New literacies research has begun to filter into classrooms, shifting teaching in the 21st century to broader interpretations of literacy. Skills for a 21st century world include constant, rapid innovation, collaboration through multimodal means, and the ability to absorb change in every context. Literacies of the 21st century workplace require preparing students for occupations that use communication, collaboration, and literacy in a variety of ways and settings (Mikulecy, 2010). Information and communication needs for modern work practices spur fresh ideas about literacy pedagogies in 21st century classrooms. Pushing beyond the traditional borders of literacy, tools such as the Internet, information communication technologies (ICT), and multimodal texts offer a plethora of options for communication and collaboration both in and out of the classroom (Lankshear & Knobel, 2006). Within the context of ICT, implications for teaching include designing opportunities for teamwork, thinking, and knowledge gathering through multimodal pathways (Cope & Kalantzis, 1999). In turn, fresh pedagogies in classrooms ignite questions about teacher learning. Specifically, in the fluid paradigm of 21st century literacy, there exists an increasing use of ICT through multimodal literacies and 21st century
practices in classrooms. Thus, new emphasis on ICT, multimodal literacies, and 21st century practices can create dissonance for preservice teacher education programs.

Preparing teachers for modern classrooms should include technology integration, diverse media experiences, broad definitions of literacy, and authentic uses of multiple literacies (Cervetti, Damico, & Pearson, 2006). Additionally, preservice teachers should be exposed to strategies designed to reflect the needs of learners’ personal and collective identities, and to promote global citizenship with emphasis on intercultural relationship skills (Cazden, 2005). Given the shifting and continuously evolving use of technology in the 21st century classroom and the increasing demands for students to demonstrate competency in communication, collaboration, and technology skills, teacher education programs may need to assess and evolve accordingly. Keeping in mind the expectations for the 21st century world, the marriage of preservice teacher education and ICT, multimodal pathways, and 21st century skills is relevant. Here, I address these questions: What expectations exist for future occupations in the global workplace? Which classroom practices lead to technology enhanced instruction? How are teacher education programs across the world preparing preservice teachers for integration of information communication technology, content, and pedagogy? What implications exist for our own practices in teacher education?

Teacher Education and Workforce Preparation

The 21st century workforce is expected to negotiate and utilize technology tools in the workplace. Therefore, providing adequate preparation, experience, and understanding of technology tools is necessary in teacher education (Northrup & Little, 1996). Teacher education programs generally include some form of technology integration in the preservice teacher program. This integration may take the form of stand-alone technology courses, some isolated use in courses, or through integrated infused experiences throughout the program (Gronseth, et. al., 2010). National accrediting agencies for teacher education include standards for technology integration and federal initiatives to support the standards (Wright & Wilson, 2011). Technology integration in teacher education may provide a pathway to preparing students for 21st century college and career opportunities. Changes in teacher education and clinical preparation should occur in response to shifting significance on worker attributes thought to be of value in a global economy.

Workplace literacy is changing as new definitions and understandings of the different types of literacies and technology needs in the workplace are rapidly emerging. (Mikulecky, 2010). Specifics of workplace literacy are dependent on the particular discourse of the sociocultural setting (Gee, 1989). According to Gee, specific discourses are generally accepted uses of language, gestures, and semiotics particular to a sociocultural setting. These discourse specific literacies apply to the particular type of occupation, be it technical or professional. For example, a secretary’s role requires a different discourse than an engineer, yet both roles use language, gestures, and semiotics to accomplish tasks. As such, educators should prepare to offer a variety of instructional opportunities for development of basic 21st century workplace literacies for all students.
The ability to communicate globally through information exchanges, file sharing, and functioning within online platforms is increasingly relevant in the workplace (Morrell, 2012). According to the 2005 Bureau of Labor Statistics (BLS) Report, in 2003 more than 77 million Americans, approximately 55% of employees, used computer technology in their job. The BLS reported the most commonly used computer technologies as email and Internet communications. Furthermore, two out of five employees engaged in email communication while on the job, with women more likely than men to use computer technology. The BLS Report explains this finding by pointing out that approximately three-fourths of female workers are more likely to be employed in management, professional, sales, and office settings, all careers that heavily depend on computer usage as a means of communication. Almost two-fifths of male workers are employed in jobs that involve construction, maintenance, transportation, and other material moving careers that are less dependent on computer usage. In another report, *Science, Technology, Engineering, and Mathematics (STEM) Occupations* (May 2009), the BLS describes STEM occupations as those that include skills and knowledge related to engineering, computer information systems, civil settings, digital networks, and natural sciences. Career choices in the STEM occupations range from sales representatives to digital network designers. The BLS reports that not all STEM occupations are computer based, but the largest categories of STEM occupations were related to computer usage.

Increasing levels of computer and information communication technology in many occupations reflects how the world of work undergoes continuous change. This change demands that information and management of knowledge be rapidly shifted in response to the needs of the global market. There is a need for workplace skills and competencies to align with new demands of the ‘new fast capitalism’ (Pillay, Boultin-Lewis, Wilss, & Lankshear, 2003). Creativity, autonomous thinking, and innovation are thought to be of value in the new workplace of the modern age. As the world context for work changes, processes related to communication, collaboration, creativity also change. This change process draws attention to the need for designing instructional frameworks that help teachers integrate new technologies and the content knowledge needed for future success in college and career endeavors. Educational organizations are keenly aware of the need to prepare students for future work in an ever changing global environment. The National Council for Teachers of English (NCTE) *Position Statement for 21st Century Literacies Framework* provides a context for literacy teaching and learning (NCTE, 2008). The NCTE *Position Statement for Multimodal Literacies* provides a broad definition for literacy as going beyond the text by combining systems for producing meaning, integration of arts, physical movement, digital technologies, and interactive modes of experience (NCTE, 2005). The NCTE 21st century and multimodal descriptions of teaching intertwine with new literacies theories, linking theory to application in pedagogical practices and student learning.

The International Society for Technology in Education (ISTE) also connects technology integration with expectations beyond the classroom. The ISTE promotes empowering teachers to utilize technology as a means of enhancing student learning and preparation for life. The ISTE *Public Policy Principals and Federal & State Objectives* document details the advocacy for technology education as a necessary integration for 21st century skills and essential for post-secondary, career, and life experiences (ISTE, 2010). Furthermore, the ISTE advocacy statement provides core principles that include elements of teaching, learning, and specifically, preservice
teacher education. According to ISTE, fluency with technology is needed. Preservice and inservice teachers and administrators must understand how to integrate technology, ways that assessment data and intervention are enhanced by technology, and how to achieve successful integration of technology and education (ISTE).

Technological Pedagogical and Content Knowledge

Designing instructional opportunities that key in on communication information technologies and computer usage are indicated in order to prepare students for 21st century college and career opportunities. Seamless technology integration in the classroom should be designed to enhance and add significance to a lesson (Crocco & Cramer, 2005). Teachers and administrators often mistake technology integration as simply using technology. Showing a PowerPoint lesson on a white board, for example, is a common classroom practice. In essence, if nothing else is happening to engage the students, the PowerPoint and white board function as the old style overhead projector and transparency. Showing the PowerPoint does not transform the instruction, it is merely a viewing tool. Basically, operating technology in a lesson may not yield the communicative, creative, and collaborative attributes necessary for success in the 21st century workplace.

In order to fully integrate technology into teaching and learning in ways that add dimension and value to the lesson, preservice teachers need to develop an understanding of Technological Pedagogical and Content Knowledge (TPACK). Neiss (2011) describes TPACK as a comprehensive package approach to implementing the full integration of technology, pedagogy, and content knowledge. Throughout preservice teacher experiences, understanding of technology integration should occur alongside pedagogical and content knowledge development. Isolated events using technology may hinder the development of TPACK as an integrated, seamless approach to teaching. In the TPACK model, technological knowledge, pedagogical knowledge, and content knowledge intersect, providing an integration of all three bodies of knowledge into unified instruction. Sometimes displayed as a three-way Venn Diagram, the TPACK model relies on the intersections of these knowledge bases. The triple intersection point is the space for designing and implementing lessons using value-added technological, pedagogical, and content components to engage students and enhance learning. TPACK has implications for preservice teacher education. The implications are described by Koehler and Mishra (2008) as “a paradigm shift for drastic changes in preservice teacher education.” Koehler and Mishra call for models to address the needs and allow preservice teachers to integrate technology, pedagogy, and content knowledge effectively.

Shifting the teaching and learning paradigm toward a true integration of technology, pedagogy, and content knowledge represents a change process that demands attention. Teacher educators have opportunity to show preservice teachers how to use technology integration so that pedagogy and content knowledge is enhanced. Preservice teachers may not be adequately exposed to technology, pedagogy, and content knowledge. Furthermore, they may harbor fears of inadequacy, time constraints, and the how-to of combining pedagogy and technology (Grisham & Smetana, 2011). Achievement of the paradigm shifts necessary to impact teaching and learning require sustained attention to the task. Within teacher education programs, it requires
more than the isolated course in technology or the methods instructor merely showing a *PowerPoint* or explaining how to integrate technology. Authentic experiences that allow students to experience teamwork, learning, and ICT through TPACK are necessary. As both teacher educators and preservice teachers learn to incorporate ICT through seamless instruction that combines technology, content, and pedagogy, the world of teaching may eventually change. These types of lessons and experiences should occur across methods courses and throughout clinical settings and become the normal way of learning about teaching, rather than the exception. Shifts of this magnitude suggest creation of new teaching cultures that include transformative visions for increased communication, collaboration, and integration of technological pedagogical content knowledge in teacher education.

**Global Trends in Technology and Teacher Education**

**Australia**

The Australian government called for a Digital Classroom Revolution in 2008 ([http://www.teacherstandards.aitsl.edu.au/Home](http://www.teacherstandards.aitsl.edu.au/Home)). To satisfy the call for change, the government invested millions of dollars in technology hardware. Inservice teacher training, however, failed to support teachers in effective integration of technology in the classroom. As a result, few changes have occurred in instruction, despite the large monetary investment by the government. Higher education and specifically, teacher education programs, felt pressured by the government to deliver better-prepared teachers in the area of technology integration (Lane, 2012), but teacher education and professional development of higher education faculty have not kept up with needs for the Digital Classroom Revolution in Australia. Lane constructed a “Future Prediction Survey” to predict what changes may occur if teacher education were better equipped to promote technology, pedagogy, and content integration. The data suggested that more economic support was needed to bring the Digital Classroom Revolution to fruition. Furthermore, the data indicated that teacher education itself must reinvent itself in relation to the government’s expectations for Australia’s future teachers. Lane concluded that many implications exist for advancing the Digital Classroom Revolution through better funded and well-resourced teacher education programs.

**Singapore**

Singaporean education is traditionally teacher-centered. The Singaporean Ministry of Education (MOE) developed initiatives to increase technology learning, higher-order thinking, and inquiry-based instruction ([http://www.moe.gov.sg/](http://www.moe.gov.sg/)) that challenged traditional modes of instruction. Implementation of the MOE initiatives proved to be difficult for Singaporean teachers and many struggled due to a preference for paper-pencil tasks (Yang, Tzuo, & Komara, 2011). A research study was implemented by Yang, Tzuo, and Komara to investigate WebQuest and Universal Design for Learning in teacher education as a way to build TPACK capacity in preservice teachers. In order to understand how the traditional teaching culture might change, the study examined preservice teachers’ comfort and understanding levels when engaging in technology integrated lessons. Specifically, the teacher education faculty sought to increase the preservice
teachers’ comfort and understanding levels by modeling and using WebQuest and Universal Design for Learning during methods courses. Using a gradual release model, the professors guided the preservice teachers in experiencing technology integration first as a learner, then as a teacher. As a result, on a pre- and post-experience survey, preservice teachers demonstrated a high level of comfort and understanding of TPACK after participating in the gradual release model with the professors. Yang, Tzuo, and Komara (2011) concluded that implications exist for increased opportunities for technology integrated instruction in higher education. Furthermore, modeling of technology integration by professors is powerful in influencing preservice teachers’ comfort and understanding levels.

New Zealand

In New Zealand, the Ministry of Education implements the New Zealand Curriculum (http://www.minedu.govt.nz/Boards/TeachingAndLearning/NewZealandCurriculum.aspx). The curriculum provides a framework that includes directives for teachers to develop instruction designed to help students succeed in the 21st century. Specifically, the directive includes strong emphasis on students’ fluency with Information Communication Technology (ICT) in preparation for New Zealand’s growing global presence in economics and business. Because the two islands of New Zealand are dependent upon global communication, this is considered a key directive for future economic stability and growth. Teacher education programs seek ways to provide a constructivist framework in conjunction with inquiry-based methodologies to prepare preservice teachers for the task. In order to examine the tension between traditional methodology and an integration of ICT, constructivism, and inquiry-based learning, Fox-Turnbull and Snape (2011) examined preservice teachers’ learning from a constructivist and inquiry-based project. The project was designed to simulate a global economic situation using a company-based problem. In this project, the teachers were given the task of using ICT in creating, marketing, and tracking a fictional product. The preservice teachers engaged in the simulation learning utilizing technology tools and collaborative approaches to complete the activities. As a result, preservice teachers gained understanding, confidence, and knowledge of technology integration through participating in the project. Consequently, Fox-Turnbull and Snape concluded that simulation based learning draws constructivism and inquiry-based approaches together, thereby yielding greater understanding of how technology integration can be used to merge technology, collaboration, and communication. The researchers asserted that more professors in teacher education need professional learning in order to design, implement, and evaluate this type of learning.

Zimbabwe

Africa University in Zimbabwe formulated a plan for implementing increased emphasis on Information Communication Technology (ICT) (http://www.moesac.gov.zw/) in all education settings. One of the primary reasons is to decrease gaps between Zimbabwe and the rest of the world in terms of 21st century life, work, and economy. Teacher education is directly implicated in the initiative. Increasing ICT proficiency falls to teachers and should move from initial understanding to accomplished integration of technology in teaching and learning. The initiative asserts that ICT capacity should be developed in higher education faculty as a means of
increasing technology integration in teaching and learning overall. Chitiyo and Harmon (2009) examined the feasibility of the ICT initiative and concluded that Zimbabwe has many obstacles in the way of the overall goal. Some of the findings were lack of budget, unreliable Internet access, weak electrical infrastructure, underdeveloped ICT integration framework, and lack of professionals with ICT expertise. The study also found that in higher education, class sizes were too large for effective ICT integration and teachers were not well-resourced to accomplish the job. Chitiyo and Harmon concluded that stronger, more reliable infrastructure is needed along with strong economic funding and support.

Conclusions

Technology integration is globally relevant. Business depends on workers who are able to connect and collaborate through Information Communication Technology (ICT). In each of the nations examined, implications existed for teacher education and preparation. As teachers progress deep into the 21st century, learning and communicating must keep up with global and economic demands. Preparation for this type of workforce includes the fluent and integrated use of instructional technology for authentic communication purposes. Simply showing a PowerPoint presentation is not sufficient to develop the workforce needed in the present and near future. Students must be able to efficiently and effectively employ digital communication techniques, while teachers must be able to provide educational opportunities for the sort of authentic exploration and practice that leads to fluency in ICT. Full understanding and implementation of technology integrated lessons will require the development of Technological Pedagogical and Content Knowledge (TPACK).

Obstacles exist in shifting the paradigm of teacher education and technology integration. Higher education faculty may not fully understand the difference between using technology and the TPACK concept. Teacher educators may be overly dependent on lecture and unable to effectively construct opportunities to boost ICT and TPACK in the teacher education program. Therefore, it may be difficult for teacher educators to model TPACK in ways that allow preservice teachers to experience technology integrated lessons that go beyond the mere use of a technology tool. This may lead to gaps in teacher education. Technology changes quickly with the appearance of both repurposed and new information communication technology and digital tools. Repurposing whiteboards, PowerPoint, clickers, and websites is necessary as TPACK evolves and becomes a natural part of a teacher’s instructional repertoire. Change must be rapid, fluid, and ever shifting in order to keep up with the expanding growth in technology integration. Institutions of higher education and local education agency leadership must support preservice and inservice teachers in making room for professional learning and practice that is sufficient for developing TPACK. Administrators and those responsible for organizational tasks must also understand the difference between showing a PowerPoint and meaningful instruction through TPACK.

Infrastructure represents yet another obstacle. Simply stated, it is beneficial to have infrastructure that supports the booming ICT development. Economic initiatives should be developed in order to provide resources, funding, and a platform of support for all levels of educational technology
integration from home to primary and high schools, and further to higher education. Teacher educators represent the builders for such a foundation, in other words, the first line of defense. Crafting a vision for infrastructure while leaving out or minimizing the role of higher education may represent a fatal flaw in the plan to impact the teaching culture with changes needed to support 21st century workers and a global workplace.

Possible Research Agenda

Many promising research agendas exist in teacher education and technology integration. Possible research opportunities include the longitudinal examination of teacher practices and development of TPACK. This study could follow teachers from preservice into inservice through checkpoints at designated intervals of through multiple years of professional service. In this way, data can be analyzed to determine which factors in teacher education and inservice professional learning are most helpful toward fluent use of ICT and TPACK. A comparative study could examine the use of ICT and TPACK by preservice teachers in multiple content settings: teaching reading, social studies, science, and math in order to determine how content knowledge best integrates with technology and pedagogy. Studies that examine specific pedagogies (such as visualizing, explicit instruction, repeated readings) combined with technology and content knowledge could be also be implemented. Classroom student data studies also represent possibilities. Examining formative and summative student data when ICT and TPACK is well-developed versus under-developed is a prospect for gleaning information on how student learning is impacted.

Yet another research study could investigate the role of peer coaching for ICT and TPACK in teacher education. This investigation could be carried out through a lesson study framework. The situated context of the lesson study may include examination of the university setting versus the classroom setting as safe and risk-free environments for preservice teachers to develop TPACK. Through lesson study, preservice teachers could engage in specific technology integrated lessons within a peer group in the university setting, reflect, and refine the lesson through repeated simulations. Possibilities further exist in the exploration of technology integration first as a learner within the university environment and then as a teacher in the clinical setting.

A different research opportunity exists in the study of technology integration practices in higher education. A study of this sort might take the form of a content analysis of teacher education syllabi and observation of accompanying classroom instruction. The content analysis could examine the intended ICT and TPACK integration while observing classroom instruction and teaching moves could uncover the actual practices to determine if gaps occur in the intended and observed behaviors. A study such as this might reveal how higher education faculty view themselves as deliverers of TPACK enhanced lessons, how preservice teachers experience and learn from it, and what gaps exist.

In sum, there are multiple considerations for technology integration and teacher education. New literacies research is impacting classrooms. As such, new pedagogies are essential to create instructional opportunities that employ skills relevant in the 21st century global workplace. Changes in teaching cultures are needed in order to address communication, collaboration, ICT,
and the growing innovations in technology. Teacher education programs are an important ingredient for changing cultures of teaching. One main goal for teacher education programs is to begin understanding and examining how technological, pedagogical, and content knowledge develops. Going beyond TPACK development and into sustained instructional application is a logical bridging point between preservice and inservice teacher education. Assisting preservice teachers in understanding how such lessons are applied should go hand-in-hand with teacher preparation for the 21st century classroom. As teachers prepare students for the global workplace and demands of ICT, it is imperative that they are able to construct learning opportunities that offer maximize opportunities for collaboration, innovation, communication, and seamless integration of technology tools.

References


