International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2015, Vol. 11, Issue 1, pp. 148-163

Reviewing and constructing categories for educational technology professionals

David Woo
University of Hong Kong, Pokfulam, Hong Kong

ABSTRACT

This literature review highlights the tension between cohesiveness and incoherence in operationalizing categories of educational technology professionals. Literature on learning technologists, educational technologists, e-learning technologists, information and communications technology coordinators and information technology coordinators was analyzed through a multilevel model of comparative education to address to what degree these educational technology professionals are similar units of analysis. Cohesiveness and incoherence within and between these categories by geographical and organizational levels, non-locational demographic groups and aspects of education and society was teased out. A degree of cohesiveness in operationalizing educational technology professionals was illustrated when the categories were framed as technologists and technology coordinators. However, ambiguity and incoherence were demonstrated particularly when attempting to locate an educational technology professional at a precise intersection of geographical and organizational levels, non-locational demographic groups and aspects of education and society. Researchers and practitioners can operationalize new categories of educational technology professionals by addressing ambiguity and incoherence within these educational technology professional categories. The review raises methodological implications and the need to establish valid constructs. It also raises the question of whether such categorization is necessary and worthwhile in an age of technological and professional change.

Keywords: *higher education, educational technology, technologists, comparative education, technology coordinators*

INTRODUCTION

As schools and other educational institutions develop using information and communication technology (ICT), educational technology professionals may play vital roles in the process of teaching and learning through technology. Their increasing presence in the research literature reflects their proliferation in practice. There may be a great opportunity to learn corporately about these professionals through the literature.

However, categories of educational technology professionals present several methodological challenges, particularly in establishing validity. Like the word technology, technologist is an assumption-laden term. The paradox of literature on educational technology professionals is that the terms used to describe educational technology professional roles are used casually without clear definitions or agreement on appropriate usage. As educational technology roles emerge in practice and as practitioners and researchers try to make sense of these roles by developing categories and assumptions for them, validity for each category must be established. Spillane and Healey (2010, p. 255) state succinctly that, “Fancy statistical methods, or even random assignment, cannot compensate for loose constructs”. If researchers, practitioners and readership do not agree on what a technologist is, they will read and write with many different assumptions about technologists and arrive at many different conclusions. A lack of clarity about the terms used to describe educational technology professionals does not advance reliable, collective knowledge about educational technology professionals.

This article is a literature review on educational technology professionals. The purpose of this review is to identify and compare how educational technology professionals have been operationalized in research and practice. The identification and comparison are a means to address to what degree categories of educational technology professionals are valid concepts, and to what degree they are comparable units of analysis. Prevalent categories of educational technology professionals were identified based on the root words to describe these professionals in the literature and this review presents limits to these categories. The first section is an examination of the technologist category. The second is an examination of the technology coordinator category. The possibility of operationalizing other educational technology professional categories was also examined based on gaps in the literature. The final section draws attention to methodological implications, opportunities to improve rigor and validity in category construction, and the question of whether such educational technology professional categorization is necessary and worthwhile in an age of technological and professional change.

This article features comparisons within and between selected categories of educational technology professionals. Comparing requires category descriptors, or levels. Although it is possible to create a unique framework for comparing technologists, the Bray and Thomas (1995) multilevel model of comparative education has been a useful foundation in the wider domains of education studies for academics and practitioners to make thoughtful comparisons (Bray, Adamson and Mason 2014). It presents a range of levels within domains with which cohesiveness and incoherence within and between categories of educational technology professionals can be explored. It can also be used for comparison between educational technology professional categories and other educational roles.

The framework's domains are geographic and organizational levels, non-demographic groups, and aspects of education and society. The analysis for each educational technology professional category addressed several levels for each of the three domains. The analytical framework is not exhaustive and leaves room for articulating new units (Manzon 2007). For instance, this review presupposed the creation of levels for comparison within the domains of non-locational demographic groups and aspects of education and society. Educational technology professionals were identified within the non-locational demographic groups domain by their membership groups, that is, to which groups educational technology professionals belong, either by self-identification or by others' identifying them; and by their associated groups, or other groups, with whom educational technology professionals work but to which membership is not claimed. Educational technology professionals were identified within the aspects of education and society domain by their professional knowledge, skills and practices; and by job titles and more generally, nomenclature associated with the educational technology professionals.

To question whether educational technology professional categories should be treated as equivalents or sub- or super-categories to each other and to question whether each category is used coherently in the literature required some reasonable generalization of educational technology professional nomenclature. In other words, this review requires operationalizing units. The units of technologists and technology coordinators were created from the root words of the terms used in the literature. The technologist literature review encompasses literature on learning technologists (LTs), educational technologists (ETs) and e-learning technologists (ELTs) since their root is technologist. Technologist is the reference term for all three groups. The technology coordinator literature review encompasses literature on ICT coordinators and information technology (IT) coordinators. The term technology coordinators refers to these two groups in this review.

TECHNOLOGISTS

Geographic/organizational levels

Regions and countries

Technologist categories may be constructed from the geographical location of technologists. Much research on LTs (Oliver 2002; Lisewski & Joyce 2003; Seale 2004; Ellaway et al. 2006; Davis & Fill 2007), ETs (Shurville, Browne & Whitaker 2008) and ELTs (Soyoz 2010) has been geographically located in the United Kingdom (UK). Shurville, Browne and Whitaker (2008) added that ETs can be geographically located in Australia. Mostert and Quinn (2009) reflected on the ET experience in South Africa. Oliver (2002) said that LTs can be found in North America and are referred to as instructional technologists.

Organizations and organizational units.

Similarly, technologist categories may be constructed from the types of organizations and organizational units to which these technologists belong. Almost all reviewed research on technologists has placed these roles within higher education institutions (HEIs), including universities and the British Council. Within HEIs, LTs have been assigned to subject-specific faculties (Davis & Fill 2007) and finer assignments such as to an e-learning unit of a learning technology section within a subject-specific faculty in a university (Ellaway et al. 2006). Ellaway et al. (2006) added that LTs can be responsible towards units, sections, colleges, universities and other organizational units within HEIs. Other authors have provided few clues as to where a technologist fits within an HEI's organizational units. LTs have been characterized as working within vague boundaries with no formal authority. And Seale (2004) suggested that LTs are a part of a community that includes disability officers, academics, researchers, and staff developers.

An exception to technologists' organizational locality came from Davidson's (2003) placing of ETs in school districts in the United States. A school district had 7 ETs who served 17 schools. Nonetheless, Davidson noted that these ETs, like other technologists, often operated with vague organizational boundaries, as demonstrated in the ETs working across multiple physical spaces in schools and rarely being anchored in a fixed location such as at an office or at a desk. Nonetheless, a strong consensus in the literature for locating technologists in HEIs may legitimize a distinct technologist category.

Non-locational demographic groups

Membership groups

Technologist categories may be constructed from who these technologists are, and are not, in terms of professional identity and personal demographic membership. The literature has offered varying and sometimes contradicting non-locational inclusion and exclusion criteria for technologists. For instance, Oliver (2002) provided the most specific non-locational demographic information to describe LTs in UK HEIs. Based on existing research, Oliver (2002) said that they were likely to be young, under-forty, and paid with external funding; and they were peripatetic, that is, they worked in many different places for short periods of time. Conversely, Shurville, Browne and Whitaker (2008) said that ETs had disparate and undocumented backgrounds and qualifications but did not specify what disparate means. As regards exclusion criteria, Oliver (2002) said that academics and established professionals with learning technology responsibility, and learning support, non-academic professionals including technicians and librarians were not LTs. Ellaway et al. (2006) concurred by stating that LTs were not academics. Mostert and Quinn (2009) said that ETs were neither academics nor academic development staff. Davidson (2003)

added that while combining aspects of these roles, ETs were not teachers, IT teachers, technicians or curriculum specialists. In contrast, Soyoz (2010) suggested that ELTs were the least exclusive technologist category. Soyoz (2010) claimed that an ICT coordinator ancillary role with a primary English teaching role comprised an ELT. Academic managers and website coordinators could also be ELTs. He added that teachers in schools and staff in corporate learning departments were ELTs.

Associated groups

Technologist categories may also be constructed from the types of groups with whom these technologists work. However, in the same way that researchers and practitioners have reluctantly located technologist membership within the bureaucracy of HEIs, they have tended to avoid operationalizing quantities and qualities of discrete stakeholder and organizational bodies that interact with technologists. Davis and Fill (2007) noted that the LTs in their study worked with ten academics in a subject-specific faculty. As Davidson (2003) located her ETs in schools, the ETs worked primarily with teachers but not parents or students. Each ET role was supported by an administrative technologist position. Other authors claimed that within HEIs, technologists work with academics (Lisewski & Joyce 2003), with either academics and academic development staff in curriculum development teams or project managers and various designers, developers and programmers in courseware development teams (Mostert & Quinn 2009), and academics and administrative staff in an e-learning unit of a learning technology section of a subject-specific university faculty while answering enquiries from external staff, students, academics and administrative staff (Ellaway et al. 2006). Technologists may also refer to others as clients and customers. Oliver (2002) said that central to the LT role was collaborating with different groups. However, Seale (2004) and Shurville, Browne and Whitaker (2008) said that LTs and ETs respectively did not work with organizations outside their HEIs, although this should be encouraged.

The importance of strong professional relationships for the learning technologist's success has been featured in the technologist literature (Oliver 2002; Lisewski & Joyce 2003; Davis & Fill 2007). Strong relationships have stemmed from collaboration and community, both of which have been central features of the learning technologist's successful working (Oliver 2002; Lisewski & Joyce 2003; Ellaway et al. 2006). However, Oliver (2002) qualified these elements by stating that they, like deep organizational learning, were difficult to come by. This is not least because technologists could associate with so many stakeholders that this naturally frayed loyalties. Bates (2004) and Bates and Sangra (2011) provided the lone voice for lone rangers, HEI technologists whose scope of technology integration in teaching and learning has been at the individual level, largely in isolation.

Aspects of education and society

Professional knowledge, skills and practices

As HEIs have become increasingly aware of how technology impacts curriculum, they have thought about new ways by which they can support technology integration in curriculum. One of these ways has been the employing of technologists. And technologists can be categorized not only by where they work and with whom they work, but also by the knowledge, skills and practices needed for their work.

Ellaway et al. (2006) described LTs as pedagogical support for teaching with information technology (IT). Oliver (2002), Lisewski and Joyce (2003) and Davis and Fill (2007) argued that LTs were sources of pedagogical expertise and that this was important for their success in activities, primarily collaborating with people on curriculum development. Shurville, Browne and

Whitaker (2008, p. 919) added that their ETs must understand "pedagogically sound methodologies." Mostert and Quinn (2009, p. 81) similarly recommended ETs, "identify areas of teaching, learning, assessment and evaluation that might benefit from the use of ICTs and in assisting lecturers to use ICTs in pedagogically sound ways." ETs' specific collaboration practices could include technology integration planning for individual lessons and for an overall curriculum, and co-teaching with teachers in classrooms and computer labs (Davidson 2003). Nonetheless, Davidson (2003) found her ET provided primarily technical support and not pedagogical support in a school. Hartley et al. (2010) delivered the broadest scope for the LT and ET by stating that any professional working in advance learning technology could be considered an LT or ET. Technologists could be considered a cohesive category insofar as technologists need to exercise pedagogical and technological knowledge.

Technologists have operated in diverse technological and pedagogical domains. This has reflected the diverse technologies, organizations and people found in HEIs. Bates's (2000) technologists specialized in distance learning. The LTs in Lisewski and Joyce's (2003) study worked on e-moderating online courses on Blackboard learning management system (LMS). Seale's (2004) LTs exercised accessibility practices for producing electronic materials for disability students. Ellaway et al. (2006) said their LTs developed three bespoke virtual learning environments: one for undergraduate medical students; another for undergraduate veterinary medicine students; and another for postgraduate students; besides, they developed a number of teaching, administration and support applications. Davis and Fill's (2007) LTs worked on blended learning with a specific toolkit. And Shurville, Browne and Whitaker (2008) and Mostert and Quinn (2009) said their ETs also worked on blended flexible learning. Soyoz's (2010) ELTs developed interactive white board teacher training courses or coordinated websites.

As regards generic competence domains, Hartley et al. (2010) developed competency-based curriculum themes for the teaching and learning of advanced technology at the tertiary and vocational education levels. They listed several competence domains that students and teachers in educational technology might need for the next decade: knowledge; process; application; personal and social; and innovative and creative. This was a rare attempt to standardize the competencies that LTs and ETs should possess and by which they should be assessed. However, even the authors admitted the possible difficulties of assessing certain competence domains, particularly the innovative and creative, and the personal and social competence domains. Davidson (2003) found that although ETs did consider themselves to be a discrete body with an overall skill set and attributes, those skills and attributes were not clearly defined. This ambiguity in generic competence domains is prevalent in the literature.

Although technologists may work within specific technological pedagogical domains, like the people with whom technologists work, the technologists' practices within these specific technological pedagogical domains have remained exceptionally vague and diverse in the literature. Oliver (2002) stated that LTs' specific practices by and large remained undocumented. He described the LT role as transdisciplinary, pointing out academic activities, and administrative, management or support activities. Ellaway et al. (2006) supported this argument by stating that LTs brought incongruent roles, expectations and norms of practice to the category. They alluded to LTs as designers, developers and providers; and described them in terms of apologist, evangelist and advocate; and they said that bringing income to their section was important. In Davis and Fill (2007), the LT role was that of a facilitator. Davidson (2003) identified five sub-identities for ETs in schools: technician; classroom teacher; specialist; administrator; and district curriculum specialist. Davidson (2003) claimed that ETs were translators who rendered different systems intelligible to users. Shurville, Browne and Whitaker (2008) added that ETs were local champions and project managers, and could be recognized as techie. Mostert and Quinn (2009) noted the shift ET practice from an instructional designer to a curriculum designer. The literature demonstrates how technologists' job scope can be broad and eclectic.

Nomenclature

The diversity in organizational units, working partners, skills, knowledge and practices correlates with a variety of job titles for technologists. Oliver (2002) said LTs were bestowed a variety of job titles by both practitioners and researchers. Ellaway et al. (2006) added that differences in job titles and practices created tension for LTs in organizations. Davidson (2003) and Shurville, Browne and Whitaker (2008) acknowledged a plethora of ET job descriptions and titles, whether in schools or in HEIs, and Shurville, Browne and Whitaker (2008) added that since many ET job titles were not recognized, this lack of legitimacy led to uncertainty in an ET's career path. Only Soyoz (2010) provided specific job titles for ELTs, and this might be a result of his different construction for the ELT category. For instance, he said that Global Products Manager was a job title of an ELT.

Technologist nomenclature in the literature also demonstrates diversity. Many authors (Oliver 2002; Lisewski & Joyce 2003; Seale 2004; Ellaway et al. 2006; Davis and Fill 2007; Hartley et al. 2010) wrote about learning technologists and to a great extent operationalized this category of educational technology professionals. Other authors (Davidson 2003; Shurville, Browne & Whitaker 2008; Mostert & Quinn 2009) operationalized the term educational technologist, and Soyoz (2010) the e-learning technologist. Oliver (2002) added that LTs were called instructional technologists in North America.

Origins

The origins of these educational technology professionals are diverse. Oliver (2002) characterized LTs as new professionals, and Lisewski & Joyce (2003) added that the LT was a neophyte, youthful profession. In contrast, Shurville, Browne and Whitaker (2008) said that the educational technologist (ET) role has existed since the 1970s. Davidson (2003) contradicted this by saying the earliest reference to an ET was in 2000 and that the role evolved within a larger system from multiple antecedents including computer subject teacher, district technology consultant position and a traditional IT coordinator. Authors have not reached a consensus on how technologist roles emerged.

TECHNOLOGY COORDINATORS

Geographic/organizational levels

Regions and countries

The literature has placed the technology coordinator role in many nations (Banyard, Underwood & Twiner 2006; Davis 2008; Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014), and in states such as Hong Kong (Law 2000; Wong 2008; Woodhead 2009; Harbutt 2011). However, this does not mean that ICT coordinators have been equally distributed across geographic levels. For instance, according to the Second Information Technology in Education Study (SITES) 2006, in the self-governing entities of Denmark, Hong Kong and Singapore, other IT staff for supporting IT were available at a higher rate than other self-governing entities. Unlike technologists, they could exist in sufficient geographic levels for quantitative study (Devolder et al. 2010) and large-scale international comparative study (Law et al. 2008; Microsoft Partners in Learning 2011).

Organizations and organizational units

The literature has placed the technology coordinator role within primary (Wong 2008; Devolder et al. 2010; Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014) and secondary (McGarr & McDonagh 2013) schools. While ICT coordinators have existed in schools in nations and states, the school contexts have varied considerably as ICT coordinators have been found in mainstream, public school contexts in districts, regions and nations as well as in non-mainstream school studies in states. An argument to explain this uneven distribution across geography and organizations can be found in the aspects of education and society section for other categories in this review. Furthermore, the literature has not definitively placed ICT coordinators within organizational units in schools. Rodríguez-Miranda, Pozuelos-Estrada and Leon-Jariego (2014) located technology coordinators in school and classroom settings in their study but did not specify these settings and whether or not there were other settings for technology coordinators. An explanation for this is offered in the membership groups within Non-locational demographic groups section.

The technology coordinator role has been covered more extensively than the technologist role in the literature, at different geographic and organizational levels. This supports the role's prevalence in education and its categorical legitimacy within primary and secondary schools. Although the geographic and organizational levels may vary greatly, this also suggests a strong degree of consensus that an ICT coordinator can be located broadly in terms of geography and organization.

Non-locational demographic groups

Membership groups

Few claims about ICT coordinator personal demographics are made in the literature. This may reflect the pluralism of the people who occupy the post. For instance, Rodríguez-Miranda, Pozuelos-Estrada and Leon-Jariego (2014) mentioned that 75% of their ICT coordinator survey respondents were men, but this may not indicate anything beyond the Spanish mainstream primary school context. Data on the number of technology coordinators in schools around the world may not exist. As regards professional identity, the literature has identified ICT coordinators as primarily teachers in schools, and sometimes administrators such as principals (Davis 2008). Spillane and Healey (2010) have said

These positions…were also classroom teachers. Having formally designated leadership position while also working as a classroom teacher very likely constrains the time and effort leaders devote to supporting their colleagues. Moreover, we suspect that for most of these individuals their own classroom teaching may take priority over their (ancillary) leadership and management responsibilities. (p. 263)

Similarly, the ICT coordinator in Harbutt's (2011) study was a teacher who, as compensation for taking the post, had a token two hours removed from the teaching timetable. Rodríguez-Miranda, Pozuelos-Estrada and Leon-Jariego's (2014) ICT coordinators likewise were relieved of 20% of their teaching load for ICT coordinator responsibility. In sum, the ICT coordinator role was not full-time but ancillary and part-time. All of this may explain why ICT coordinators may not belong to specific organizational units in schools, because the people occupying these posts are teachers and other roles assigned to organizational units.

Associated groups

More generalizations have been made about ICT coordinators in relation to other school stakeholder groups. The ICT coordinators have had a narrower sphere of influence and scope of school stakeholders than LTs. ICT coordinators worked with teachers and technicians (Law 2000;

Law et al. 2008; Wong 2008). In Hong Kong schools they could work in ICT teams (Law 2000), the members of which were primarily teachers. They might receive varying degrees of support from these groups (Harbutt 2011). The literature has made few claims about ICT coordinator interactions with other stakeholders such as students and parents. Harbutt (2011) said that the ICT coordinator in his study provided ICT training and support for teachers but not for parents.

Aspects of education and society

Professional knowledge, skills and practices

The consensus in the literature is that ICT coordinators support technical aspects of teaching through technology, for instance, by troubleshooting technology (Davis, 2008; Wong 2008; Devolder et al. 2010; McGarr & McDonagh 2013) and answering technical questions (Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014). This can be irrespective of curriculum, whether English national curriculum or International Baccalaureate (Harbutt 2011), or technology-infused, school-based curriculum (Woodhead 2009). This work can often be burdensome (Davis 2008; McGarr & McDonagh 2013) not least because technical support consumes the most time, and is the most urgent and immediate from teahcers, but has such a low priority for ICT coordinators (Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014).

Research methodology in large-scale studies provides further insight into ICT coordinators as technical support staff. What ICT coordinators were asked in SITES 2006 and in the SITES M-1 case studies, in contrast to what others were asked in those studies, presuppose what this educational technology professional role in schools entails. For instance, in SITES 2006, the ICT coordinators filled out a technical questionnaire. They were asked about the maintenance of ICT infrastructure such as computers. They were also asked about the availability of technical support for teachers when using ICT. Similarly, to explore the school ICT infrastructure in which a good practice takes place, the SITES M-1 researchers toured the school with either the principal or one of the ICT members. On the other hand, in both studies a school principal would be consulted on ICT developments in the school, the school's ICT implementation plan and the major obstacles in implementing this plan. Each school principal was also asked about the availability of pedagogical support for teachers when using ICT. All of this evidences the disassociation of pedagogical support and educational technology leadership from the ICT coordinator. Presumably the principal knew more about the availability of pedagogical support for teaching through technology in the school. The ICT coordinator presumably knew more about the technical support for teachers using ICT in the school. Wong's (2008) study also demonstrated this curious reliance on school principals to understand ICT coordinators as teachers and head teachers in Hong Kong, and head teachers in the UK were surveyed about the ICT coordinator role in schools.

When ICT coordinators have provided pedagogical support, this support has lacked depth and sustainability. The ICT coordinator in Harbutt's (2011) study developed voluntary workshops for teachers and had the authority to no more than encourage teachers to use software in a vague way without tangible outcomes and practices. In Woodhead's (2009) case, an instrumental teacher, not the official ICT coordinator, was instrumental in the leadership, policies and relationships to change pedagogical support for teaching through technology in a new curriculum. In the SITES 2006 study, the ICT coordinator was identified as a frequent, informal method by which to deliver ICT knowledge and skills, but it was unclear if this was pedagogical support, technical support or both. Wong (2008, p. 9) observed, "It is uncertain, for example, whether ICT coordinators are meant to perform operational or pedagogical functions, or both." Nonetheless, ICT coordinators ideally would provide pedagogical support (Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014). Only in the UK context has there been strong evidence that ICT coordinators are "pedagogical leaders, with few if any technical support duties" (Wong 2008, p. 9).

Nomenclature

The practice of categorizing technology coordinators has been more prevalent than categorizing technologists. This has reduced ambiguity to a degree because the names for technology coordinators in the literature are less diverse. The names generally are IT coordinator and ICT coordinator. Governments may legitimize such terms in their policies for technology in schools.

OTHER CATEGORIES

Clarifying ambiguity and incoherence in educational technology professional categories across geographic and organizational levels, non-locational demographic groups and aspects of education and society presents the opportunity for operationalizing other categories of educational technology professionals. Locating educational technology professionals at other intersections of these domains does the same. Constructing other educational technology professional categories may take the form of developing sub-categories of technologists and technology coordinators; or developing alternatives to existing categories of educational technology professionals. These other categories fill gaps in the literature. This section explores possible alternatives and sub-categories by first summarizing technologists and technology coordinators across geographic and organizational levels, non-locational demographic groups and aspects of education and society in Table 1.

Table 1: *A summary of technologists and technology coordinators*

		Technologists	Technology Coordinators
Geographic/ organizational levels	Regions and countries	UK, Australia, South Africa and North America	Many nations and states
	Organizations and organizational units	HEIs and units, sections and colleges within HEIs	Individual primary and secondary, mainstream and non-mainstream schools
Non-locational demographic groups	Membership groups	Full-time, not academics, librarians, lone rangers, technicians or teachers	Part-time, teachers and administrators
	Associated groups	Academics, administrators, academic development staff, students, communities	Teachers, technicians, ICT teams
Aspects of education and society	Professional knowledge, skills and practices	Diverse and emergent skills and knowledge; trans-disciplinary pedagogical support practices; technical, administrative and academic practices	Technical support practices and generally not pedagogical support or technological pedagogical leadership
	Nomenclature	LTs, ETs, ELTs and instructional technologists; diverse job titles	ICT coordinators and IT coordinators; unknown job titles

ET: educational technologist; ELT: e-learning technologist; HEI: higher education institution; ICT: information and communications technology; IT: information technology; LT: learning technologist; UK: United Kingdom;

Geographic/organizational levels

Other educational technology professional categories and sub-categories may be operationalized at undervalued, finer or broader geographical and organizational levels. The educational technology professional categories reviewed in this paper were found in individual schools and HEIs, and within HEIs, various departments and faculties. They were found in certain nations, states and systems. A nation, state or organization could operationalize its own categories of educational technology professionals. Additionally, categories of educational technology professionals could exist for categories of HEIs, or other educational institutions. These include informal or casual educational organizations and non-mainstream or private schools, such as tutorial schools. For example, Apel (2009) and Friesen (2010) set out to operationalize and categorize technology leaders within the geographic/organizational level of private international schools, that is, a category of non-mainstream schools. Friesen (2010, p. 10) observed, "Neither international private school teachers nor IT workers have received extensive attention in academic literature." Educational technology professionals were also found within groups of schools, namely technologists in a United States education system school district in Germany (Davidson 2003). Furthermore, since schools can be increasingly stratified by classes, grade levels, content areas and curricula, educational technology professionals could be assigned to one or more of those organizational units. This would mirror the type of technologist stratification found in HEIs.

Non-locational demographic groups

Other educational technology professional categories and sub-categories may be operationalized at non-locational demographic groups. Associated and membership groups can be clarified greatly. For instance, Friesen (2010) identified IT workers as,

A new occupational group enters the traditionally mono-professional realm of the teacher…The literature is ambiguous regarding the designation of these employees. Although 'IT worker' dominates, 'IT staff' is also common. Compounds with 'ICT' are rare. 'Technician' does not adequately discriminate functions" (p. 1)

The proposition that educational technology professionals work within or belong to communities of practice should be accompanied by a clear definition of these communities. Similarly, educational technology researchers have often sampled educational technology leaders in schools without clarifying their roles. For instance, Apel (2009) defined technology leaders as the primary technology decision-makers in these schools, and these technology decisions might encompass technical, pedagogical, administrative and other considerations. In the same way, The Microsoft Partners in Learning (2011, p. 14) international study on innovative teaching practice ambiguously defined its sample as several thousand students, "teachers of students," and "school leaders". Therefore, the term technology leader remains ambiguous and broad. It could include traditional school roles, such as principal, and emergent, unconventional categories of educational technology professionals. Other educational technology categories may exist in practice but have not been disseminated, even within an institution where the professionals are found. For instance, Bates (2004) and Bates and Sangra (2011) have been great proponents of a "lone ranger" educational technology category comprising professionals who work largely in isolation in HEIs. The distinctiveness of the lone ranger category comes from the absence of non-locational demographic groups. Other operationalized educational technology categories may also be undervalued because, like the technology coordinators, the role has been primarily part-time and ancillary to another role, or there has been insufficient supply of these professionals.

Aspects of education and society

Other categories of educational technology professionals may emerge, and existing categories may change as aspects of education and society emerge and change. The more a school integrates IT into their curriculum the more they may need different types of support, including technical, administrative, managerial and pedagogical support, at individual and organizational levels. In describing IT workers in a private international school in Singapore, Friesen (2010, p. 143) broaches this possibility of "low-level technical staff…tasked with comparatively straightforward repair jobs, while upper-level workers engage in more complex tasks that require a greater degree of professional judgment. These higher-level IT workers are managers of school-wide resources." To increase support levels for school staff, schools may design more full-time roles to replace ancillary, part-time. Ultimately, educational technology professional roles can only evolve insofar as the school's policies, curricula and pedagogies can change to support role evolution in the environment. Introducing and sustaining technological pedagogical change in a school demands reflexivity at several levels. ICT coordinators may be unevenly distributed across geographic and organizational levels because many organizations in many nations do not have environments to scale or to sustain this role.

Davidson (2003) examined the relationship between roles and school reforms. In an environment of continuous reform, Davidson argued that even the technologist role was evolving rapidly. It came from traditional roles, such as computer subject-teacher, technology coordinator and district technology consultant position. She suggested that the ET role was evolving to include more responsibility and to become more integrated with colleagues' roles. Davis (2008) supported this by constructing a possible bridge between the IT coordinator and other possible educational technology roles. Davis argued that at one stage, presumably an immature one, neither a change manager nor an IT coordinator was needed in a school. However, at another stage when IT use among teachers became localized, an IT coordinator was needed, alongside change management. McGarr and McDonagh (2013) supported the evolution of roles when they said that the ICT coordinator role might be changing because schools might require greater pedagogical support. They envisioned ICT coordinators becoming more influential in school leadership and policy-making and moving away from the technician and trouble-shooter roles. A teacher in Harbutt's (2011) report also supported the evolution of the ICT coordinator role to achieve the school's technological ambitions:

...It's difficult for the IT coordinator to be full-time in the classroom and do his IT stuff. We need to look at things as a school. We need to prepare and train our teachers. We've got the tech but do we know how to use it effectively? Maybe we should put a halt to spending money on machines and spend more on releasing the IT coordinator from his teaching duties. (p. 22)

If education environments and school roles are changing rapidly, educational technology professional pluralism may be great. For instance, Apel (2009) introduced nine discrete categories for educational technology professionals in international schools. He furthermore demonstrated the ambiguity and pluralism of educational technology professionals in international schools by introducing twenty job titles of technology leaders in his study. New categories can emerge from such pluralism, particularly as standardization is applied to the profession. Formal curriculum is being developed for training technologists and other professionals working in advanced learning technology (Hartley et al. 2010) and this curriculum can reify categories of educational technology professionals.

DISCUSSION AND CONCLUSION

A comparison of categories of educational technology professionals by geographic and organizational levels, non-locational demographic groups and aspects of education and society

demonstrates incoherence and cohesiveness within and between categories. The review is a demonstration that categories can be delineated in several ways and that within categories diversity can still be prevalent. In sum, the categories are cohesive insofar as the literature can reach consensus for certain geographic and organizational levels, non-locational demographic groups and aspects of education and society where these professionals are present. In other words, the categories present a roadmap for present and future categorization. For instance, many researchers and practitioners place technologists in HEIs and technology coordinators in schools. However, a limitation of educational technology professional categories is that these categories cannot be easily compared or located at precise intersections of geographic and organizational levels, non-locational demographic groups and aspects of education and society, in accord with the Bray and Thomas (1995) analytical framework. Other analytical frameworks may employ different kinds of levels and highlight other similarities and differences within and between categories. Nonetheless, incoherence or great variety may present opportunities for clarification by the creation of sub-categories or alternatives.

The tension between cohesiveness and incoherence in operationalizing categories of educational technology professionals requires more exploration. Reviewing categories and constructing categories for educational technology professionals are significant ways to advance research into these professionals. This also raises the question of whether such technologist categorization is necessary and worthwhile in an age of technological and professional change. While there are calls for standardization and codification for technologists (Ellaway et al. 2006; Shurville, Browne & Whitaker 2008), and while adding classifications to multilevel models of comparative education have been an important way to create more definitive units of analysis (Manzon 2007), less-codified or dogmatic approaches by researchers and practitioners to understanding educational technology professionals may also be appropriate. Educational technology professionals can be left an "ill-defined population" (Oliver 2002, p. 251) with scant cohesion or recognizable professional identity (Lisewski & Joyce 2003; Ellaway et al. 2006). At present, the battle to operationalize educational categories and professional identities for these educational technology professionals is waged in the imaginations of researchers and practitioners.

On the one hand, since the literature is emergent, all of it is necessary and constructive for educational technology professionals. As technologies continue to change education systems, educational technology professionals will be needed in increasing numbers to support these changing systems. The professional ranks will grow, as the need to research these professionals in several ways. For instance, how specific educational technology professional roles are designed, how they evolve over time to support changing teaching and learning practices, and how different levels of schooling and areas of the world mediate these emerging roles. The degree of technology integration in an educational institution and the types of educational technology professionals that the institution can support and sustain can also be explored. Furthermore, a limitation of this literature review on educational technology professionals is the dearth of large-scale, comparative international studies that feature these professionals. For instance, the large-scale, international comparative education study SITES (Law et al. 2008; Law, Lee & Chan 2010) provides incidental information on these professionals because they comprise part of the sample. Similarly, there have been few (Devolder et al. 2010) national (Rodríguez-Miranda, Pozuelos-Estrada & Leon-Jariego 2014), regional or trans-organizational studies (Apel 2009) to focus primarily on educational technology professionals. In general, educational technology professionals' presence in the literature is undervalued.

On the other hand, the literature may only be as useful as it is reliable in several ways. Some research methodologies may be less appropriate than others for researching these professionals, and this, for instance, may contribute to the dearth of large-scale, comparative international studies that feature these professionals. The lack of validity can become problematic in large-scale, survey studies of educational technology professionals. In accord with Apel's (2009) study,

to survey educational technology professionals from different contexts, to ask them to self-identify their roles according to categories developed by a researcher, and then for the researcher to generalize based on this dubious self-identification without additional validation may distort findings. Inappropriate comparison points also arise when Apel (2009) attempted to compare educational technology professionals in the United States of America (USA) with educational technology professionals in international schools around the world. Although he suggests a high degree of convergence between international schools and between schools in the USA, the context of each international school may differ greatly from the contexts of the other international schools, let alone the context of schools in the United States. A similar problem exists for Wong's (2008) study of ICT coordinators in Hong Kong and in the UK primary school contexts because how ICT coordinators are defined and identified not only in individual school contexts but also in national contexts may be different. To try to group together schools of the same category but different circumstances, and schools of different categories and circumstances but of the same country is dubious at best. Equally dubious is Davidson's (2003) assertion that the ET role is growing in United States schools without offering any quantitative evidence outside a case within one school district. If educational technology professional roles are highly contextualized, broad and ambiguous, qualitative research methods may be a more appropriate, but less statistically generalizable research approach to substantiate to what degree a sample falls within certain categories. There are many geographical and organizational units in which to study and to compare educational technology professionals, including in mainstream schools and in private schools in a nation. The more researchers and practitioners can agree on how to reduce the high degree of these professionals' contextualization for statistical generalization, the more large-scale studies and comparisons can and should be made. Researchers and practitioners have the opportunity to make more agreeable analytical and statistical generalizations from more rigorous research into these professionals.

The limited literature also points to the difficulty in synthesizing literature on these professionals. Discovering literature on educational technology professionals, even developing the appropriate terms by which to search for these professionals, presents challenges. The categories of educational technology professionals in this review do not represent the totality of educational technology roles in practice and likewise, the literature reviewed in this article do not represent the totality of the literature. Their selection, however, is to present a range of research and practice from which categories of educational technology professionals can be operationalized, and to highlight the challenges to operationalizing.

ACKNOWLEDGEMENTS

I thank Professor Mark Bray, Professor Nancy Law and Professor Bob Fox.

REFERENCES

Apel, W. 2009. International School Technology Survey, 2009, Part I: Technology Staffing.

Banyard, P., Underwood, J. & Twiner, A. 2006. Do Enhanced Communication Technologies Inhibit or Facilitate Self-regulated Learning? *European Journal of Education,* 41**,** 473-489.

Bates, T. 2000. *Managing technological change : strategies for college and university leaders*, San Francisco, Jossey-Bass.

Bates, T. 2004. The promise and myths of e-learning in post-secondary education. *In:* CASTELLS, M. (ed.) *The Network Society: A Cross-cultural Perspective.* Cheltenham, UK/Northampton MA: Edward Elgar.

Bates, T. & Sangrà, A. 2011. *Managing technology in higher education strategies for transforming teaching and learning,* Hoboken, John Wiley & Sons.

Bray, M. & Thomas, R. M. 1995. Levels of comparison in educational studies: Different insights from different literatures and the value of multilevel analyses. *Harvard Educational Review,* 65**,** 472-491.

Bray, M., Adamson, B. & Mason, M. 2014. *Comparative education research approaches and methods,* Hong Kong, Comparative Education Research Centre University of Hong Kong ; Springer.

Davidson, J. 2003. A New Role in Facilitating School Reform: The Case of the Educational Technologist. *Teachers College Record,* 105**,** 729-752.

Davis, N. 2008. How May Teacher Learning Be Promoted for Educational Renewal with IT? *In:* VOOGT, J. & KNEZEK, G. (eds.) *International Handbook of Information Technology in Primary and Secondary Education.* Springer.

Davis, H. C. & Fill, K. 2007. Embedding blended learning in a university's teaching culture: Experiences and reflections. *British Journal of Educational Technology,* 38**,** 817-828.

Devolder, A., Vanderlinde, R., Van Braak, J. & Tondeur, J. 2010. Identifying multiple roles of ICT coordinators. *Computers & Education,* 55**,** 1651-1655.

Ellaway, R., Begg, M., Dewhurst, D. & Macleod, H. 2006. In a Glass Darkly: identity, agency and the role of the learning technologist in shaping the learning environment. *E-Learning,* 3**,** 75-87.

Friesen, M. 2010. *The Teacher-IT Worker Relationship: A Case Study of a Singapore International Private School.* Doctor of Education, University of Leicester.

Harbutt, D. 2011. A Report into the Use of ICT in a Primary School. Hong Kong.

Hartley, R., Kinshuk, Koper, R., Okamoto, T. & Spector, J. M. 2010. The Education and Training of Learning Technologists: A Competences Approach. *Educational Technology & Society,* 13**,** 206-216.

Law, N. 2000. *Changing classrooms & changing schools : a study of good practices in using ICT in Hong Kong Schools,* Hong Kong, Centre for Information Technology in Education Faculty of Education University of Hong Kong.

Law, N., Pelgrum, W. J., Plomp, T. & International Association For The Evaluation Of Educational Achievement. 2008. *Pedagogy and ICT use in schools around the world : findings from the IEA SITES 2006 study,* New York

Law, N., Lee, M. W. & Chan, A. 2010. Policy impacts on pedagogical practice and ICT use: an exploration of the results from SITES 2006. *Journal of Computer Assisted Learning,* 26**,** 465-477.

Lisewski, B. & Joyce, P. 2003. Examining the five-stage e-moderating model: designed and emergent practice in the learning technology profession. *Association for Learning Technology Journal (ALT-J),* 11**,** 55-66.

Manzon, M. 2014. Comparing Places. *In:* BRAY, M., ADAMSON, B. & MASON, M. (eds.) *Comparative education research approaches and methods.* Second ed. Hong Kong: Comparative Education Research Centre University of Hong Kong ; Springer.

Mcgarr, O. & Mcdonagh, A. 2013. Examining the role of the ICT coordinator in Irish post-primary schools. *Technology, Pedagogy and Education***,** 1-16.

Microsoft Partners In Learning 2011. Innovative Teaching and Learning Research: 2011 Findings and Implications. *ITL Research.*

Mostert, M. & Quinn, L. 2009. Using ICTs in teaching and learning: Reflections on professional development of academic staff. *International Journal of Education and Development using ICT,* 5**,** 72-84.

Oliver, M. 2002. What do learning technologists do? *Innovations in Education & Teaching International (2002),* 39**,** 245-252.

Rodríguez-Miranda, F. P., Pozuelos-Estrada, F. J. & León-Jariego, J. C. 2014. The role of ICT coordinator. Priority and time dedicated to professional functions. *Computers & Education,* 72**,** 262-270.

Seale, J. 2004. The development of accessibility practices in e-learning: an exploration of communities of practice. *ALT-J, Research in Learning Technology,* 12**,** 51-63.

Shurville, S., Browne, T. & Whitaker, M. Employing the new educational technologists: A call for evidenced change. ascilite 2008 Melbourne, 2008 Melbourne, Australia. 917-926.

Soyoz, S. 2010. Identifying e-Learning Technologists: Key Roles, Activities and Values of an Emerging Group. *eLearn,* 2010.

Spillane, J. P. & Healey, K. 2010. Conceptualizing school leadership and management from a distributed perspective: An exploration of some study operations and measures. *The Elementary School Journal,* 111**,** 253-281.

Wong, K.-P. 2008. School-based technology coordinators and other human factors in the implementation of ICT in primary schools: A comparative study. *International Journal of Education and Development using ICT,* 4.

Woodhead, P. L. 2009. *Digital natives v Swine Flu a study in two halves: how adversity can drive change.* Master of Science in Information Technology in Education, University of Hong Kong.

Copyright for articles published in this journal is retained by the authors, with first publication rights granted to the journal. By virtue of their appearance in this open access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

Original article at: http://ijedict.dec.uwi.edu/viewarticle.php?id=1843