helping Doctoral Students Write: Pedagogies for Supervision* (2nd ed.). London: Routledge.

Kennedy, G., Krause, K.-L., Gray, K., Judd, T., Bennett, S., & Maton, K. (2006). *Questioning the net generation: A collaborative project in Australian Higher Education*. Paper presented at the 23rd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE), University of Sydney. Sydney, Australia. 3-6 Dec, 2006.

Kirschner, P., & Davis, N. (2003). Pedagogic Benchmarks for Information Communications Technology in Teacher Education. *Technology, Pedagogy and Education, 12*(1), 125-147.

Koppi, T., & Naghdy, F. (2009). *Managing Educational Change in the ICT discipline at the tertiary level*. Retrieved from Wollongong, Australia.: http://www.altc.edu.au/resource-managing-educational-change-ict-discipline-uow-2009

Leask, M. (Ed.) (2001). *Issues in Teaching Using ICT*. New York: RoutledgeFalmer.

Loveless, A. (2003). Technology, Pedagogy and Education - Widening the Scope. *Technology, Pedagogy and Education, 12*(2), 197-199.

Markauskaite, L., & Wardak, D. (2015). Research students' conceptions of the role of information technology and communication technologies in educational technology research. *Australian Journal of Educational Technology (AJET), 31*(4), 421-438.
Montgomery, K. C. (2000). Children's Media Culture in the New Millennium: Mapping the Digital Landscape. *Children and Computer Technology, 10*(2), 145-167.
Moore, J. L., Dickson-Deane, C., & Gaylen, K. (2011). e-Learning, online learning, and distance learning environments: Are they the same? *Internet and Higher Education, 14*, 129-135.
Moyle, K., & Owen, S. (2009). *Listening to Students' and Educators' Voices: Research Findings*. Retrieved from Canberra, Australia:
Murray, R. (2006). *How to write a thesis* (2nd ed.). Berkshire, England.: Open University Press.
Norton, P., & Wiburg, K. M. (2003). *Teaching with Technology: Designing opportunities to learn*. London: Hartcourt Brace.
Pace, D., & Middendorf, J. (Eds.). (2004). *Decoding the Disciplines: A Model for helping students Learn Disciplinary Ways of Thinking* (Vol. 98). San Francisco: Jossey-Bass.
Pennington, R. (2014). Smart Learning Programme transforms education in UAE's government schools. *The National*. Retrieved from http://www.thenational.ae/uae/education/smart-learning-programme-transforms-education-in-uaes-government-schools
Phelps, R. (2002). *A Constructivist Approach To Professional Development in ICT Leadership: Creating A Learning Community*. Paper presented at the ACEC, Hobart, Tasmania.
Pretto, G. (2011). *The Pedagogy of IT Teachers: An investigation into the pedagogical framework used in the teaching of Information Technology in the TAFE/VET sector*. (Doctor of Education - Research Classified), University of Melbourne, Australia.
Resnick, M. (2000). Five Commentaries: Looking to the Future. *Children and Computer Technology, 10*(2), 173-175.
Ridley, D. (2012). *The Literature Review: A step-by-step guide for students*.
Robertson, M., Fluck, A., Webb, I., & Loechel, B. (2004). *Classroom Computer Climate, Teacher Reflections and 'Re-envisioning' Pedagogy In Australian Schools*. Retrieved from
Roschelle, J., Pea, R., Hoadley, C., Gordin, D., & Means, B. (2000). Changing How and What Children Learn in School with Computer-Based Technologies. *Children and Computer Technology, 10*(2), 76-101.
Schoeny, Z. G. (2002). Leadership of Information Technology in Education. *Journal of Information Technology for Teacher Education, 11*(3), 245-251.
Schrader, P. G. (2008). Learning in Technology: Reconceptualizing Immersive Environments. *AACE Journal, 16*(4), 457-475.
Shields, M., & Behrman, R. (2000). Children and Computer Technology: Analysis and Recommendations. *Children and Computer Technology, 10*(2), 4-30.
Shulman, L. (2005a). Signature pedagogies in the professions. *Daedalus, 134*(3), 52-59.
Shulman, L. (2005b, 6-8 Feb). *The Signature Pedagogies of the Professions of Law, Medicine, Engineering, and the Clergy: Potential Lessons for the Education of Teachers.* Paper presented at the Teacher Education for Effective Teaching and Learning at the Math-Science Partnership (MSP) Workshop, Irvine, California.

Spezi, V. (2016). Is information-seeking behaviour of doctoral students changing?: A review of the literature (2010-2015). *New Review of Academic Librarianship, 22*(1), 78-106.

Subrahmanyam, K., Kraut, R., Greenfield, P., & Gross, E. (2000). The Impact of Home Computer Use on Children's Activities and Development. *Children and Computer Technology, 10*(2).

Swales, M., & Feak, C. (2012). *Academic Writing for Graduate Students* (3rd ed.). Michigan, USA.: University of Michigan.

Thomson, P. (2006). *Helping Doctoral Students Write: Pedagogies for Doctoral Supervision*. Hoboken: RoutledgeFalmer.

Tomei, L. A. (2005). *Taxonomy for the Technology Domain*. Hershey, PA.: Information Science Publishing.

Torraco, R. J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review, 4*(3), 356-367.

Underwood, J. (2004). Research into Information and Communications Technologies: where now? *Technology, Pedagogy and Education, 13*(2), 135-145.

Voogt, J., & Knezek, G. (Eds.). (2008). *International Handbook of Information Technology in Primary and Secondary Education: Part One* (Vol. 1). New York, NY: Springer.

Walton, G. (2016). Digital Literacy (DL): Establishing the Boundaries and Identifying the Partners. *New Review of Academic Librarianship, 22*(1), 1-4. doi:10.1080/13614533.2015.1137466

Wartella, E., & Jennings, N. (2000). Children and Computers: New Technology - Old Concerns. *Children and Computer Technology, 10*(2), 31-43.

Webb, M., & Cox, M. (2004). A Review of Pedagogy Related to Information and Communications Technology. *Technology, Pedagogy and Education, 13*(3), 235-286.

Younie, S., & Leask, M. (2013). *Teaching With Technologies*. UK & New York: Open University Press (McGraw-Hill Maidenhead).