Faculty perceptions of technology literacy in the community college curriculum

by

Oneka Samet

B.A., Purdue University, 1999
M.L.I.S., Wayne State University, 2005

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF EDUCATION

Department of Educational Leadership
College of Education

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Abstract

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Community colleges are open access and mainly serve low-income and disadvantaged populations looking for low-cost options in career preparation or acquiring an advanced degree. In 2012, the American Association of Community Colleges put out a call-to-action for community college leaders to redefine the mission of the community college ensuring that students are learning current technology skills to advance personally and professionally.

This investigation addresses GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. This research replicated the methods followed in a study conducted by Kalfsbeek in 2007 and builds evidence to validate the original study's findings. This replicated study highlights key differences between GE faculty and CTE faculty in the community college.

This multilevel concurrent research used an online, anonymous survey with 24 Likert-type quantitative questions and several open-ended questions. The population of the study was 157 full-time faculty at a community college in Michigan. Results revealed differences in the perceptions of GE faculty and CTE faculty across different disciplines, highlighting the need for more formal guidelines for inclusion of technology literacy competencies across the curriculum. The groundwork for the findings of this research is underpinned by Bloom's taxonomy and used to create course learning outcomes that can be easily integrated into creating a shared curriculum.

Keywords: technology literacy, digital literacy, community college, digital divide, general education, career and technical education

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Table of Contents

List of Figures

List of Tables

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Dedication

I would like to dedicate this dissertation to the unfailing support, encouragement, and understanding of my husband Joseph Samet. I would also like to show appreciation to Deitrick and Dorian, my kids. I know it was rough while I was pursuing this degree but I love you guys always. I would like to give thanks to my family, especially my Mom and my twin sister Erica for their love and encouragement. Thank you to my brothers Glenn, Darryl, and Dabney and my sister, Danielle, for keeping me smiling and encouraged through the entire thing.

Chapter 1 - Introduction

> "The lack of technology access and skills puts disadvantaged members of our society increasingly at risk of becoming disenfranchised spectators of a digital world that is passing them by bit by bit" (Milliron & Miles, 2000).

The 1st-year, first-generation college student has many obstacles to overcome before reaching the classroom. Knowing how to navigate the digital world is just as crucial as navigating the college hallways. Dependency on technology in careers and daily life has led to a new class of "haves" and "have-nots" based on technology literacy (Riel et al., 2012, p. 2), yielding a digital divide (Anderson & Kumar, 2019; Riel et al., 2012). Technology provides access to knowledge and wealth for many but may not be as available and accessible as many believe. Every aspect of life is influenced by technology, including entertainment, government, and commerce. In 2020, the world depended on students having access to technology for continuity of instruction during a global pandemic. Many communities found that their students were underprepared for this unforeseen scenario. Students in low-economic communities did not own computers or have access to broadband complicating the transition to remote teaching and learning. Picciano (2012) explained that in the field of education, access to technology can contribute to the basic skills of writing papers, conducting research, helping English as a Second Language students to improve language skills, and providing the necessary training for the global job market. Researchers have asserted that issues go beyond access to include questions such as having an adequate number of personnel to train and maintain faculty and students on the use of technology (Huffman, 2018).

Statement of the Problem

Career and technical education (CTE) and general education (GE) faculty are being asked to include technology literacy competencies into the academic curriculum. The National

Academy of Engineering [NAE] and National Research Council [NRC] (2002) proposed a model of technological literacy knowledge necessary for all citizens. Researchers in the report posited that without reliable data on what people know about the technological world and how understandings of technological innovations change over time, educators will have a difficult time making the case that the study of technology must be included in the curriculum (NAE & NRC, 2002).

The Organisation for Economic Co-operation and Development (2013) Survey of Adult Skills collected data on problem-solving skills in technology-rich environments and found that fewer than half of Americans 16 to 24 years old scored above a basic proficiency level. Fullard (2017) asserted that ideas of technology literacy as a skill have not been fully accepted, contributing to an erroneous perception among faculty that development of technology literacy belongs outside of the curriculum. However, an essential role of the community college is ensuring that students have access to technology and have technology literacy skills. Community college leaders must reimagine their goals and activities to meet the demands of the future and to maximize results for individuals, communities, and the country (American Association of Community Colleges [AACC], 2012).

Community colleges have an open enrollment policy to provide the citizens of the region they serve with quality, accessible, and affordable education and skills training by generally offering credit and noncredit courses and programs. According to Mullin (2017), open access means that all members of a community, regardless of status, are given a path to college education, whether through career preparation or acquiring an advanced degree. As community colleges expanded in the 1960s and 1970s, the national percentage of Black and Hispanic students attending college also increased. From the beginning, community colleges have reflected the communities around them (Cohen et al., 2014). Established in every metropolitan area and many rural areas, community colleges were available to everyone by attracting new students comprised of ethnic minorities, women, people who performed poorly in high school, and those who would otherwise never have considered or been able to afford further education. The trend of the open-door policy continues in community colleges. The AACC (2020) indicated 41% of all undergraduate students and 39% of all first-time 1st-year college students are enrolled in community colleges. More specifically, 42% of Black undergraduate students are in community college, as are 57% of Native American undergraduates and 5% of Hispanic undergraduates. The population of American community colleges students is 57% female, 42% ethnic minority, and 29% first generation; the average age of community college students is 28 (AACC, 2020). These populations are impacted by improvements to community college curricula.

Community college leaders need to redefine the mission of the community college to ensure that students are learning current technology skills to advance personally and professionally. In the United States, education is connected to wealth and success. The community college provides many disenfranchised students with the opportunity for self-empowerment with the skills needed to create a better future for themselves and their communities (Riel et al., 2012). Technology literacy is among those skills.

For low-income students, the lack of digital access hinders the ability to gain technology literacy skills that students would have acquired with consistent access. Roughly 29% of students with household incomes below $30,000 a year do not own a smartphone, and more than 44% do not have access to home broadband services (Anderson & Kumar, 2019). As students begin community college, they must understand how to use current technology and how to utilize digital information academically, professionally, and personally.

Purpose of the Study

The purpose of this mixed methods study was to examine GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. Kalfsbeek (2007) surveyed CTE faculty and regional employers to ascertain how Saint Paul College in St. Paul, Minnesota, faculty could best prepare students for a technology-driven workforce. Kalfsbeek's study revealed that of the 134 faculty invited to be surveyed, 21% responded. Of the respondents, most agreed that technology literacy has become a primary literacy type and must be integrated into the college curriculum. However, "the manner in which these outcomes should be included varied. Faculty did not like the idea of the college determining TL [technological literacy] competencies and then requiring them of all programs" (Kalfsbeek, 2007, p. 101). The respondents teaching in CTE programs responded that their individual programs must determine and implement the technology literacy outcomes they deemed necessary for their graduates. Based on the findings of her study, Kalfsbeek suggested,

> Another methodological change that would boost the validity of like research projects would be to triangulate the data collection by surveying additional sample groups. For example, should this study be replicated, a positive change to the sampling would include sampling the General Education faculty to assess their definition of TL [technology literacy] and their responsiveness to including TL literacies into the General Education curriculum. (p. 109)

The need for technological literacy skills in a technological and digital society continues to impact the academic growth of incoming students. These changes require consideration of how faculty are integrating technology literacy skills in the classroom.

Research Questions

Three research questions guided the study:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?
2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?
3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

Methodology

The study design employed a concurrent mixed-methods approach. This research replicated the methods followed in a study conducted by Kalfsbeek (2007) and built evidence to validate the original study's findings. This study involved GE and CTE faculty from the study college located in Michigan. The sample included faculty teaching in the following GE academic divisions: Humanities, Social & Behavioral Sciences, Math, and Sciences & Engineering Technology. The sample also included faculty teaching in the following CTE academic divisions: Business and Computer Technologies, Health Science, Advanced Technologies, and Public Service Careers.

For Research Questions 1 and 2, responses to quantitative Survey Items 4–16 were analyzed and compared based on respondent's program (CTE vs. GE), which was determined based on responses to Survey Item 1. For Research Question 3, responses to quantitative Survey Items 17–22 and qualitative Survey Items 23–25 were analyzed.

The conceptual framework is based on the five standards established by the International Technology Education Association (ITEA, 2007) and Bloom's (1984) taxonomy of educational objectives. The ITEA standards are used to assess technology literacy in five areas: (a) the nature of technology, (b) technology and society, (c) design and problem-solving, (d) abilities for a technological world, and (e) the designed world. Bloom's taxonomy provided definitions for each of the six major categories in the cognitive domain: knowledge, comprehension, application, analysis, synthesis, and evaluation. Bloom's taxonomy is hierarchical, and therefore learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. These six levels can be used to structure learning objectives and assessments for incorporating technology literacy skills into the curriculum.

Significance of the Study

Community college leaders need to ensure students are acquiring technology literacy skills required in the workforce and daily life. The National Academy of Engineering and National Research Council (2002) recommended technology literacy competencies be integrated into the academic curriculum. Data are needed on CTE and GE faculty perceptions of integrating technology literacy into the curriculum to ensure buy-in and integration of appropriate competencies. This study likely would impact three groups: (a) community college students lacking technology literacy instruction, b) community college faculty, and (c) community college curriculum committees. Findings could reveal obstacles or common perceptions regarding integration of technology literacy into the college curriculum. Technology literacy is a crucial part of learning and financial advancement for community college students (Bruce, 2008). Study results may impact the community college academic curriculum and training for faculty in technology literacy competencies for students. In a broad sense, improving ways to increase community college technology literacy will increase workforce possibilities for community college graduates.

Assumptions

This study was based on several assumptions. Participants were assumed to have enough knowledge of the college and technology literacy to answer the survey. Whereas different faculty members would have various levels of knowledge about technology literacy, it was assumed that CTE and GE faculty had enough knowledge about technology literacy to answer the survey. It was assumed that CTE and GE faculty understood how to incorporate competencies into the curriculum. Finally, it was assumed that faculty would answer the anonymous survey honestly.

Delimitations and Limitations

Several delimitations of the study are identified. This study focused on GE and CTE faculty at a community college in Michigan. Therefore, the findings might not be applicable to 4-year institutions or other community colleges.

Study participants were limited to faculty. Therefore, students, administrators, and other stakeholders were not invited to participate in this study. Surveys were distributed using paper and pen or an online platform. The study was limited to the availability of faculty due to the changing environment of the academic year.

Definition of Terms

The following key terms are adapted for this study and based on concepts identified in the literature:

Association for Career & Technical Education (ACTE) – A national education association committed to the improvement of education to prepare youth and adults for careers in emerging occupations (ACTE, 2020).

Career and technical education (CTE) – An education system that prepares youth and adults for a wide range of high-skill, high-wage, and high-demand careers, formerly known as vocational education (ACTE, 2020). At the study community college, CTE includes courses in accounting, automotive technology, business, computer systems, construction, hospitality management, video production, graphic design, health care, robotics, photography, web design, and welding.

Digital divide – Unequal access or opportunity to learn how to use information and computer technology, creating a significant impact on reading, numeracy, and problem-solving skills (International ICT Literacy Panel, 2001).

General education (GE) – nonoccupational or non-CTE courses (Higher Learning Commission, 2016). On the study community college website in 2020, GE was defined as

> a prescribed curriculum that assures a broad acquaintance with the basic areas of academic study. The general education requirements are designed to provide degree students certain skills and knowledge that include an understanding of and appreciation for the important modes of human thought, communication, and inquiry.

Technology literacy – the ability to effectively use technology to access, evaluate, integrate, create, and communicate information to enhance the learning process through problem-solving and critical thinking (Keengwe & Onchwari, 2017).

Summary

This chapter introduced the concept of how technology literacy is key to educational and career enhancement for students. Access to digital technology hinders many economically disadvantaged students when attending a community college. Faculty collaboration is an essential aspect of making sure that students gain the knowledge required to navigate the evolving technologically advanced society. Study results may impact the community college academic curriculum and training for faculty in technology literacy competencies for students. Three research questions are presented in this chapter. This chapter identified several assumptions and delimitations of the study. Finally, the definitions of terms were listed.

Organization of the Study

This chapter has provided an introduction to the study and explanation of the problem and purpose. The second chapter of this study is a review of the literature within the field of higher education pertaining to technology literacy skills in the workforce and integration of such skills into the college curriculum. The third chapter discusses the methodology used in the study. It includes a description of the survey instrument, a description of the procedures, and an explanation of how the data will be collected and analyzed. The fourth chapter contains an analysis of the data collected and the findings. The fifth chapter will conclude the study with an overview of the study, the results, implications of the research, and recommendations for future studies and further research.

Chapter 2 - Review of the Literature

This literature review is comprised of four main sections. In the first section, the history and role of community colleges are reviewed. This section includes a discussion of GE versus CTE and of community college faculty. Section 2 offers a synthesis of the literature related to the impact of technology on higher education. Section 3 discusses technology literacy in the 21st century. Section 4 reviews the conceptual framework that guides this study. The chapter concludes with a summary.

The researcher conducted a search to locate monographs, peer-reviewed journal articles, data sources, and dissertations using databases through the Kansas State University Library, including ProQuest Education Journals, ERIC, Google Scholar, Michigan Library Catalog (MelCat), and WorldCat. Articles and monographs were selected based on how often the combination of the following terms appeared in the title, abstract, or subject heading: *community college*, *computer mediated literacy, digital divide, digital literacy, technology literacy, and 21st century multiliteracies.* References from these sources were also checked for further publications to be used.

History and Role of Community Colleges

During great economic changes in the early 19th century, school leaders responded to the urgency to support a skilled workforce reflecting the needs of the community. Specialized high school programs gradually became community-based "junior colleges," which eventually became what is now known as the community college (Cohen et al., 2014; O'Banion, 2019). O'Banion (2019) described the role of the community college:

> The primary purpose of the community college is to ensure that students are prepared to make a good living and a good life. It is an open-door institution that accepts all who can benefit from its programs and services. It is a comprehensive institution that offers a

> variety of programs and opportunities to meet the needs of its diverse population. It is grounded in its local community but serves national and global needs when opportunities arise. It is Democracy's College, ever evolving. (p. 27)

The community college can be described as any not-for-profit institution regionally accredited to award the Associate in Arts or the Associate in Science as its highest degree (Cohen et al., 2014). According to Cohen et al. (2014), the community college serves five curricular functions in its community: academic transfer, occupational education (also known as CTE), continuing education, developmental education, and community service. As an open-door type of institution, community colleges often attract first-generation college students, working students, and adult learners with families and responsibilities (AACC, 2020).

Community colleges have advocated and launched numerous innovations in CTE designed to close the gaps in urban communities while keeping up with changing knowledge and skill requirements of the workplace (Myran et al., 2013). Most students take career courses and share in the common experience of taking GE courses for associate degree completion requirements. These shared requirements provide cohesion and provide knowledge and skills such as critical thinking, problem-solving, communication, and teamwork. Partnerships with community partners keep colleges informed of the needs of the community.

GE Versus CTE

Educators often argue about the true purpose of education vacillating between training students for a particular job or the ability to live a better life (O'Banion, 2016). The debate between the value of a liberal arts education or the incorporation of a workforce education into the structures of the curriculum has raised questions about the primary focus. Workforce education in the United States has evolved through a number of movements including apprenticeship training, manual training, trade schools, industrial education, home economics, agricultural education, vocational education, and CTE (O'Banion, 2016).

Several significant policies have guided the development of CTE for more than 100 years, beginning with the Smith-Hughes Act in 1917 through the federal government's most recent investment in 2018 with the Strengthening Career and Technical Education for the 21st Century Act (ACTE, 2019; Imperatore & Hyslop, 2017). CTE policies have changed and evolved in response to the changing economic and social conditions of the time period.

Integrating academic and technical knowledge with a focus on problem-solving in the real world is an important way that CTE engages students and enhances college performance (ACTE, 2013). Historically, behavior changes the lens of learning and shifts from teaching to learning to earning. O'Banion (2016) strongly suggested that community colleges need to create a common core of GE integrated with CTE for a new essential education to help students make a good living and live a good life.

O'Banion (2016) explained that GE gained momentum as higher education became more accessible to nontraditional students, initially following World War II and continuing with the increase of 2-year colleges in the 1960s. GE provided students with an integrated education of core knowledge (O'Banion, 2016). Many community college GE programs are guided by the Association of American Colleges and Universities (2015, 2020) essential learning outcomes. The GE essential learning outcomes developed by the Association of American Colleges and Universities (2020) are presented in Table 2.1.

Table 2.1.

Essential Learning Outcomes of a Liberal General Education

Learning outcome	Details
Knowledge of human cultures and the physical and natural world	• Sciences and mathematics • Social sciences, humanities, histories • Languages • The arts
Intellectual and practical skills	• Inquiry and analysis • Critical and creative thinking • Written and oral communication • Quantitative literacy • Information literacy • Teamwork and problem-solving
Personal and social responsibility	• Civic knowledge and engagement, both local and global • Intercultural knowledge and competence • Ethical reasoning and action • Foundation for lifelong learning • Involvement with diverse communities and real-world challenges
Integrative and applied learning	• Synthesis of learning across general and specialized studies • Application of knowledge and skills to new settings and problems

Note. Data source: *Essential Learning Outcomes*, by the Association of American Colleges and Universities, 2020, https://www.aacu.org/essential-learning-outcomes

Community College Faculty

Cohen et al. (2014) stated that when the size and number of community colleges were increasing rapidly, the question of proper training and experience for instructors was frequently debated. Cohen et al. argued that the master's degree has been the typical preparation, although obtaining the doctorate is the most desirable. Major objections include that most doctorate holders have been prepared as researchers and not teachers, which alters their expectations (Cohen et al., 2014). Faculty members who teach GE courses or other nonoccupational courses must hold a master's degree or higher in the discipline or subfield (Higher Learning

Commission, 2016). A faculty member may hold a degree outside of the teaching discipline, in which case, that faculty member must have completed a minimum of 18 graduate credit hours in the discipline, according to the Higher Learning Commission (2016).

In the community college environment, most faculty teach part time. According to the National Center for Education Statistics (2006), in the fall of 2003, two thirds of faculty at community colleges were employed part time. Strain on faculty workload must be considered by taking into consideration the hours spent in the classroom each week times the number of students enrolled (Cohen et al., 2014). The time required of faculty does not include additional research, scholarship, consulting, collaboration, or professional development. Such responsibilities are sometimes included in community college teaching contracts but not always. Faculty would need to take time out of their own schedule to fulfill these needs. Moreover, researchers for the National Center for Education Statistics (Hussar et al., 2020) noted faculty salaries were lower at 2-year degree-granting institutions than at 4-year universities.

Impact of Technology on Higher Education

Technology access affects students in the community, workforce, classroom, and at home. This access, or lack of access, is transforming society exponentially. Technology skills can be learned starting in the classroom, but they can be shaped at work and in commerce through academic and business collaborations. In a 2012 study by the Pew Research Center, 60% of the stakeholders surveyed predicted innovative shifts would occur in higher education by 2020 (Anderson et al., 2012). These innovative changes included “cloud-based computing, digital textbooks, mobile connectivity, high-quality streaming video and ‘just-in-time’ information gathering” (Anderson et al., 2012, p. 2), which indeed have been implemented. Integrating technology literacy curriculum in the classroom is an integral next step. Unfortunately, both teachers and students may be using a curriculum that has not been adjusted to keep abreast of the rapid developments in technology (Littlejohn et al., 2012, Prensky, 2012).

Technology literacy skills are necessary for students doing academic research, actively learning about the economic world, engaging in a democratic society, and participating in digital social justice (ACTE, 2013; Association of American Colleges and Universities, 2015). Technology literacy prepares students for lifelong learning and financial empowerment. Many students take advantage of the low cost of attending community college to refresh and acquire new skills for the 21st-century workplace (AACC, 2020; Velez et al., 2018); however, some students may be underprepared for the digital environment. Lack of preparation or technology literacy is related to what has become termed the digital divide.

In a collection of essays from de los Santos, de los Santos, and Milliron (2001), educational scholars led the call to action to take the strategic steps that will provide the necessary information technology access and skill sets for underserved and economically challenged populations. In addition to providing definitions for the digital divide in the community college context, de los Santos et al. (2001) also reviewed the literature and described model programs. Children who are considered the 'haves' in the digital age are provided with the necessary technology and Internet access at early ages providing them with greater opportunity to pick up important information and literacy skills. Over 75% of households with incomes over $75,000 have at least one computer, compared to less than 32% of households with incomes between $25,000 and $35,000 (as cited in de los Santos et al., 2001). Technology literacy and training could potentially be the key resource to help students obtain their highest potential, but without the knowledge, these students may fail (de los Santos et al., 2001). The skills that these students need translates into the local economy when they need to conduct research at work, communicate with coworkers and customers, and compete in a global economy.

The Digital Divide

Between 1991 and 1996, personal computer use increased significantly in the United States. During that time, researchers at the National Telecommunications and Information Administration began to use the term "digital divide," beginning with a study for the Clinton Administration showing many in rural and urban areas lacked access to internet and related technology (Brown et al., 1995). This was the beginning of many discussions of the lack of technology access for certain groups identified by income, age, and education. The digital divide has come to be accepted as a division between people who have access to and use of digital media and those who do not (van Dijk, 2020).

Researchers continue to explore the remaining gap and how higher education can address this issue (Bozzetto-Hollywood et al., 2018, Huffman, 2018; International ICT Literacy Panel, 2001). Even with access increasing, the digital divide still exists as a great social challenge (Bozzetto-Hollywood et al., 2018, Cohron, 2015).

Three concepts of access affect digital users: physical, material, and conditional access. Physical access is the opportunity to use digital media by obtaining them privately in homes or publicly in collective settings (van Dijk, 2020). Many users have access through schools, libraries, and community centers. Over time, use has shifted from mainly accessing technology from the collective to private ownership. Yet inherent misconceptions remain, for example, that a student with a cellphone has internet access. Broadband or Wi-Fi is still required, and many find access difficult. Other times, lack of transportation, lack of mobility due to age, and avoidance altogether are negative influencers of physical access (Huffman, 2018).

The second concept is material access, defined as all means needed to maintain the use of digital media over time, including subscriptions, peripheral equipment, electricity, software, and print necessities (van Dijk, 2020). These expenses may be a barrier even with basic physical access and may exceed the cost of maintaining basic devices. Some users of lower socioeconomic status may not be able to purchase the additional equipment or fees necessary for proper access (Graham & Choi, 2015).

The third concept is conditional access, which is defined as the provisory entry to applications, programs, or contents of computer and networks (van Dijk, 2020). Many faculty are now using digital textbooks and supplemental materials in their curriculum. These may be convenient in instructional design but can require additional costs. All three concepts of digital access remain challenging. Technologies are increasing and changing daily. Higher education leaders and faculty struggle to keep faculty up to date, infrastructure updated, and technology integrated into curriculum amid institutional financial constraints.

Technology Literacy

Technology literacy is very broadly used as a term because of the range of technology available. Individuals need more than just knowledge of current technology but also the skills to use the technology. Technology also encompasses more than just a basic computer or simple cell phone. Current modern technologies include automobiles, airplanes, water purification and distribution systems, electronics, radio, television, and agricultural mechanizations to name a few. Technology acknowledges more than a simple, individual device but also includes the people and infrastructure necessary to design, manufacture, operate, and repair those technologies (National Academy of Engineering & National Research Council, 2006).

The International Technology Education Association (ITEA, 2007) defined technology literacy as the ability to use, manage, understand, and assess computer-mediated technologies and communications. The ITEA explained that technology literacy includes demands for mental tools such as problem-solving, visual imaging, critical thinking, and reasoning. According to the National Academy of Engineering and National Research Council (2006), technological literacy incorporates three significant dimensions: knowledge, capabilities, and critical thinking and decision-making. The knowledge dimension includes both factual knowledge and conceptual understanding as key components. The capabilities dimension considers that a person with strong skills must be able to use technology design to solve a problem. A technologically literate person would be capable of using technologies commonly found in the home and perform basic troubleshooting when problems occur with that technology. The critical thinking and decision-making dimension determines that a skilled person would be able to participate in discussions about the use of technology.

Several distinctions are made between the types of computer-mediated or technology literacies. These literacies are labeled 21st century skills to show that they are connected to economic and social developments of current society rather than to the Industrial Era of the last century. As a starting point for discussion, the term “literacy” has been expanded from simply reading and writing to include additional foundational literacies, including textual literacy, numeracy, disciplinary literacy, or knowledge within a specific domain (ITEA, 2007; Littlejohn et al., 2012; National Academies of Sciences, Engineering, and Medicine, 2016).

The National Research Council (1999) noted that “computer literacy” is concerned with rote learning specific hardware and software applications, whereas familiarity with innovation focuses on understanding the underlying concepts of technology and applying problem-solving and critical thinking to using technology. Computer-mediated communications play a role in computer literacy and include asynchronous methods (email, listserv, discussion boards, and blogs) and synchronous or real-time tools (chat, instant messaging, and audio and video web-based conferencing). Digital literacy has been defined as the ability to find and use digital information (Phan et al., 2011). Cell phones have more powerful computing capability of a mid-1990s computer (Prensky, 2012). According to Prensky (2012), educators must think of cell phones as computers and relevant technology media. Prensky suggested that educators find useful and innovative ways to implement features including voice, text messaging, graphics, user-controlled operating systems, camera, graphic displays (videos), geo-positioning, fingerprint readers, and new operations updated regularly. If many students have this basic technology, faculty can connect learning with the technological skills students need for critical thinking in any situation. The National Academy of Engineering and National Research Council (2002) noted the full benefits of technology literacy:

> The study of technology involves evaluating how others have successfully solved problems and provides experience in hands-on problem solving; hence, technologically literate workers are likely to be able to identify and solve problems. They are also more likely to put things in a broad context because the study of technology emphasizes systems thinking. They are more likely to be comfortable with complex interrelationships, which are common in technological systems. And they may be able to troubleshoot problems with equipment when necessary because they have learned how to ask the necessary questions to understand why a technology works—or why it isn't working. (p. 41)

Standards of technology literacy were developed in 2000 by the ITEA and revised in 2007. These ITEA standards, developed for kindergarten through Grade 12, are still relevant (Herman et al., 2017; International Technology and Engineering Educators Association, 2017). Kalfsbeek (2007) compared the ITEA standards to Bloom's (1984) taxonomy of educational objectives to create a conceptual framework for use with community colleges.

Conceptual Framework

The conceptual framework helps to provide a guide in refining what is considered technology literacy and how to integrate it into the community college curriculum. Measurable curricular outcomes were developed based on the five standards established by the ITEA (2007) and Bloom's (1984) taxonomy of educational objectives. The ITEA standards are used to assess technology literacy in five areas: (a) the nature of technology, (b) technology and society, (c) design and problem-solving, (d) abilities for a technological world, and (e) the designed world. The ITEA suggested that curriculum developers, teachers, and others use these standards as a guide for developing appropriate curricular approaches for a given setting. Table 2.2 illustrates the standards as defined by the ITEA, translates their conceptualizations into measurable outcomes for the college curriculum (Kalfsbeek, 2007), and places them on the Bloom (1984) taxonomy of educational objectives. Bloom's taxonomy provided definitions for each of the six major categories in the cognitive domain: knowledge, comprehension, application, analysis, synthesis, and evaluation. Bloom's taxonomy is hierarchical, and therefore learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. These six levels can be used to structure learning objectives and assessments for incorporating technology literacy skills into the curriculum.

Table 2.2.

Standards of Technology Literacy

ITEA category[a]	Measurable outcomes	Bloom's taxonomy level[b]
1. The nature of technology	Show knowledge of general characteristics and scope of technology.	1. Knowledge
2. Technology and society	Explain the connections between technology and society.	2. Comprehension
3. Design and problem-solving	Demonstrate and examine the role technology can play in problem-solving.	3. Application 4. Analysis
4. Abilities for a technological world	Use and manage technological products and systems.	5. Synthesis
5. The designed world	Evaluate how technology is applicable to specific fields of study and careers.	6. Evaluation

Note. ITEA = International Technology Education Association. Adapted from *Technology Literacy as a 21*st *Century Basic Skill: A Study of Evolving Technology Literacy Competencies for a Workforce Education, Community College*, p. 31, by J. L. Kalfsbeek, 2007 (Publication No. 3274593), Doctoral dissertation, Capella University, ProQuest Dissertations and Theses. Copyright 2007 by Jennifer Kalfsbeek. Adapted with permission.
[a]*Standards for Technological Literacy: Content for the Study of Technology* (3rd ed.), by International Technology Education Association, 2007, https://www.iteea.org. [b]*Taxonomy of Educational Objectives,* by B. Bloom, 1984, Allyn and Bacon.

Kalfsbeek (2007) ultimately reported that the first two levels of the ITEA and Bloom frameworks were adequate for technology literacy integration into the community college curriculum. Kalfsbeek concluded the GE curriculum must include basic knowledge and skill elements enabling students to use basic computer hardware and software, navigate the internet, use email, use asynchronous message boards, and use security software. Kalfsbeek noted the need to expand upon her research.

Gaps in the Literature

Whereas the literature has demonstrated findings documented at the university and secondary levels, very little empirical research has examined technology literacy integration in the community college curriculum. Reviewing the literature regarding technology literacy competencies for workforce-ready students demonstrated a need for additional research and study at the community college level, particularly related to the role and perceptions of GE faculty versus CTE faculty. The synthesis of the literature revealed that research will need to be conducted as fast as technology updates are occurring to ensure that faculty are collaborating and integrating technology literacy skills into the curriculum. This study adds to the emerging scholarly research in the field of community college curriculum requirements that prepare a market-ready workforce.

Summary

This chapter explored the role of community colleges, including community college GE versus CTE curriculum. A review on the impact of technology in higher education was presented. Technology literacy for the 21st century was defined. The chapter concluded with a discussion identifying the relevant conceptual framework that guides this study. The next chapter explains the methodology in detail used to conduct the study.

Chapter 3 - Methodology

The purpose of this mixed-methods study was to examine GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. The research method, rationale for the study design, procedures, data collection, data analysis, and researcher positionality are described in this chapter. In addition, informed consent and confidentiality and the relevance of the author's interests in this study as a researcher and academic administrator are considered.

The research questions guiding the study were as follows:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?
2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?
3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

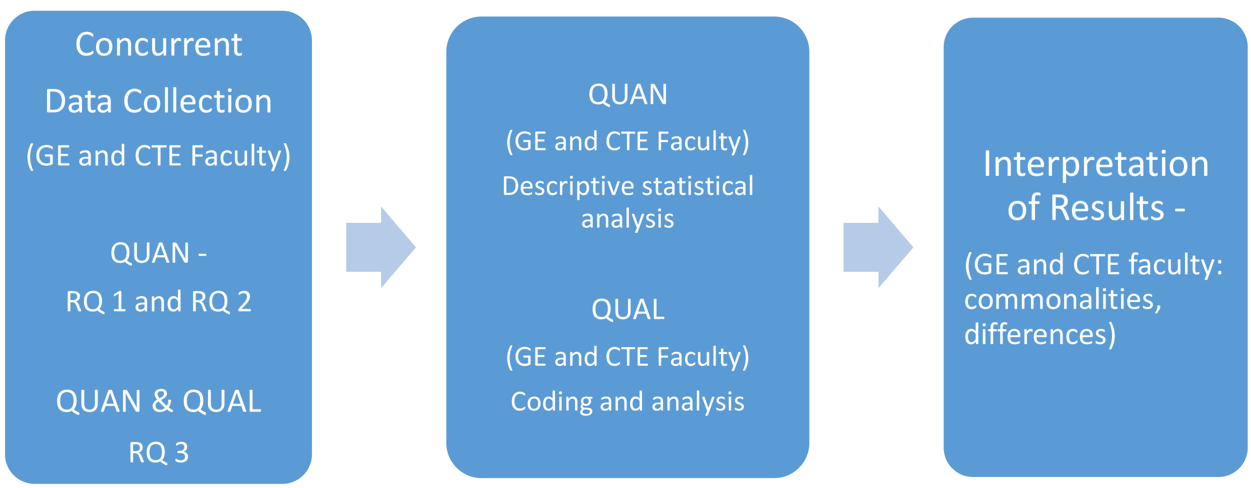
Research Method

This study used a mixed-methods research design, which can be defined as an intellectual and practical synthesis based on qualitative and quantitative research; mixed methods is the third methodological or research paradigm (Johnson et al., 2007). Mixed-methods researchers recognize the importance of traditional quantitative and qualitative research, but also use a powerful third paradigm choice that often provides the most informative, complete, balanced, and useful research results (Johnson et al., 2007). Researchers in many fields have advocated for and used mixed-methods research (Creswell, 2018; Johnson et al., 2007, Tashakkori & Teddlie, 2003).

The mixed methodology in this study consisted of an online, or paper, anonymous survey with both closed- and open-ended questions. Creswell et al. (2003) emphasized the criteria of quality in mixed methods research are including various types of information, using an unmistakable model or configuration, including a visual outline or plan, and talking about the structure in detail. Researchers have stressed the importance and value of providing a visual model (Creswell, 2018; Creswell et al., 2003; Tashakkori & Teddlie, 1998). A visual model was created for this multilevel concurrent study; see Figure 3.1.

Figure 3.1.

Visual Model of Mixed-Methods Plan



Note. GE = general education; CTE = career & technical education; QUAN = quantitative; QUAL = qualitative; RQ = research question.

Rationale for the Study Design

By using both methods of research, the researcher can rely on quantitative data to formulate an understanding of the research problem while using qualitative data to allow refinement and explanation of specific quantitative findings and concepts in the participants' own words (Lochmiller & Lester, 2017). Characteristics of concurrent mixed-methods designs are well described in the literature (Creswell, 2018; Creswell et al., 2003; Tashakkori & Teddlie, 2003). Creswell et al. (2003) explained that concurrent designs are those in which the analyst joins or consolidates quantitative and qualitative, subjective information for a thorough investigation. This research replicated the methods followed in a study conducted by Kalfsbeek (2007) and built evidence to validate the original study's findings.

This study used a multilevel concurrent design that collected data with one survey instrument (Appendix A). The data collection phase included simultaneous, or concurrent, survey instruments and targeted two multilevel data respondent types (Creswell, 2018; Tashakkori & Teddlie, 1998): CTE and GE faculty. This research design allowed a comparison of different perspectives between the faculty of the college.

Population and Setting

The study site was a suburban community college in Michigan serving over 20,000 students. Community colleges in Michigan are guided by the Michigan Community College Association [MCCA]. The MCCA (2020) provides legislative and public advocacy in Lansing and throughout Michigan. The organization works to improve the image and credibility of community colleges and advances shared initiatives through the Michigan Center for Student Success, Michigan Colleges Online, and the Michigan New Jobs Training Program (MCCA, 2020). As noted by the AACC (2020), community colleges tend to serve low-income, ethnic minority, female, and adult students, which is particularly true for Michigan community colleges.

The community college was selected as the study site due to the convenience of access and proximity to the researcher's location. The community college opened its doors in September 1966. During the early years, the college had no central campus, and more than 1,200 students took classes at varied sites including an elementary school, a dairy farm, a church basement, a former fire station, and an abandoned bomber plant. Local educators believed that a 2-year college would provide technical skills education for a workforce and give liberal arts students in their first 2 years of study an affordable alternative to a university education. The college currently enrolls more than 20,000 students and offers over 137 credit programs in business, health, advanced manufacturing and skilled trades, public service, humanities, social science, math, natural sciences, art, and technology (see Appendix B). The college offers apprenticeships and training partnerships with many businesses and organizations. Transfer agreements with 4-year higher education institutions are updated regularly, including agreements with the University of Michigan and Eastern Michigan University.

Participants and Sampling

Purposeful nonprobability sampling was employed. Purposeful sampling is the process of intentionally recruiting participants who align with the key phenomenon or concept being studied (Creswell & Plano Clark, 2018). Faculty were selected from the specific college who could provide data regarding their perceptions and attitudes of technology literacy competencies needed in the workforce and the process of integrating technology literacy into the college curriculum. For this study, the researcher aimed to recruit GE and CTE faculty who had full-time teaching status.

Faculty were eligible for participation if they met the following characteristics: (a) faculty at the study community college, (b) employed full time, and (c) in one of the Associate Degree or Certificate programs. Faculty names were identified using the community college directory posted online. The college employs 157 full-time faculty. The survey was sent to all 157 faculty.

Ethical Considerations

The researcher obtained Human Subjects Approval and Informed Consent Approval from the Institutional Research Board at both Kansas State University and the individual community college site. Participants signed an informed consent document before participating. The document informed participants of the study, provided an explanation of the plans for the collected data, and gave assurance that their identity would be kept confidential. Data were analyzed in aggregate to protect individual respondents. Participant rights also were discussed in the informed consent document. Participants had the right not to participate and could choose not to answer any specific question. Participants could end their participation at any time. The consent form also advised participants that although they were asked to provide their name and contact information for data collection and analysis purposes, this information would be kept confidential. The researcher had no position of authority over any participants in the study.

Survey Instrument

The survey instrument was adapted from a previous study by Kalfsbeek (2007). Because Kalfsbeek piloted her survey to determine the clarity of the questions as well as to solicit suggestions, the survey used in this study incorporated Kalfsbeek's findings. Kalfsbeek reported a 21% response rate and employed a much longer survey. To increase participation and avoid attrition during responses, the survey was adapted to be shorter, and incentives were provided. A $10 gift card to a local café was provided at the conclusion of the digital survey or upon return of the paper survey. A panel of experts reviewed the survey to determine length of time and clarity of questions. In addition, the members of the dissertation committee reviewed and approved the survey instrument. All aspects of the data collection were designed to support the call for improved understanding of the perspectives of GE faculty and CTE faculty on the technology literacy competencies students need in the classroom and workplace and ways to incorporate technology literacy into the college curriculum. The survey included Likert-type quantitative questions and several open-ended questions. By using open-ended questions, in addition to the quantitative questions, the data collection gathered interviewees' perspectives on technology literacy in their own words.

Data Collection Procedures

An e-mail was sent to all full-time faculty members at the community college. Full-time faculty were identified through the institution's website and direct phone calls through the academic units for verification of email addresses. Additionally, an initial contact note was placed in each faculty member's mailbox. This initial contact explained the research and requested participation. The note explained that faculty should feel no obligation to participate in the study. Faculty members were given the option of completing the survey in paper-and-pencil format. Survey links to the survey via SurveyMonkey were sent via email. Any potential participants who responded and preferred a paper copy of the survey had the paper survey delivered to their campus mailbox along with a preaddressed, postage-paid return envelope addressed to the researcher. Data were collected through two methods: (a) participants could submit their completed informed consent forms and paper surveys in the envelope provided or (b) participants could complete the informed consent form online and then complete the survey online. All participants were provided with email, regular mail, and telephone contact information, so that they could contact the researcher if they had questions or concerns.

Panel of Experts

The survey instrument was reviewed by a panel of experts comprised of practitioners and scholars in educational leadership and technology literacy curriculum development. These participants were chosen because they were not included in the final survey population. Experts included leadership from organizations including the Association for Career & Technical Education [ACTE], the study college, and other higher education organizations. Panel Member 1 is president of a community college district governing board and has worked in community colleges for over 40 years, 29 years as a chief executive officer. Panel Member 2 is executive director and chief executive officer of the International Technology & Engineering Educators Association. Panel Member 2 also has 10 years of experience in classroom teaching in CTE, 13 years of experience as a school district administrator, and 6 years as a state supervisor for technology education. Panel Member 3 is president of the Michigan ACTE and associate superintendent for CTE in a regional education district. The panel of experts reviewed and evaluated the questions to be used in the survey after receiving an email letter (Appendix C). The survey instrument (Appendix A) and a comment form (Appendix D) were included with the letter to elicit feedback. Each respondent was asked to indicate the amount of time needed to complete the instrument, readability, clarity, and any additional feedback to be considered.

Validity

Creswell (2014) defined validity in mixed-methods research as employing strategies that address potential threats to drawing correct inferences and accurate assessments from the integrated data. Tashakkori and Teddlie (1998) explained that measurement results must be strongly associated with other measures of the same construct or measures of those constructs that are theoretically related to it such as in convergent validity. The survey in this study had been used in a previous study but was shortened and slightly adapted. A review by a panel of experts ensured the questions were clear and the survey did not take long to complete.

Credibility

Credibility is met once there is an agreement between what the study participants believe is the meaning of their words and the researcher's representation of the experiences and meaning. For qualitative analysis, the researcher relies upon the respondents' own words and set aside personal biases during analysis.

Data Analysis

Integration refers to the stage in the process where the mixing or integration of the quantitative and qualitative methods occurs (Creswell et al., 2003; Tashakkori & Teddlie, 1998). This integration can happen at several times during the process, including the beginning stages or during the findings stage. Data from completed faculty surveys were analyzed using Microsoft Excel. Responses were separated based on type of faculty (CTE vs. GE). Descriptive statistics including count and frequency were calculated for each item.

For Research Questions 1 and 2, responses to quantitative Survey Items 3–15 were analyzed and compared based on respondent's program (CTE vs. GE), which was determined based on responses to Survey Item 1 (see Appendix A). For Research Question 3, responses to quantitative Survey Items 16–21 and qualitative Survey Items 22–24 were analyzed.

Data from the open-ended questions, Survey Items 22–24, were analyzed through coding and content analysis to determine common or divergent themes across results. Data were coded including the number of similar responses to determine common patterns or themes across both sets of findings. According to Creswell and Plano Clark (2018), in a convergent design, interpretation involves not only identifying points of congruence and discrepancy but also working to understand how these points provide additional insight into the problem being studied. Table 3.1 gives an overview of the research workflow process.

Table 3.1.

Research Workflow Process by Phase and Level

Research phase	Activity
Data collection	• Informed consent and surveys to 157 community college full-time faculty: general education (GE) and career & technical education (CTE) • Surveys returned either online or paper via envelope
Data analysis	• Responses sorted by GE vs. CTE faculty (Survey Item 1) • Quantitative Likert responses analyzed using descriptive statistics: • Survey Items 3–15 by GE faculty group to answer Research Question 1 • Survey Items 3–15 by CTE faculty group to answer Research Question 2 • Survey Items 16–21 by faculty group and as a whole to answer Research Question 3 • Qualitative responses to Survey Items 22–24 coded to determine themes to answer Research Question 3
Recommendations and implications	• Development of technology literacy competencies (from findings for Research Questions 1 and 2) • Implications for implementing technology literacy integration into curriculum (findings for Research Question 3)

The conceptual framework helped to provide a guide in refining what is considered technology literacy and how to integrate it into the community college curriculum. Results from the study links specific technology literacy outcomes and connects them to competencies identified by GE faculty and CTE faculty respondents in this investigation across Bloom's (1984) taxonomy and the five ITEA (2007) categories. The ITEA standards are used to assess technology literacy in five areas: (a) the nature of technology, (b) technology and society, (c) design and problem-solving, (d) abilities for a technological world, and (e) the designed world.

Researcher Positionality

The researcher must acknowledge any bias related to the study. Creswell (2018) emphasized the importance of practicing reflexivity throughout the study and how researchers acknowledge how personal experiences, history, and potential biases could impact the study. The researcher is interested in the chosen topic as a former librarian who has transitioned to an academic administrator. The researcher's understanding of teaching and learning comes from a 12-year career as a public librarian and 5 years as an academic librarian and instructional dean at a community college. To make participants aware of the researcher's role as an academic dean and doctoral student, the researcher provided full disclosure in the initial contact message and in the email announcement sent to potential participants during study recruitment.

Summary

The purpose of this study was to examine GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. Using the mixed-methods approach would provide a solid understanding of the issue, potentially yielding a preliminary set of measurable technology literacy competencies for the community college curriculum. Findings could reveal potential strategies and roles when implementing technology literacy into the community college curriculum.

The three research questions were presented in this chapter. Full-time community college faculty were asked to complete anonymous surveys. The survey instrument was tested through a panel of experts to determine length of time to complete and question clarity. The chapter described how the data were collected online through SurveyMonkey or mailed to the researcher's address. Chapter 4 describes and discusses the results of the study.

Chapter 4 - Results

The purpose of the study was to examine general education (GE) and career and technical education (CTE) faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. The study utilized a mixed method research design with a quantitative and qualitative approach.

The results of the survey are presented in this chapter. The chapter is divided into seven sections: (a) discussion and recommendations of the expert panel, (b) posting of the final survey and response rate, (c) participant data, (d) quantitative data collection and analysis, (e) qualitative data collection and analyses including coding of the data, (f) results of both quantitative and qualitative data as applied to research questions, and (g) a summary of the chapter. This chapter presents the quantitative and qualitative results to address the research questions:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?
2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?
3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

Recommendations by Panel of Experts

The survey instrument was reviewed by a panel of experts comprised of practitioners and scholars in educational leadership and technology literacy curriculum development. Panel Member 1 is president of a community college district governing board and has worked in community colleges for over 40 years, 29 years as a chief executive officer. Panel Member 2 is executive director and chief executive officer of the International Technology & Engineering

Educators Association. Panel Member 2 also has 10 years of experience in classroom teaching in CTE, 13 years of experience as a school district administrator, and 6 years as a state supervisor for technology education. Panel Member 3 is president of the Michigan ACTE and associate superintendent for CTE in a regional education district. After the expert panel reviewed the survey instrument, the following comments or recommendations were given: (a) the survey takes approximately 10 minutes to complete, (b) include the Standards for Technological and Engineering Literacy 2020 definitions at the head of the survey, (c) consider eliminating one question to reduce risk of identifying specific faculty, and (d) consider rewording four questions to reflect a more neutral tone.

Survey and Response Rate

Faculty participants in the survey were eligible for participation if they met the following characteristics: (a) faculty at the study community college, (b) employed full time, and (c) in an Associate Degree or Certificate program. The population of this study was 157 full time faculty at a community college in Michigan, of whom 48 volunteered to participate in the survey for a 30% response rate. Four participants withdrew before completing the survey. This response rate met the criteria for a sample size at the 90% confidence level, plus or minus 10%.

This study involved GE and CTE faculty from the study college in Michigan. The sample included faculty teaching in the following GE academic divisions: Humanities, Social & Behavioral Sciences, Math, and Sciences & Engineering Technology. The sample also included faculty teaching in the following CTE academic divisions: Business and Computer Technologies, Health Science, Advanced Technologies, and Public Service Careers.

Before any research could begin, the study college required the researcher to complete a Research Request Application. This required additional time to complete the form, confirm receipt of the document, and make required revisions for approval by the director of institutional research and analytics. Once the revisions were accepted, the document was then approved by the vice president for instruction. The director then generated a list of faculty who would be qualified to participate in the research survey. The researcher was not given phone number information, and permission was not granted to follow up using phone calls. The researcher was restricted to two email reminders to faculty.

An initial contact email (see Appendix E) explained the research and requested faculty participation from those who met the criteria. The email was sent to 157 faculty on August 12, 2020. The invitation was sent directly from SurveyMonkey to maintain a list of direct responses. The invitation explained that faculty should feel no obligation to participate in the study. Survey links to the survey were sent via email. Faculty members were given the option of completing the survey in paper-and-pencil format. No participants requested paper-and-pencil surveys. Data were collected by online surveys, administered through the SurveyMonkey.com website. One version of the survey was used for both GE faculty and CTE faculty. Before beginning the survey, participants completed the informed consent form. All participants were provided with the researchers' email and telephone contact information, so that they could contact the researcher if they had questions or concerns. A reminder email was sent to faculty on September 9, 2020 just before the fall semester started. The vice chancellor of instruction did send a follow-up email (see Appendix F) with a personal note to a limited number of faculty on September 12 and September 18, 2020, to encourage greater participation. All participants who provided their email for contact received a gift card to a local café. Providing the incentive did seem to encourage participation but not as many as expected. All participants completed an informed consent form (Appendix G). The deadline to answer the surveys was October 1, 2020. All surveys were closed on October 9, 2020.

Participants

This section describes the two respondent groups associated with the present investigation: GE faculty and CTE faculty. SurveyMonkey.com provided a basic breakdown of results for the Likert scale and multiple-choice questions. Descriptive statistics were applied to the questionnaire results by the researcher. Survey research methods were utilized to identify what differences, if any, existed between and within GE and CTE faculty groups. Descriptive statistics were calculated for division of both groups. Among the 44 respondents, members from all divisions were represented, with 61% (n = 27) representing CTE faculty and 39% (n = 17) representing GE faculty. Table 4.1 presents participant divisions.

Table 4.1.

Survey Respondent Division at the Community College (N = 44)

Division	*n*	%
Humanities, Social & Behavioral Sciences	10	22.7
Advanced Technologies/Public Service	10	22.7
Health Sciences	9	20.5
Business and Computer Technologies	7	15.9
Math, Sciences & Engineering	7	15.9
Other (Career Transitions)	1	2.3

Quantitative Data Collection and Analyses

The quantitative data may serve as a guiding document for planning digital literacy instruction, incorporating multimodal literacy activities in the general curriculum, and designing assessments. Data analysis indicated that most faculty strongly agreed or agreed that most of the skills listed are needed in the workplace. All faculty agreed or strongly agreed that the top competencies that students need in the workplace were basic internet and email use and knowledge in using a personal computer. Further, whereas 48% (*n* = 13) of CTE faculty strongly agreed that students need to know word processing skills (see Table 4.2), 82% (*n* = 13) of GE faculty strongly agreed (see Table 4.3). CTE and GE faculty perspectives on technology literacy skill competencies needed in the workplace results are presented in Tables 4.2 and 4.3, respectively.

Table 4.2.

Technology Skill Competencies Needed in the Workplace, According to CTE Faculty

Skill	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	n	%	n	%	n	%
Personal computer	21	77.8	6	22.2	0	0	0	0
Hardware specific to the career	18	66.7	7	25.9	2	7.4	0	0
Word processing and spreadsheet applications	13	48.1	14	51.9	0	0	0	0
Software programs specific to the career	21	77.8	6	22.2	0	0	0	0
Internet	23	85.2	4	14.8	0	0	0	0
Email	23	85.2	4	14.8	0	0	0	0
Company Intranet	17	63.0	7	25.9	3	11.1	0	0
Other	12	44.4	6	22.2	1	3.7	0	0

Table 4.3.

Technology Skill Competencies Needed in the Workplace, According to GE Faculty

Skill	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	n	%	n	%	n	%
Personal computer	16	94.1	1	5.9	0	0	0	0
Hardware specific to the career	12	70.6	5	29.4	0	0	0	0
Word processing and spreadsheet applications	14	82.4	3	17.6	0	0	0	0
Software programs specific to the career	12	70.6	5	29.4	0	0	0	0
Internet	16	94.1	1	5.9	0	0	0	0
Email	16	94.1	1	5.9	0	0	0	0
Company Intranet	7	41.2	8	47.1	2	11.8	0	0
Other	4	23.5	2	11.8	1	5.9	0	0

Faculty were also asked to list career-specific competencies that students may need in the workplace. Table 4.4 lists hardware and software items faculty listed in response to this open-ended question. Both faculty groups noted that students need technological literacy competencies using learning management systems, networking systems, and cloud software. CTE faculty also indicated that students must have competencies in using software programs specific to the career. CTE faculty prioritized knowledge of specific programs specific to the career including McKesson picture archiving and communication system (PACs), patient-management systems like EPIC, and simulation software (see Table 4.4).

Table 4.4.

Hardware and Software Items Specific to Career

Type	Faculty Type	Item
Hardware	CTE	Calculator
	CTE	Scan tools
	CTE	Digital multimeters and lab scopes
	CTE	Digital recording device
	CTE	Warehouse management system
	CTE	iPad/digital tablet
	CTE	Digital cameras, scanners and printers
	CTE	Smart phone
	CTE	Digital radiography equipment and picture archiving and communication system (PACs)
	GE	Photography equipment
	GE	Audio equipment
	GE	Computer
Software	CTE	Programming editors/compilers
	CTE	Simulation software
	CTE	Child observation and assessment tools/platforms
	CTE/GE	Adobe InDesign, Illustrator, and Photoshop
	CTE	Medical record programs
	CTE	Office, basic opening, attaching, scanning, uploading, downloading
	CTE	McKesson PACs
	CTE	Patient management like EPIC
	CTE	Networking software
	CTE	Cloud software
	CTE	3D software
	GE	Arcview
Other computer skills	CTE	Computerized diagnostic equipment
	CTE	Electronic service Information
	CTE	Information search of specifications, directions
	CTE	Learning Management System
	CTE	Hands-on application of running machines (not virtual only)
	CTE	File management and user accounts
	CTE	Project management
	GE	Information Literacy
	GE	Social media
	GE	Calendar applications like Outlook
	GE	Image manipulation (Adobe Photoshop and Lightroom)
	GE	Zoom, GoToMeetings, video conferencing
	GE	Lab equipment: graduated cylinders, pH, etc.

Data analysis indicated that for Survey Items 11–15, 78% of CTE faculty prioritized basic computer usage skills, and 67% prioritized internet and email skills. As shown in Tables 4.5 and 4.6, 22% (*n* = 6) of CTE faculty and 24% (*n* = 4) of GE faculty agreed that computer programming skills were prioritized lower as skills needed for the workforce.

Table 4.5.

CTE Faculty Responses to Survey Items 11–15

Workforce education programs, like those found in community and technical colleges, should train all students in the following computer skills:	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	*n*	%	*n*	%	*n*	%
Basic computer usage skills	21	77.8	5	18.5	1	3.7	0	0
Business/office software skills	15	55.6	11	40.7	1	3.7	0	0
Internet skills	18	66.7	7	25.9	2	7.4	0	0
Email skills	18	66.7	8	29.6	1	3.7	0	0
Computer programming skills	6	22.2	4	14.8	16	59.3	1	3.7

Note. CTE = career and technical education. *N* = 27.

Table 4.6.

GE Faculty Responses to Survey Items 11–15

Workforce education programs, like those found in community and technical colleges, should train all students in the following computer skills:	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	*n*	%	*n*	%	*n*	%
Basic computer usage skills	17	100.0	0	0	0	0	0	0
Business/office software skills	16	94.1	1	5.9	0	0	0	0
Internet skills	16	94.1	1	5.9	0	0	0	0
Email skills	16	94.1	1	5.9	0	0	0	0
Computer programming skills	4	23.5	5	29.4	8	47.1	0	0

Note. GE = general education. *N* = 17.

To determine the responsibility of integration of technology literacy into the curriculum, the survey instrument asked several questions developed to assess this role and responsibility as perceived by CTE faculty and GE faculty. As shown in Tables 4.7 and 4.8, over 70% (n = 19) of CTE faculty and 76% (n = 13) of GE faculty strongly agreed that technology literacy competencies should be included in the college's curricula much like the college does with reading, writing and mathematical literacy skills. One CTE faculty member disagreed that the college should do this. Both respondent groups were hesitant to agree that the college should matriculate students who are technologically literate, with 18% (n = 3) of GE faculty disagreeing that it is the college's responsibility.

Table 4.7.

CTE Faculty Responses to Survey Items 16–21 on Responsibility of Integration of Technological Literacy Into the Curriculum

Survey Item	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	*n*	%	*n*	%	*n*	%
The college should integrate technology literacy competencies into the college's curricula much like the college does with reading, writing, and math.	19	70.4	7	25.9	1	3.7	0	0
It is the responsibility of all open enrollment institutions of higher education geared toward workforce readiness to matriculate students who are technologically literate.	17	63.0	9	33.3	0	0	1	3.7
It is the responsibility of specific departments or programs to determine which technology skills their students should possess, rather than the responsibility of the institution overall.	14	51.9	8	29.6	5	18.5	0	0
An open enrollment institution of higher education geared toward workforce readiness should require all programs to incorporate technology literacy competencies into their curricula.	10	37.0	16	59.3	1	3.7	0	0
It is the college's responsibility to graduate technologically literate students into the workforce.	15	55.6	11	40.7	1	3.7	0	0
GE/CTE departments should play a role in promoting technology literacy	13	48.1	13	48.1	1	3.7	0	0

Note. CTE = career and technical education. *N* = 27.

Table 4.8.

GE Faculty Responses to Survey Items 16–21 on Responsibility of Integration of Technological Literacy Into the Curriculum

Survey item	Strongly agree		Agree		Disagree		Strongly disagree	
	n	%	*n*	%	*n*	%	*n*	%
The college should integrate technology literacy competencies into the college's curricula much like the college does with reading, writing, and math.	13	76.5	4	29.4	0	0	0	0
It is the responsibility of all open enrollment institutions of higher education geared toward workforce readiness to matriculate students who are technologically literate.	9	52.9	5	29.4	3	17.6	0	0
It is the responsibility of specific departments or programs to determine which technology skills their students should possess, rather than the responsibility of the institution overall.	3	17.6	8	47.1	6	35.3	0	0
An open enrollment institution of higher education geared toward workforce readiness should require all programs to incorporate technology literacy competencies into their curricula.	3	17.6	11	64.7	3	17.6	0	0
It is the college's responsibility to graduate technologically literate students into the workforce.	8	47.1	9	52.9	0	0	0	0
GE/CTE departments should play a role in promoting technology literacy	10	59.8	7	41.2	0	0	0	0

Note. GE = general education. *N* = 17.

Qualitative Data Collection and Analyses

To expand the results of the quantitative data, qualitative data were also examined and analyzed according to the three qualitative survey questions posed. Data were coded using Microsoft Excel to determine common patterns, trends, or themes across findings. The remainder of this chapter discusses the outcomes of the qualitative responses to Survey Items 22–24. Analyses of qualitative survey data were categorized based on the research questions posed by the study, by group (CTE vs. GE faculty). Codes were tallied according to the number of times respondents mentioned each theme or concept. All quoted material within this analysis has been pulled directly from questionnaire respondents. Overall, the qualitative data revealed two overarching themes: Integrating technology literacy skills across the curriculum and making no change as the college is already providing such skills.

The first qualitative question posed to both faculty respondent groups was the following:

> If [the study community college] were to adopt, as part of its mission, the aim to graduate technologically literate students into the workforce—students who can comfortably use computers, basic software applications, and general online and email applications—how would you like to see the college accomplish this goal?

Tables 4.9 and 4.10 summarizes the responses of both respondent groups.

Table 4.9.

Codes in Responses by CTE Faculty Regarding How the College Can Graduate Technologically Literate Students

Code	*n*
Require basic course	9
Integrate into coursework	8
No change needed	3
Preassessment	3
Postcourse assessment	2
Technical support	1
General education classes	1
Provide workshops	1
Integrate into specific programs	1
Integrate across programs	1
Student technical support	1
Require a computer	1

Note. CTE = career and technical education. *N* = 27.

Table 4.10.

Codes in Responses by GE Faculty Regarding How the College Can Graduate Technologically Literate Students

Code	*n*
Integrate into coursework	6
No change needed	4
Promote faculty technology proficiency	2
No answer	2
Purchase hardware/software	1
Integrate across programs	1
Integrate into specific programs	1
Identify existing curriculum	1
Create committees	1
Postcourse assessment	1

Of the 44 faculty who completed the survey, 41 faculty wrote comments in the response box. Results indicated three emergent themes. The first theme is that the college is already successfully providing technology skills to students, and no change is needed to the curriculum. One math faculty stated, “We already integrate assignments that require development of these skills.” A photography faculty agreed, “I believe [the college] is working toward this goal even though it is not specifically referenced in the mission.” A life science faculty responded, “Every student I know comes in literate already.”

Some concern was expressed across all faculty that many students may not start their coursework with the same technical experience; therefore, the community college must assess students’ skills and competencies before beginning classes. Among CTE faculty, 28% (n = 9) responded that the college must require students who lack the skills to take a basic course. As one CTE faculty respondent stated,

> If a student lacks background in the technology, they would do very well to take a course or refresher in that area before getting involved with any specialty courses, since the

> available tools make the work progress easier. The school could market it as an approach to ensure everyone has the same footing before they become involved with higher classes where they're more likely to wash-out.

Another CTE faculty respondent explained that the college

> should be structured in a way that prioritizes the student's mental model of these technologies, not just familiarizing them with clicking on the correct buttons. My students are good at working their social media accounts and playing online games but are terrible at knowing, for example, which email address they used to create their Adobe account (they often accidentally create multiple Adobe accounts because of this), and they do not know how to download files to a folder or unzip compressed files or explain things clearly in writing when they email me for help, resulting in me not being able to help them because of their problematic writing. Students seem like they need hardware/software help, but in reality, they need another layer of general help that precedes their interaction with hardware/software.

As the most common theme that emerged from this question, 25% (n = 8) of CTE faculty and 30% (n = 6) of GE faculty agreed that incorporating technology literacy skills across the curriculum must be strongly considered. One CTE faculty respondent stated,

> I disagree with the premise that we should adopt such a policy. But if we do, we should work to incorporate these skills into all courses rather than adding specific technology courses to the current programs—just like we do with (e.g.) writing across the curriculum, critical thinking across the curriculum, sustainability, and entrepreneurship.

One math faculty shared an idea that collaboration and committee work helps students:

> There are probably many ways that this could be accomplished. One possibility might be for each department to meet and work on incorporating technology literacy into the programs associated with that department. After brainstorming, each department could work with other departments at the college and share their plans. Another possibility would be to create brainstorming groups with a mix of people from different departments and then they go back and share with their departments.

The second qualitative question posed to both groups of faculty respondents was the following: "What role (if any) do you think should the GE/CTE departments take in promoting technology literacy among [community college] learners?" Tables 4.11 and 4.12 summarize the responses of both respondent groups.

Table 4.11.

Codes in Responses by CTE Faculty Regarding the Role of Departments in Promoting Technology Literacy

Code	*n*
Integrate throughout curriculum	8
No answer	4
Provide student support	2
Use guest speakers	2
Teach specific skills	2
Market technology use	2
Create committees	2
Promote student assessment	2
Important/critical role	1
Incorporate technology into pedagogy	1
Model and instruct use	1
Provide financial support	1
Require separate course	1
Unsure	1

Note. CTE = career and technical education. *N* = 27.

Table 4.12.

Codes in Responses by GE Faculty Regarding the Role of Departments in Promoting Technology Literacy

Code	*n*
Integrate throughout curriculum	4
Require separate course	3
Important/critical role	2
Incorporate technology into pedagogy	2
No change needed	1
No answer	1
Review outcomes alignment	1
Create committees	1
Balance with soft skills	1
Integrate throughout curriculum	1

Note. GE = general education. *N* = 17.

The third qualitative question posed to GE and CTE faculty respondents was the following: "Please share additional comments or information regarding technology literacy, workforce education, and [the community college], as you see fit." Of the 44 faculty who completed the survey, 18 faculty wrote comments in the response box. One faculty respondent teaching in the Advanced Technologies division responded, "Right now the programs are teaching these skills rather than GE classes. GE should teach this so that we can spend our time teaching the job skills they need in our area and not basic knowledge skills." An additional faculty respondent in the Advanced Technologies Division stated,

> I find this to be an issue mostly with the older students who are returning to the school for retraining or to pursue a different field. Generally, the younger students have less trouble (with some exceptions). However, speaking to the industrial automation field in specific, there is a massive push for more networking in recent years which will certainly require people that have an above-average understanding of computers and linked systems. Formally this was an advanced activity that only large-scale industries utilized, but it has become more common and accessible for smaller businesses. The network manufacturers

> (Siemens, Cicso, etc.) offer their own training but it costs a LOT of money and requires travel.

Additional comments included, “We all know now the importance to be able to function, at least at a basic level, technologically,” and “technology literacy is integral to all workforce requirements as it applies to logistics and maintenance of work programs and career success.”

CTE faculty showed a concern for students before starting their coursework. One stated, “Technology literacy should be taught and tested for BEFORE students enter some of the more technical fields. Not having these skills from the start impedes the students’ learning.” Another response was,

> The computer skill test is taken before any online course. I am not sure if it is still required ... as we are all online with the pandemic. I do not have time to teach these basic computer skills along with the content of the class. It is so helpful to know my students are technically ready to succeed in the class and at the workplace.

One comment from an English faculty was, “To move in this direction, [the community college] would have to be sure students had access to a variety of technology. There are many gaps in access and availability, resulting in increased equity gaps that exacerbate the economic gaps in our area.” Many faculty emphasized the importance of integrating technology literacy skills into the curriculum. One stated, “I’m a strong believer in Writing Across the Curriculum—writing in the tech classroom, story in the biology classroom, math in literary study, physics in composition. The more we cross the streams, the better off we’ll be.” Another faculty stated, “Based on what I know and have heard, [the community college] is a leader in technology literacy/workforce education.”

Integration of Data

Research Question 1

Research Question 1 asked, “What are GE faculty perceptions about components of technology literacy needed in the workplace?” To gather applicable data to Research Question 1 for GE faculty, responses to Survey Items 3–15 were analyzed. The aim of these questions was to determine which basic technology skills students should possess before seeking employment in their field. GE faculty overwhelmingly indicated employees need skills in using a personal computer, the internet, email, word processing and spreadsheets, and software specific to the career. Hardware specific to the career was a somewhat less important skill. Every GE faculty respondent strongly agreed that workforce education programs should train all students in basic computer use. All GE faculty reported programs should train all students in Office software, the internet, and email.

Incorporating additional feedback from qualitative responses indicated that some faculty felt they could use institutional support to incorporate technology literacy initiatives. GE faculty suggested promoting guest speakers and events to discuss the importance of technology literacy could help motivate students. An additional motivating factor for students could be faculty modeling of technology literacy skill and use in the classroom. By modeling, faculty actively can show students the importance of using the skills in the real world.

Research Question 2

Research Question 2 asked, “What are CTE faculty perceptions about components of technology literacy needed in the workplace?” To answer Research Question 2 for CTE faculty, their responses to Survey Items 3–15 were analyzed. CTE faculty, similar to GE faculty, indicated employees needed personal computer skills, internet, email, and software programs specific to the career. CTE faculty were slightly less adamant than GE faculty about employees understanding word processing and spreadsheet applications. Again, hardware specific to the career was important, but less so. Regarding the role of workforce education programs in training, nearly all the CTE faculty agreed that programs should train students in basic computer use, Office software, email, and internet. One or two CTE faculty disagreed with training all students in these areas.

Research Question 3

Research Question 3 asked, "What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?" To answer Research Question 3, responses to Survey Items 16–21 by faculty group were analyzed in addition to qualitative Survey Items 22–24. The aim of these questions was to determine if they felt community and technical colleges should train students in specific skill sets. Faculty also responded to prompts related to roles and responsibilities of the CTE/GE departments and the college in requiring students to have these skills. Faculty expressed that the college should integrate technology literacy competencies into the college's curricula. CTE and GE programs should play a role in promoting technology literacy, according to all respondents except one CTE faculty. Respondents were less adamant about it being the responsibility of specific departments or programs to determine which technology skills students should possess, indicating that it was the responsibility of the college. CTE faculty were more likely to suggest a basic course to teach technology literacy, whereas GE faculty and CTE faculty agreed with integrating technology literacy into coursework.

Summary

Chapter 4 presented the results of the study from data gathered using the survey instrument. The final study results provided descriptive statistical and qualitative analysis to address the research questions:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?

2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?

3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

Chapter 5 will present conclusions, implications, and recommendations for future research.

Chapter 5 - Discussion

This chapter consists of the following sections: summary of the study, conclusions, implications, and recommendations for future research. First, the summary of the study briefly reintroduces the problem and purpose of the study, research questions, and methodology used to collect the data. Second, the conclusions section includes highlights of the major findings, including limitations, as they relate to each of the research questions—quantitative followed by qualitative conclusions. Third, the implications section gives an interpretation of the significance of the findings and how they relate to the practice of professionals in higher education. The fourth section includes recommendations from the results of the study and suggestions for further research. Finally, a chapter summary concludes this chapter.

Summary of the Study

A report by the National Academy of Engineering and National Research Council (2002) proposed a model of technological literacy knowledge necessary for all citizens that could potentially be integrated into the academic curriculum. The report recommended that career and technical education (CTE) and general education (GE) faculty include technology literacy competencies into the academic curriculum. The report also indicated that educators would have a difficult time making the case that the study of technology must be included in the curriculum. The initial task for educators begins with building a unified understanding of which technology literacy skills are most needed and use this as a starting point for incorporating skills into the college curriculum.

The American Association of Community Colleges (AACC, 2012) put out a call-to-action for community college leaders to redefine the mission of the community college ensuring that students are learning current technology skills to advance personally and professionally.

Community colleges are open access and often serve low-income and disadvantaged populations looking for low-cost options in career preparation or acquiring an advanced degree. O'Banion (2016) strongly suggested that community colleges need to create a common core of GE integrated with CTE for a new essential education to help students make a good living and live a good life.

This study addresses GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. The International Technology Education Association (ITEA, 2007) defined technology literacy as the ability to use, manage, understand, and assess computer-mediated technologies and communications. The ITEA explained that technology literacy includes demands for mental tools such as problem-solving, visual imaging, critical thinking, and reasoning. This study clarified which computer-mediated technologies faculty deemed most important for students in preparation for the workforce.

The results of this study are summarized to help community college students, community college faculty, and community college curriculum committees. This research replicated the methods followed in a study conducted by Kalfsbeek (2007) and builds evidence to validate the original study's findings. This replicated study highlights key differences between GE faculty and CTE faculty in the community college.

Research Questions

Three research questions guided the study:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?

2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?

3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

This study used a mixed-method design that collected quantitative and qualitative data with one survey instrument. The data collection phase included a survey instrument and targeted two multilevel data respondent types (Creswell, 2018; Tashakkori & Teddlie, 1998): GE and CTE faculty. This research design allowed a comparison of different perspectives between the two faculty groups of a Michigan community college. Purposeful sampling was used to identify participants and included completion and analysis of a replicated survey instrument. The sample included faculty teaching in the following GE academic divisions: Humanities, Social & Behavioral Sciences, Math, and Sciences & Engineering Technology. The sample also included faculty teaching in the following CTE academic divisions: Business and Computer Technologies, Health Science, Advanced Technologies, and Public Service Careers. These divisions were defined as GE and CTE by the college.

Conclusions

The following section discusses the findings and conclusions of the study. It is organized around the study's research questions. The quantitative data were used to answer the first two research questions and may serve as a guiding document for planning digital literacy instruction, incorporating multimodal literacy activities in the general curriculum, and designing assessments.

Research Question 1

Research Question 1 asked, “What are GE faculty perceptions about components of technology literacy needed in the workplace?” To gather applicable data to answer Research Question 1 for GE faculty, responses to Survey Items 3–15 were analyzed. The aim of these questions was to determine which basic technology skills students should possess before seeking employment in their field. According to GE faculty, a technologically literate adult in the workforce who wishes to be currently in demand, as well as prepared for future workforce needs, should have these basic competencies: knowledge in using a personal computer, a general understanding in using business or office software programs, competence using the internet for research, and use of email for work.

All but one GE faculty member agreed that students should be trained in basic computer usage skills, business/office software skills, internet skills, and email skills. There was not consensus on the importance of computer programming skills. These findings suggest that most GE faculty feel that students should only be required to learn basic computer usage skills. Computer programming skills are beyond the necessary requirements.

Research Question 2

Research Question 2 asked, “What are CTE faculty perceptions about components of technology literacy needed in the workplace?” CTE faculty responses to Survey Items 3–15 were examined to answer Research Question 2. The aim of these questions was to determine which basic technology skills students should have before seeking employment in their field.

According to CTE faculty, a technologically literate adult in the workforce who wishes to be currently in demand, as well as prepared for future workforce needs, as a priority should have these basic competencies: navigating the internet and using email. CTE faculty also feel that as a second priority students should also have knowledge in using a personal computer and demonstrate proficiency in software program skills specific to the career of their choice. The CTE faculty included more hardware and software skill recommendations specific to the career, noting that some students should be familiar with using digital recording devices connected through cloud software, tablet devices, and medical patient-management software for allied health career students.

Research Question 3

Research Question 3 asked, “What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?” To determine the responsibility of integration of technology literacy into the curriculum, the survey instrument asked several questions developed to assess this role and responsibility as perceived by CTE faculty and GE faculty. Faculty expressed that the college should integrate technology literacy competencies into the college’s curricula. CTE and GE programs should play a role in promoting technology literacy, according to all respondents except one CTE faculty. Respondents were less adamant about it being the responsibility of specific departments or programs to determine which technology skills students must possess, indicating that it was the responsibility of the college. Whereas GE faculty and CTE faculty agreed with integrating technology literacy into coursework, CTE faculty were more likely to suggest a basic course to teach technology literacy.

Overall, the qualitative data revealed two overarching themes: (a) integrating technology literacy skills across the curriculum and (b) making no change as the college is already providing such skills. Faculty responses indicate that many faculty have confidence in the students’ technology literacy skills and the current curriculum. Other ways to support students’ skills include balancing technology competencies with mental model skills such as problem solving and information searching. Faculty were hesitant to require students to take any additional courses but rather encouraged the incorporation across all disciplines.

Several strategies for strengthening the role that the college plays include providing faculty professional development, encouraging subcommittee work, incentivizing faculty collaborative efforts, and boosting college marketing initiatives. If most faculty feel that dramatic change is not necessary, then making incremental changes over time could encourage positive change in the college culture.

Recommendations by CTE faculty include providing additional technical support for students struggling with technology issues. Students in the career programs using career-specific hardware and software programs have additional challenges of learning specific skills. Some financial and time investment may be needed to make sure students are getting the added support they need in learning these skills. Before starting their course work, students may be administered a technology literacy assessment to identify any gaps in knowledge. It is important to acknowledge that many students begin at a disadvantage due to inequalities of access. Faculty cited a concern that many students would need additional instruction time to catch up because these students did not have an opportunity to pick up the skills needed earlier in their academic career. Giving students the means and opportunity would provide the advantage they need to supplement and their lack of access and knowledge.

Limitations

This study has limitations. Findings from this study should be interpreted while keeping the limitations of the study in mind. Limitations of the study included the time when the survey was deployed, the number of participants, and lack of generalizability of results.

The survey used to collect data from participants was distributed during the last 2 weeks of the summer semester. This could have hampered participation due to the schedule of participants during that time of year. The director of institutional research and analytics at the study school advised that the demands for fall term preparation in addition to the changes wrought by the pandemic made the timing not particularly opportune to send the survey to faculty.

The population of this study was 157 full time faculty at a community college in Michigan, of whom 48 volunteered to participate in the survey. Four participants withdrew before completing the survey. Among the 44 respondents from the survey, members from all divisions were represented, with 61% (n = 27) representing CTE faculty and 39% (n = 17) representing GE faculty. The director of institutional research and analytics at the study college provided the list of faculty who would be qualified to participate in the research survey. The researcher was not provided phone number information and permission was denied to follow up with faculty using phone calls. The researcher was restricted to two email reminders to faculty.

An additional scenario limiting results of the study was that only full-time faculty were surveyed. The findings of this study offer good insights into perceptions of full-time community college faculty, but these findings may not apply to other groups of faculty, larger institutions, private institutions, or 4-year institutions.

Implications

The majority of research related to technology literacy has focused on primary education, secondary education, and the 4-year institution curriculum. Little research has focused on the community college curriculum.

There are several implications from this study for practitioners in community colleges. The differences in perceptions of GE faculty and CTE faculty in different disciplines have highlighted the need for more formal guidelines for inclusion of technology literacy competencies across the curriculum. The development of training programs for faculty across disciplines is an important first step. Each college should offer incentives for professional development training, workshops, and events during the academic year to encourage growth in this area. As the original researcher, Kalfsbeek (2007) suggested, “workforce readiness institutions must infuse technology literacy values and standards in all of their divisions, including the academics, libraries, and student services” (p. 34). Collaborative efforts must be encouraged and reinforced, and incentives must be provided to promote a culture of technology literacy.

Technology skills can be learned starting in the classroom, but they can be shaped at work and in commerce through academic and business collaborations. Community partners, local businesses, and industry leaders must continue to communicate and contribute to ensuring that the community college curriculum is staying at the forefront for technology updates. Advisory boards and community outreach are important aspects to ensure that the curriculum is meeting the demands of workforce needs.

It is becoming more apparent daily that community colleges must continue to adapt to better serve the needs of low-income and underserved populations. By developing policies and recommendations that change with technological advances and close the skills gap among students, community colleges provide students with greater job security and meet the needs of the community for workforce demands. Low-income students arrive at the college disadvantaged due to limitations of physical, material, and conditional access of digital technologies (van Dijk, 2020). Perhaps community partnerships sponsoring digital initiatives could promote collaborative efforts to support students who cannot financially afford the access they need.

Integrating technology literacy skills into the curriculum is necessary to provide the technology literacy skills for students doing academic research, actively learning about the economic world, engaging in a democratic society, and participating in digital social justice (ACTE, 2013; American Association of Colleges and Universities, 2015). The basic competencies in technology literacy could be assessed during college admission and include student placement into appropriate coursework. Students then could be required to complete a summer bridge program, 1st-year seminar, basic technology literacy course, or other appropriate coursework before graduation. Community colleges could offer technology literacy programs to high schools and other community organizations looking to support technology literacy initiatives.

The groundwork for the quantitative and qualitative findings of this research is underpinned by Bloom's (1984) taxonomy and should be used to create course learning outcomes that can be easily integrated across the curriculum. The college would start by creating a planned review of all course learning outcomes, submit recommendations to the faculty senate or curriculum committee, and update all documents reflecting updates over time. These reviews for relevancy to technology updates should be conducted on a regular cycle as technology is updated frequently.

Table 5.1 outlines specific technology literacy outcomes and links these competencies to (a) the technology literacy competencies identified by GE faculty and CTE faculty respondents in this investigation, (b) Bloom's (1984) taxonomy, and (c) the five ITEA (2007) categories. Differences in this investigation from the original researcher's investigation (Kalfsbeek, 2007) are indicated. Faculty did not identify the ability to successfully send facsimile messages or ability to enable and use security software for a personal computer as important competencies for their students. Also, the technology no longer includes personal digital assistants but now includes handheld tablet devices (e. g., iPad) and cloud-based software.

GE faculty acknowledged the importance of using business and office software for managing daily tasks such as scheduling meetings and file management which must be considered as important skills to incorporate across the curriculum. CTE faculty respondents indicated that many students must have technology literacy competencies using hardware and software skills specific to the careers in which they are studying. The technologies included computerized diagnostic equipment, image manipulation software such as Adobe photoshop, and warehouse management systems, McKesson picture archiving and communication systems (PACs), patient-management systems like EPIC, and simulation software. The importance of these career specific technology skills must be emphasized in addressing curriculum development and discussed by college administrators on whether their students provided with all the technical skills they need to be workforce ready.

Table 5.1.

Summary and Synthesis of Bloom and ITEA Learning Goals

Bloom's taxonomy level[b]	ITEA category[a]	Measurable outcomes
1. Knowledge	1. The nature of technology	Show knowledge of general characteristics and scope of technology. "What is computer-mediated technology?" "What are the available computer-mediated devices and skills?" "What are the purposes of the computer-mediated devices and skills?"
2. Comprehension	2. Technology and society	Explain the connections between technology and society. "How does computer-mediated technology work?" "How can I use these devices and applications?" "Why are these important to me in my studies and in my career?"
3. Application 4. Analysis	3. Design and problem-solving	Demonstrate and examine the role technology can play in problem-solving. "How is the instructor using technology in the classroom?"
5. Synthesis	4. Abilities for a technological world	Use and manage technological products and systems. "How can I apply the design process using computer-mediated technology tools in projects and assignments?"
6. Evaluation	5. The designed world	Evaluate how technology is applicable to specific fields of study and careers. "How am I utilizing skills at my internship/apprenticeship learned in the classroom?"

Note. ITEA = International Technology Education Association. Adapted from *Technology Literacy as a 21*st *Century Basic Skill: A Study of Evolving Technology Literacy Competencies for a Workforce Education, Community College*, p. 31, by J. L. Kalfsbeek, 2007 (Publication No. 3274593), Doctoral dissertation, Capella University, ProQuest Dissertations and Theses. Copyright 2007 by Jennifer Kalfsbeek. Adapted with permission.
[a]*Standards for Technological Literacy: Content for the Study of Technology* (3rd ed.), by International Technology Education Association, 2007, https://www.iteea.org. [b]*Taxonomy of Educational Objectives,* by B. Bloom, 1984, Allyn and Bacon.

Whereas Kalfsbeek (2007) determined that the data suggested the higher levels of learning are not necessary to deem a person technologically literate, this researcher would assert that the additional outcomes can be used in modeling and higher level thinking in implementing outcomes. According to the National Academy of Engineering and National Research Council (2006), technological literacy incorporates three significant dimensions: knowledge, capabilities, and critical thinking and decision-making. The Bloom taxonomy Level 3, application, and Level 4, analysis, can be demonstrated in the classroom and curriculum by students modeling competencies in use and actively engaging in using technology literacy skills in the classroom and outside engagements. The Bloom taxonomy Level 5, synthesis, would demonstrate that students can use knowledge learned in project demonstrations and small-group use. Bloom's taxonomy Level 6, evaluation, could have students report back on ways that technology literacy helps them accomplish their career and professional goals in the workforce.

Kalfsbeek (2007) recommended course learning outcomes that can be integrated into a shared curriculum. According to Kalfsbeek and the results of this study, at the end of a course, a successful learner will be able to do the following:

1. Demonstrate the ability to turn on and log into a personal computer.

2. Demonstrate the ability to power up and log on to a handheld tablet device.

3. "Demonstrate the ability to connect a printer to a personal computer" (Kalfsbeek, 2007, p. 107).

4. "Demonstrate the ability to print documents sent from a personal computer to a printer" (Kalfsbeek, 2007, p. 107).

5. "Demonstrate the ability to successfully scan documents for use with a personal computer software or a printer" (Kalfsbeek, 2007, p. 107).

6. “List the basic business/office software programs used on the personal computer, including word processing, spreadsheet, database, and presentation software applications” (Kalsbeek, 2007, p. 107).

7. “Demonstrate the ability to open and use the basic business/office software programs used on the personal computer” (Kalsbeek, 2007, p. 107).

8. Demonstrate the ability to open and use cloud-based software programs used on the personal computer or handheld tablet.

9. Demonstrate the ability to access the internet.

10. Demonstrate the ability to navigate the internet.

11. “Demonstrate the ability to send, receive, and save e-mail messages” (Kalsbeek, 2007, p. 108).

12. Demonstrate the ability to log on to a password-protected web site.

13. Demonstrate the ability to complete and submit internet- or intranet-based forms (e.g., online course registration).

14. Demonstrate the ability to access and use asynchronous, online message boards.

Recommendations for Future Research

Based upon the observations made throughout this study, it is evident that there is a call for community college curriculum review, technology training in all academic disciplines, and technology literacy training for workforce-ready students to combat the widening gap in technology literacy skills between the haves and have nots. Methods such as those used in this study could be used to measure collaborative efforts between GE faculty and CTE faculty. In addition, collaborative efforts between faculty and librarians could be explored, as several faculty asserted the importance of incorporating information literacy skills. Further research into defined policies and procedures for implementing technology literacy competencies into the curriculum is necessary.

This study provides a model for future research in the field with a broader audience. Conducting research regarding perceptions of technology literacy with a state or national sample would allow for generalization of findings. This study was limited to one community college in a small region of Michigan, which limited the scope of study.

Should the researcher decide to continue an exploration of the role of the community college in implementing technology literacy initiatives as discussed in this study, the focus on the areas of integrating technology literacy competencies across the curriculum and faculty technology training and professional development are areas of further interest. Faculty in all disciplines, librarians, students, and administrators must consider the rapidly evolving culture and climate facilitated by the vastly changing virtual learning environment, which could be motivation for all to develop skills necessary to succeed in the ever-changing digital learning world.

The results of the current study suggest further research could be conducted to add to the existing body of research. The study could be expanded to include administrator perceptions. An assessment of beginning levels of student technology literacy skills could be compared to faculty perceptions. Finally, researchers could conduct a study to examine collaboration efforts between GE faculty, CTE faculty, and librarians.

Summary

This research replicated the methods followed in a study conducted by Kalfsbeek (2007) and builds evidence to validate the original study's findings. This study addresses GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. This chapter provided a summary as to the purpose of the study, which included the summary of research findings, recommendations to leaders, and suggestions for future research.

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Appendix A - Faculty Survey on Technology Literacy

Please complete the digital survey online or paper survey using a permanent INK PEN. Upon completion, return your completed paper survey, no later than [Date], in the self-addressed stamped envelope provided.

All responses are anonymous. Your name will not be used in the dissertation.

Please contact Oneka Samet if you have questions or concerns regarding the survey or research study. Phone: 248-917-7225 or e-mail: odsamet@ksu.edu

Section 1: Demographics

	Please complete the sentences below by selecting the response to the right that best represents your position. *At [Name] Community College, …*
1	I currently teach in the following DIVISION: ☐ Business and Computer Technologies ☐ Health Sciences ☐ Humanities, Social & Behavioral Sciences ☐ Math, Sciences & Engineering ☐ Advanced Technologies/Public Service ☐ Other [specify]:
2	I teach for the ____________________ PROGRAM, in the above DIVISION.

Section 2: Needed Skills

	Please complete the sentences below by selecting the response to the right that best represents your <u>knowledge of the current workplace</u> in your field.				
	Upon completion of their program requirements or necessary coursework at [the community college], students who plan to seek employment in my career field should possess basic skills in using ...	Strongly disagree	Disagree	Agree	Strongly agree
3	a personal computer.	1	2	3	4
4	computerized hardware or devices that are specific to my career field. List any specific hardware or devices:	1	2	3	4
		If there are no computerized devices common to your field leave blank.			
5	common office software programs, like word processing and spreadsheet applications.	1	2	3	4
6	common software programs that are specific to my career field. List specific software programs:	1	2	3	4
		If there are no software programs common to your field leave blank.			
7	the internet	1	2	3	4
8	email	1	2	3	4
9	a company/organization internal online system or intranet	1	2	3	4
10	Other: (indicate other computer mediated applications or devices, if applicable)	1	2	3	4
		If there are no software programs common to your field leave blank.			

Section 3: Integration of Technology Literacy Into the Curriculum

	Please complete the sentences below by selecting the response to the right that best represents your knowledge of the current workplace in your field.				
	Workforce education programs, like those found in community and technical colleges, should train all students in the following computer skills:	Strongly disagree	Disagree	Agree	Strongly agree
11	Basic computer usage skills	1	2	3	4
12	Business/Office software skills	1	2	3	4
13	Internet skills	1	2	3	4
14	Email skills	1	2	3	4
15	Computer programming skills	1	2	3	4
16	[The community college] should integrate technology literacy competencies into the college's curricula much like the college does with reading, writing and mathematical literacy skills.	1	2	3	4
17	It is the responsibility of all open enrollment institutions of higher education that are geared toward workforce readiness, like [the community college], to matriculate students who are technologically literate.	1	2	3	4
18	It is the responsibility of specific departments or programs to determine which technology skills their students should possess, rather than the responsibility of the institution overall.	1	2	3	4
19	An open enrollment institution of higher education that is geared toward workforce readiness, like [the community college], should require all programs to incorporate technology literacy competencies into their curricula.	1	2	3	4
20	It is the college's responsibility to graduate technologically literate students into the workforce.	1	2	3	4
21	GE/CTE departments should play a role in promoting technology literacy among [community college] learners.	1	2	3	4

	Based on your expertise as an educator in your field, please answer the following questions with a much detail as possible: *(you may use the back of these pages if you need additional room to write)*
22	If [the community college] were to adopt, as part of its mission, the aim to graduate technologically literate students into the workforce—students who can comfortably use computers, basic software applications, and general online and email applications—how would you like to see the college accomplish this goal?
23	What role (if any) do you think should the general education/CTE departments take in promoting technology literacy among [community college] learners?
24	Please share additional comments or information regarding technology literacy, workforce education and [the community college], as you see fit.

Survey adapted from *Technology Literacy as a 21st Century Basic Skill: A Study of Evolving Technology Literacy Competencies for a Workforce Education, Community College*, by J. L. Kalfsbeek, 2007 (Publication No. 3274593), Doctoral dissertation, Capella University, ProQuest Dissertations and Theses.

Appendix B - Using appendices, adding more, adding captions

Division	Programs
Humanities, Social & Behavioral Sciences (GE)	Behavioral Sciences Communications, Media & the Arts English & College Readiness Humanities, Languages & the Arts Social Sciences
Math, Sciences & Engineering Technology (GE)	Life Sciences Math & Engineering Studies Physical Sciences
Business and Computer Technologies (CTE)	*Business* *Computer Science and Information Technology* *Culinary and Hospitality Management* *Digital Media Arts*
Health Science (CTE)	Allied Health Health Science Nursing
Advanced Technologies and Public Service Careers (CTE)	Advanced Manufacturing Heating, Ventilation and A/C Public Service Careers Transportation Technologies Welding and Fabrication

Note. GE = general education. CTE = career and technical education.

Appendix C - Panel of Experts Letter

[date]

Dear Colleague:

As a doctoral student at Kansas State University's Community College Leadership Program, my dissertation entitled, "Faculty Perceptions of Technology Literacy in the Community College Curriculum," will focus on GE and CTE faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum. The survey will be distributed to full time faculty at a study community college in the Southeast Michigan region.

Due to your experience in community colleges and expertise in working with curriculum, I am requesting your feedback on my proposed survey instrument. Before the instrument is distributed, it needs to be reviewed by a panel of experts that can help me determine the instrument's validity as well as provide me with feedback on issues such as ease of readability, clarity, and length of instrument. I have attached a copy of the survey, and a comment sheet that also lists the research questions.

Thank you for taking the time to fill out the survey, provide feedback on the comment sheet, and for serving as a panel of experts member. Please return your comment sheet by e-mail within 10 days, by [date]. I know you are very busy, and I appreciate your assistance in this stage of my dissertation progress.

Sincerely,

Oneka Samet
Ed.D. Candidate
Kansas State University
John E. Roueche Community College Leadership Program

Appendix D - Comment Sheet for Panel of Experts

Faculty Survey on Technology Literacy

Thank you for completing the enclosed survey. In order for me to acquire additional information about the instrument, it is also important that you complete the questions below. The survey that you just completed is designed to address the following research questions:

1. What are GE faculty perceptions about components of technology literacy needed in the workplace?
2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?
3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

Please answer the following questions (re-save and e-mail back as an attachment):

1. How long did it take you to complete the survey?

2. Is the survey designed to sufficiently address the research questions above?

3. Please indicate any items that were not clear. You can list them below or write "not clear" next to the item on the survey.

4. Please indicate any items that you feel should not be included in the survey. You can list them below or write "don't include" next to the item in the survey.

5. Please include any additional comments that you have about the survey's design, clarity or validity.

6. Please provide any additional comments on the survey.

Thank you again for taking the time to assist me with my research.

Appendix E - Initial Letter Sent to Faculty

Dear Colleague,

My name is Oneka Samet, a doctoral candidate in the Community College Leadership Program at Kansas State University. I hope to graduate with my Ed.D. this fall. I am also an Academic Dean at Wayne County Community College. I am inviting you to participate in a study on faculty perceptions of technology literacy in the community college curriculum.

I am requesting that you complete a brief web-based survey that should take no more than 10-15 minutes. This information will support the call for improved understanding of the perspectives of GE faculty and CTE faculty on the technology literacy competencies students need in the classroom and workplace and ways to incorporate technology literacy into the college curriculum.

This research has been approved by the Kansas State University Institutional Review Board (IRB). Each participant in the study will be assigned a unique identification number to assure confidentiality. All responses from this survey will be aggregated in order to maintain the anonymity of all participants. Participation in this research is voluntary. You may withdraw at any time with no penalty.

A survey link follows that will take you to a website through your Internet browser (or a paper copy of the survey that can be sent to you). An Informed Consent Form will be included in the survey. The survey and related documents will be enclosed in a gold, 8x10 clasp envelope. I will also include an additional envelope so you can easily and confidentially return the survey and consent form to me at the address provided.

Again, I appreciate your time and consideration in completing the survey. It is only through the help of faculty like you that we can provide information which can advance research in the field. To thank you for your time, participants will receive a $10 gift certificate if an email address is provided.

Please contact me if you have any questions about this research at (313) 365-0449 or e-mail odsamet@ksu.edu

Thank you so much for your time and consideration.

Yours truly,
Oneka Samet
Ed.D. Candidate
Kansas State University
John E. Roueche Community College Leadership Program

Appendix F - Follow-Up Letter Sent to Faculty

Dear Colleague,

I know this is a very busy time for faculty, and I understand how valuable your spare time is during the semester. I am hoping you may be able to give about ten minutes of your time before Thursday, October 1st to help me collect important information regarding the technology literacy skills in the community college curriculum by completing a short survey.

If you have already completed the survey, I appreciate your participation. If you have not yet responded to the survey, I encourage you to take a few minutes and complete the survey. Participants who complete the survey and leave their email address receive a $10 gift certificate to Zingerman's.

Please click on the link below to go to the survey website (or copy and paste the survey link into your Internet browser) to access the survey.
Survey link:

Thank you in advance for completing the survey. Your responses are important, and I truly appreciate your willingness to participate.

Sincerely,
Oneka Samet
Ed.D. Candidate
Kansas State University
John E. Roueche Community College Leadership Program

Appendix G - Informed Consent Form

PURPOSE OF THE RESEARCH: The purpose of this mixed-methods study is to examine general education (GE) and career and technical education (CTE) faculty perceptions and attitudes toward integrating technology literacy competencies into the community college curriculum.

The research questions guiding the study are as follows:
1. What are GE faculty perceptions about components of technology literacy needed in the workplace?

2. What are CTE faculty perceptions about components of technology literacy needed in the workplace?

3. What are GE and CTE faculty perceptions and attitudes of how the college should integrate technology literacy competencies into the curriculum?

PROCEDURES OR METHODS TO BE USED: I am requesting that faculty complete a brief web-based survey that should take approximately 10-15 minutes. This information will help the researcher better assess what it means to be technologically literate in our community and how we can promote these skills at our colleges.

COMPENSATION: A $10 gift card will be provided at the conclusion of the survey if an email address is provided. All information that you provide through your participation will remain confidential.

RISKS OR DISCOMFORTS ANTICIPATED: There are no known risks associated with taking part in this study.

BENEFITS ANTICIPATED: The benefits to participation will include assisting the principal investigator to support the call for improved understanding of the perspectives of GE faculty and CTE faculty on the technology literacy competencies students need in the classroom and workplace and ways to incorporate technology literacy into the college curriculum.

EXTENT OF CONFIDENTIALITY: Findings will be summarized across participants in reports that will not identify individual participants. Survey participants will be assigned randomized ID numbers during the study. All collected data will be kept in a secure location, at the principal investigator's home. All data collected from surveys will be stored in a password-protected file on a computer, and the investigator will be the only one with access to the data. The researcher will retain the data for up to one year after completing the research, after which all digital files will be erased.

Terms of participation: I understand this project is research, and that my participation is voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

* By clicking below, you are agreeing to participate in this study. Make sure you understand what the study involves before you agree. If you have questions about the study after you agree to participate, you can contact the researcher, Oneka Samet at odsamet@ksu.edu. For administrative questions, please contact Rick Scheidt (785) 532-3224 or Cheryl Doerr (785) 532-3224 at Kansas State University IRB. You may print a copy of this form for your files.

I certify that I am 18 years of age or over and agree to participate in this research study.

Please enter an email address here if you are interested in being compensated for participating. (optional)