Technology Skills and the Need for Further Skill Development in Community College Students Enrolled in Career and Technical Education

Chadwick A. Springer, Leane B. Skinner, Elisha Wohleb, Geana Mitchell

Abstract

This study provides information that may be utilized to help improve students' acquisition of technology skills while enrolled at a community college. Students enrolled in one or more Career and Technical Education (CTE) courses at a community college in a Southeastern state were surveyed to determine their perceived competencies with technology and need for further development of skills concerning (a) software technology, (b) hardware technology, and (c) technology tools. In addition, the survey was used to determine students' perceived ability to complete basic computer tasks without assistance. Significant differences were found in students' perceived competencies to utilize software technology and technology tools. Results further indicated the perceived ability to complete basic computer tasks varied. Technology competencies varied among degree program groups; however, the majority of students do not believe they need further development of technology skills despite the varied perceived ability to complete basic computer tasks.

Keywords: career and technical education, technology skills, community college, basic computer tasks

The twenty-first century has been revolutionized by the rapid evolution of technology (Schreiner, n.d.). Technology is ever changing, it is the engine for success in modern business, and it has completely overtaken our conventional way of life (Kolaski, 2018). According to Dukes (2019), a flood of new technological advances make our personal lives and professional endeavors much more convenient. Evolving advances in technology have changed the way we interact with others and the traditional work environment, thus transforming the skills employees need to be productive and successful in the twenty-first century workplace (Schreiner).

The work environment of yesteryear has been overtaken by technology (Dukes, 2019). Pan and Seow (2016) agreed and reported that business activities have been changed by advances in technology. Individuals need strong skills in technology, particularly cloud computing and business analytics software. According to the U.S. Bureau of Labor Statistics (n.d.), "technology employees in the United States reached an estimated 12.1 million in 2019, an increase of nearly 2.3 million workers or 23 percent during the last decade" (p. 7). Further, the outlook for technology employment points to a continuation of this growth trend, indicating that 8.8 million new jobs in technology will be added by the year 2028 (Cyberstates 2020, n.d.).

Brown and Finnell (2020) reported that employers want to hire employees who are prepared and able to apply current technical skills in the workplace. Technology has changed the traditional work environment and changed the skills employees need to be productive and successful workers (Schreiner, n.d.). Thus, twenty-first century training needs have changed. Career preparation programs

of the past focused on memorization and knowledge; today the focus must be on skills application. Technology skills are now fundamental skills; they are essential competencies all students need (Brown & Finnell, 2020). If technology is used correctly, workers have instant access to knowledge that can be used to better perform employment tasks (Dukes, 2019). Furthermore, technology is important for many non-information technology jobs, including inventory control, hospitality, manual trades, and restaurant service, to name a few. Consequently, all employees entering the workforce need strong technology skills (Anderson & Gantz, 2013). The technology curriculum should be updated constantly to remain current with rapidly changing business and industry expectations. Educators are challenged to create effective instructional environments that foster technology (Brown & Finnell, 2020). While educators strive to ensure all students are fully prepared to be successful in the workplace, Bernini (2018) reported that only about one-half of graduating students are prepared for a successful career upon completion of career preparation programs.

Purpose of the Study

This study was designed to investigate (a) the technology skills concerning software, hardware, and technology tools; and (b) the perceived competency level to complete basic computer tasks of students enrolled in one or more CTE courses at a community college in a Southeastern state. The purpose of this study is to provide information that may be used to improve CTE programs at the community college level so that students will graduate with the skills needed to succeed in a chosen field.

Statement of the Problem

Ensuring students receive an education for employment upon graduation is a priority for government entities and educators. According to former United States Secretary of Education, Arne Duncan (2011), "CTE programs provide instruction that is hands-on and engaging, as well as rigorous and relevant. Many of them are helping to connect students with the high-demand science, technology, engineering and math fields – where so many good jobs are waiting" (p. 2). In addition, the Alabama Workforce Council (2018) included the goal of adding 500,000 employers with industry-recognized skills to the state workforce by the year 2025. To ensure these individuals possess industry-recognized skills, they will earn degrees, certificates, or credentials in their intended field. Moreover, the Alabama State Department of Education (ALSDE) CTE department stated that the foundation of the future of the state is built on CTE programs (Alabama Workforce Council, 2018).

Since federal and state government departments and organizations have a spotlight currently on CTE and the job outlook for CTE fields is strong, students must be prepared to enter the workforce with the skills and traits demanded by employers. While many CTE programs are rigorous in nature and provide students with the skills needed to gain employment, there is a challenge in ensuring curriculum standards are aligned with the rapidly changing employer demands concerning employees' skills. Thus, the expectation is that a student enrolled in a CTE program at a community college should graduate and enter the workforce with the skills to get a job. Thus, this study addressed the problems that exist due to the lack of information about technology skills of students enrolled in a CTE program at a community college in a Southeastern state.

Research Questions

The following questions were designed to address the problem:

1. To what extent do students enrolled in one or more career and technical education courses at a community college in a Southeastern state differ in their perceived competency to use (a) software technology, (b) hardware technology, and (c) technology tools based on degree program?

2. To what extent do students enrolled in one or more career and technical education courses at a community college in a Southeastern state perceive that they need further development of skills in (a) software technology, (b) hardware technology, and (c) technology tools based on degree program?

3. Do students enrolled in one or more CTE courses at a community college perceive that they can complete basic computer tasks with out assistance?

Review of Literature

The History and Evolution of Technology

Technology has been part of the workforce for more than 100 years, but the rapid technological changes of today are exponential compared to those of the

past. According to O'Neill (2013), there are three distinct periods of technology transition. The first period, the period of standardized platforms, was from 1900 to 1979. The development of technologies was slow, with color photography being introduced in 1907, the electric typewriter in 1919, the computing machine concept in 1937, the digital computer in 1943, the silicon chip in 1958, the computer mouse in 1963, the tablet personal computer and laptop concept in 1968, electronic mail and floppy disk in 1971, and the personal computer and mobile phone in 1973 (O'Neill, 2013). During this time, 54% of the United States' economic output consisted of the production and delivery of material goods. This type of production did not require large amounts of technology as most employees held factory jobs (Apte, Karmarker & Nath, 2008). More importantly, however, the use of technologies such as typewriters lowered the cost of processing and distributing information while simultaneously increasing the demand for educated and skilled workers (Frey & Osborne, 2013).

The second period of technology transition was from 1980 to 1999 and was characterized by individualized technologies. These individualized technologies allowed users for the first time to have unique experiences with technology, unlike previous inventions where the use of technology was homogenous. During the individualized period, development was much quicker with the introduction of the laptop in 1982, the camcorder in 1983, Microsoft Windows in 1985, World Wide Web (WWW) in 1990, Digital Video Disc (DVD) in 1995, and Google in 1998 (O'Neill, 2013). According to O'Neill (2013), the standardized platforms period and the individualized technology period were times of top-down implementation meaning "technology decisions were made at the enterprise level and all employees used the same limited number of devices, applications, and platforms" (p. 3). During this time, information products became the largest output of the United States, representing 63% of total output. This change shows the growth in reliance on technologies in businesses from production companies to stock traders (Apte et al., 2008). Furthering business reliance on technology were decreases in computation, with a 37% yearly decrease through 1980 and a 64% yearly decrease during the 1980s and 1990s, making these technologies available to all businesses, not just large companies with great wealth (Frey & Osborne, 2013).

The third period of technology transition, characterized by consumerized technologies, began in 2000 and continues to this day. These consumerized technologies are devices that have blended personal and business applications. The development of technologies during this period is the fastest in history. The consumerized period's technological inventions include the iPod in 2001, Facebook in 2004, Blu-Ray and Twitter in 2006, the iPhone in 2007, cloud computing in 2008, and the iPad in 2010 (O'Neill, 2013). In more recent years, there has been less emphasis on introduction of new products and more focus on the abilities of already developed products. For instance, Instagram has become a major social networking tool for businesses, yet it can be accessed through a smartphone or personal computer. According to Rupton (2016), the focus of business technology is currently centered on security, payment, wearables, and the cloud. Businesses want information to be secure from a business perspective, but also want data of customers to be secure. Furthermore, wearable devices such as the Apple Watch allow for continuous connectivity and real-time updates. These wearable devices and smartphones allow for a new form of payment, payment via device. No longer do individuals need a card or cash to pay for an item, as the wearable device contains account information which allows for instant payment. Lastly, the cloud continues to be an integral technology concerning the business sector. According to Rupton (2016), approximately 93% of businesses utilize the cloud for software applications. Moreover, the cloud allows for greater connectivity as individuals are not limited by file size when utilizing the cloud. In this period, implementation of technologies is top down and grass roots meaning, that "businesses observe that people want to use their own devices and can do so effectively." Businesses are deciding "that it is more expedient and productive to support them" (p. 3).

According to Newman (2012), as we look to the future, technology will continue to transform the workplace and the individuals who work within the workplace. The greatest change to the workplace is a distributed workforce, meaning employees do not have to live locally to work for a company. Technologies make it possible to complete projects remotely. Due to this change, employees must have the ability to use conferencing and telecommuting software. Employees must have the ability to utilize social media. According to Goldenberg (2015), social customer relationship management (CRM) is the use of social media to engage and manage relationships with customers such as pushing coupons via Facebook or answering questions concerning a product via Twitter. Newman (2012) stated, "To capture, track, store, and utilize the raw data, Social CRM will further revolutionize how we interact with the web to

better the workplace. All of the major players … are integrating social into their platforms" (p. 2).

A concern of future technologies for employees is the ability of technologies to perform cognitive tasks. In the past technologies have performed manual tasks; however, with the advent of technologies such as Siri, cognitive tasks may soon become computerized (Frey & Osborne, 2013). As we move forward, technologies are only going to become more prevalent and perform more tasks, and the ability to properly utilize these technologies is going to be of greater and greater importance if an individual is to be gainfully employed.

The Importance of Technology and Technology Instruction

According to Dukes (2019), workplace technology has evolved significantly over the past few decades. The emergence of new technologies and the daily use of the Internet has transformed all aspects of everyday life (Kolaski, 2018). Williams (2009) stated that technology literacy is imperative for success in the twenty-first century workplace. Technology is now a vital part our work and everyday life (Capella University, 2017). Technology literacy can be defined as "the ability to use technology to access and communicate information effectively, to use a computer and its software to accomplish physical tasks, and to identify the appropriate technology to use in specific situations" (Williams, 2009, p. 4). In order for students to be competitive in the global job market, business educators must prepare them with the technology skills that business and industry expect (Brown & Finnell, 2020).

Constantly changing advances in technology have reshaped the twenty-first century workplace, the needs of the labor force, and the educational institutions that provide CTE training across the nation (Washbon, 2012). Researchers throughout the years have abundantly reported the importance of technology (Bernini, 2018; Careless, 2012; Cornelius, 2012; Foster, Kelley, Pritz, & Hodes, 2011; Harter, 2011; Lewis, 2019; Mitchell, Wohleb, & Skinner et al., 2016; Pritchett, 2012; Skinner, 2016; Washbon, 2012; Wohleb, 2016; Williams, 2009). Moreover, technology is a key ingredient for student success in the 21st century workplace. Technology is "woven into the fabric" (Bailey & Mountjoy, 2009, p. 3) of virtually every profession, including education. Skinner (2016) stated that integrating technology into instruction increases student engagement in the learning process.

Business programs exist at different levels and in different configurations across American education. Business education is constantly evolving to meet the needs of contemporary students and to prepare them to be ready for college, careers, and life. Students are able to take advantage of an array of opportunities to be future ready, including earning industry-based credentials, taking dual-credit courses in high school, and gaining experience in a variety of work-based learning activities. Constant advancements in technology have heavily influenced the way programs are taught and how students engage. Therefore, business educators must be adaptive experts who are able to prepare students through 21st century business education programs that are relevant, meaningful, and future-oriented. (Fletcher, 2020, p. 25)

Although students possess different technological skill levels, the curriculum that is taught and the teaching methods should accommodate students' learning information technology (Brown & Finnell, 2020). Pritchett (2012) concurred, asserting that using technology in instruction promotes realistic learning atmospheres; hence, learners make the connection from instruction to the workplace.

Technology and Generation Z

The current generation is very different from the teachers who educate them. Pew research defined Generation Z (Gen-Z) as anyone born between 1997 and 2012. Furthermore, Gen-Z has grown up in an "always-on" technological environment (Dimock, 2019). They have always had access to mobile devices, WiFi, high-bandwidth cellular, and on-demand entertainment (Wohleb, 2016). Dimock further reported that these students were born and raised in a digital world, demand instant gratification, view the Internet as a tool for convenience, and are constantly connected via some form of technology. These students have superior technical skills compared to individuals in earlier generations (Brown & Finnell, 2020). Mitchell et al. (2016) emphasized that today's students expect technology to be integrated into their education. Technology is common to most students; they embrace it, therefore justifying the development and implementation of a more advanced technology curriculum (Brown & Finnell, 2020). Numerous researchers over the last decade agree that effective educators should accommodate students by integrating technology into the curriculum (Cornelius, 2012; Foster et al., 2011; Gaytan, 2011; Harter, 2011; Henderson & Chapman, 2012; Lewis, 2019; Pritchett, 2012;

Skinner, 2016; Washbon, 2012; Wohleb, 2016). Lewis (2019), found that students are constantly immersed in technology every day from sunrise until bedtime. "Technology has influenced the dynamics of teaching and learning on many levels" (Pritchett, 2012, p. 47). The Internet age has completely reshaped society and transformed the educational environment (Kolaski, 2018). Teachers are required to stay up-to-date on the latest technology trends, while constantly devising new teaching methods to better prepare students to enter the 21st century workplace. Students' capabilities to use the most current technologies in real-world applications is vital to their future success (Lewis, 2019). Unfortunately, research suggested that young adults are often overly confident in their ability to utilize technology (Jones, Leonard, & Lang, 2018). Many students consider their skill with social applications as being technology savvy; however, there is a difference in possessing the ability to operate social media applications and being able to effectively and productively utilize software or applications to complete tasks for a career (Jones et al., 2018).

The Future of Technology Instruction

Brown and Finnell (2020) reported that rapid change in technology requires educators and decision makers to review the curriculum and revise offerings on a regular basis; furthermore, the technology curriculum must coincide with the needs of industry. According to Capella University (2017), teaching students to use technology prepares them for the real world. If students understand how to use technology to research, collaborate, and problem solve, they are better prepared for their careers. In order to ensure that business education students are prepared for the workplace, industry partnerships, certifications, and industry standards are all very important to consider in making curriculum revisions (Brown & Finnell, 2020). The challenge for educators to create meaningful technology instruction is continuous (Pritchett, 2012). Gaytan (2011) emphasized that there is a difference between simply using technology in the classroom and effectively integrating technology into practice. The effective use of technology helps develop the opportunity for learning to take place and for students to be successful in education, employment, and life (Mitchell et al., 2016). Students need to understand not only how to use technology but also how technology can help them be successful (Capella University, 2017). Harter (2011) concluded that in order to prepare students to be career ready, integration of technology across the curriculum is critical.

Theoretical Framework

This study focused on the work values and technology skills of community college students enrolled in one or more CTE courses. The theoretical framework is formed from the achievement goal theory in which motivation and behaviors can vary in different people and different circumstances (Maehr, 1984). Thus, the motivation for each student at the community college may be different than that of his or her peers. For instance, the goal of obtaining a degree or certificate would be the same for two degree-seeking students, but their motivation for that may be different. One student may be completing a degree to begin a career while another student may be completing a degree to display the importance of education to his or her children. Many theories have been developed in an attempt to understand why individuals perform in a certain manner, specifically in an academic setting. In response to the development of social cognitive theories and goal content theories that attempt to understand why some individuals perform better academically, researchers began to develop theories focused on achievement goals. According to Pintrich and Schunk (1996), achievement goals are the reasons people attempt to master a task. Achievement goals typically focus on academic tasks, but can be applied to any context, including business tasks or athletic tasks. The aforementioned social cognitive theories and goal content theories can apply to any context or goal; however, achievement goals may be applied only to achievement motivation and behaviors (Pintrich & Schunk, 1996). Since the achievement goal theory focuses on achievement motivation and behaviors, the theory can vary in different situations and individuals (Maehr, 1984). Thus, for the purpose of this study, the achievement goal theory focused on values and technology skills of students because values and skills act as the motivators for obtaining a degree or certificate.

If individuals strongly want to achieve a goal or avoid failing at a goal, then they will be more motivated to succeed. According to Pintrich (1999), "goal orientation is often used to represent the idea that achievement goals ... represent a general orientation to the task that includes a number of related beliefs about purposes, competence, success, ability, effort, errors, and standards" (p. 94). Thus, individual and personal characteristics, such as values and skills, can influence achievement goals (Pintrich, 1999). Very rarely do two individuals have identical goals or aspirations; hence, achievement goal theory can apply to any goal an individual may want to achieve in the short- or long-term. The goal orientation emphasizes two types of goals: mastery goals and performance goals. Mastery goals "focus on acquiring and developing

competence," while performance goals "focus instead on demonstrating one's competence and outperforming others" (Senko, Hulleman, & Harackiewicz, 2011, p. 27). Mastery goals and performance goals focus on the acquisition of skills in an intrinsic manner. Mastery-avoidance and performance-avoidance goals focus on the acquisition of skills in an extrinsic manner. Mastery-avoidance orientation is the "lack of mastery or failure to learn as much as possible" and performance-avoidance orientation "describes students who wish to avoid looking incompetent, lacking in ability, or less able than their peers" (Wolters, 2004, p. 236). Achievement goals may be adopted based on what people want to become or do not want to become in the future (Maehr & Zusho, 2009, p.81). If individuals strongly want to achieve a goal or avoid failing at a goal, then they will be more motivated to succeed.

Research Design and Methodology

Auburn University Institutional Review Board (IRB) granted permission to conduct this study. Prior to the survey being sent to participants, protocol, a request for exempt status, an information letter, and a copy of the survey instrument was sent to the IRB for approval. The community college granted permission for students to participate in the study, and participants gave permission in the form of a completed survey.

Population

The participants for this study were the students enrolled in one or more CTE courses at a community college in a Southeastern state. The community college student directory provided the roster of names and email addresses.

Instrumentation

Participants received an informational email explaining the purpose of the survey, the need for the study, and the importance of participation. Because data was collected anonymously, a follow-up email was sent to participants asking for participation if they had not already completed the survey. A total of 886 emails was sent asking for participation. At the conclusion of data collection, 225 surveys were returned, a 25.4% participation rate.

The survey instrument contained two sections relevant to this study: demographics and technology skills. The demographic data section included age group, ethnicity, gender, current degree program, and number of semesters enrolled in current degree program. The second section, technology skills, contained four questions. Questions one to three asked students to report their perception of their competence with software technology, hardware technology, and technology tools. Question four asked students to assess their ability to complete basic computer tools without assistance.

The first question (2a) sought to determine students' competence to utilize software, the second question (2b) sought to determine students' competence to utilize hardware, and the third question (2c) sought to determine students' competence to utilize technology tools. In each of these questions, students were asked to identify their perceived competence level concerning a software, hardware, or technology tool. A four-point Likert scale was used for each of these three questions using the following scale: (1) No Competence; (2) Basic Competence; (3) Moderate Competence; (4) Expert Competence.

The fourth question in this section (2d) sought to determine students' perceived need for further development of software, hardware, and technology tools skills across degree program groups. A four-point Likert scale was used on each of the questions with the following scale: (1) Definitely Not; (2) Probably Not; (3) Probably Will; (4) Definitely Will. A total score for each participant for the three categories, software, hardware, and technology tools, was calculated. A participant's total score for software could range from 10 to 40 with the highest possible mean value of 20. A participant's total score for hardware could range from 15 to 60 the highest mean value being 30. A technology tools total score for a participant could range from 12 to 48 with the highest possible mean value being 24.

The software tools included in the survey instrument for questions 2a and 2d were Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Microsoft Access, Microsoft Outlook, Video Editing Software, Photography Editing Software, Web Page Design Software, Antivirus Software, and Accounting Software (ex. QuickBooks). Hardware tools for survey questions 2b and 2d included Tablet, Digital Camera, Digital Video Cameras, Webcam, Laptop, Scanner, Headphone, Microphone, USB/Flash Drive, Router, Smartphone, Smartboard, GoPro Camera, 3D Printer, and Smart Watch. Technology tools included in survey questions 2c and 2d were Internet, Web Conferencing (ex. Skype), Video Sharing (ex. YouTube), Facebook, Twitter, Instagram, Vine, Social Media Management (ex. Hootsuite), Customer Relationship Management (ex. Salesforce), Email Marketing (ex. MailChimp), and Organization (ex. Google Drive).

The fifth question (2e) sought to determine students' ability to complete computer tasks. In this question, students were asked to identify (1) Yes, they could independently complete the task or (2) No, they could not independently complete the task. The tasks identified for the fifth question were based on credentialing certification objectives and included the following tasks: Utilize Spell Check to edit documents; Create a table in Microsoft Word; Create Headers and Footers in Microsoft Word; Complete a Mail Merge in Microsoft Word; Save a Microsoft Word document as a different file type; Create formulas in Microsoft Excel; Edit formulas in Microsoft Excel; Create Macros in Microsoft Excel; Create a PowerPoint presentation; Add transitions to a PowerPoint presentation; Add videos to a Power Point presentation; Add a link in a PowerPoint presentation; Create an email in Microsoft Outlook; Add an attachment to an email in Microsoft Outlook; Create a signature for an email in Microsoft Outlook; Create a folder in Microsoft Outlook; Add contacts in Microsoft Outlook; Open a link in a new window in a web browser; Clear browser cache in a web browser; Edit URLs to navigate in a web browser; Create bookmarks/favorites in a web browser; Utilize Boolean operators in a search engine; Manually run a virus scan of a computer; Run a disk defragmentation; Empty the Recycle Bin; Complete a copy/paste using shortcuts; Complete a cut/page using shortcuts; Verify physical connectivity to a network; Determine your IP address; Create a folder on the desktop; Zip/Compress a folder/file; Unzip/Decompress a folder/file; Change a folder/file name.

Validity and Reliability

The research objectives and the review of literature set the foundation for the items of the survey. A panel of expert university faculty members was used to evaluate the content of the survey instrument to ensure the content validity and usability of the scores. The panel members were chosen based on their knowledge and experience concerning descriptive survey research design, survey instruments, and/or data collection. The panel of experts reviewed the survey instrument for clarity of directions, concepts, and definitions.

Internal consistency reliability was determined by Cronbach's alpha. According to Gay, Mills and Airasian (2009), Cronbach's alpha determines internal consistency reliability by determining the correlation of survey instrument items. Cronbach's alpha was used in this study to determine reliability coefficients for the following sections of the research instrument: perceived competency with hardware, software, and technology tools. Cronbach's alpha ranges from 0 to 1, with 1 indicating perfect reliability and 0 indicating no reliability, thus, reliability coefficients for each scale suggested that the items had high internal consistency. Table 1 presents Cronbach's alpha for three sets of tools included in the research instrument.

Table 1

Reliability of Scales

Item	N	Cronbach's alpha
Perceived Competence		
Hardware Technology	14	.947
Software Technology	10	.918
Technology Tools	12	.920

Data Analysis

Statistical treatment of the data included the use of the Statistical Package for Social Sciences (SPSS) 22.0. Descriptive statistics were used to analyze, organize, summarize, and describe the collected data. Research questions one and two were analyzed using higher-way analysis of variance (ANOVA) tests. Research question one used the ANOVA tests to determine the difference in perceived competency of students enrolled in one or more CTE courses at a community college in three groups of degree programs. Identified competencies were the ability to use hardware technology, software technology, and technology tools. Research question two used the ANOVA tests to determine the difference in perceived need for further development of hardware, technology, and technology tools skills. As in question one, respondents were grouped by degree programs. According to Green and Salkind (2011), ANOVA tests are appropriate because there is an independent variable, with multiple levels, and a dependent variable, and the ANOVA will test for significant differences between the means. Research question three was analyzed using descriptive statistics to determine percentages and frequency counts. According to Green and Salkind (2011), descriptive statistics summarize a given data set by creating numerical expressions and graphs.

Results and Discussion

The majority of respondents were female (71.3%). The most common reported age category was 20-29 years of age (42.9%). The largest percent of respondents were Caucasian (52.9%). Due to the

response rate, respondents in degree programs were grouped for data analysis. The three groups were (1) Workforce Development, (2) General Studies, and (3) Health-Related.

The degree programs within the **Workforce Development** group included Applied Technology (AT): Air Conditioning and Refrigeration, AT: Automotive Manufacturing, AT: Industrial Maintenance, AT: Sustainable Construction/ Renewable Energy, Business and Office Technology (BOT): Administrative Technology, BOT: Legal Administrative Technology, BOT: Medical Administrative Technology, Computer Information Systems (CIS): CISCO Networking, CIS: Information Technology, Criminal Justice, Fire Science, Homeland Security, Visual Communications (VC): Multimedia Graphic Design, and VC: Simulation and Modeling. The degree programs within the **General Studies** group included Business, Banking and Finance, Management and Supervision, Small Business Management, and Other. The degree programs within the **Health-Related** group included Nursing (ADN), Nursing (Mobility), and Medical Assisting. The highest reported degree program was other (29.5%) which were identified to be the General Studies degree programs group. Gender had 44 missing responses resulting in an n= 181; Age had 34 missing responses resulting in an n = 191; Ethnicity had 36 missing responses resulting in an n = 36; Current degree program had 35 missing responses resulting in an n = 190.

Competency with Software Technology, Hardware Technology, and Technology Tools

Research Question 1 asked: To what extent do students enrolled in one or more career and technical education courses at a community college in a Southeastern state differ in their perceived competency to use (a) software technology, (b) hardware technology, and (c) technology tools based on degree program?

Software Technology. Table 2 and Table 3 report results for respondents' perceived competence with Software Technology. Results showed statistically significant differences for students' competency to utilize software technology based on their degree programs group [F(2, 95) = 3.554, p = .032]. Follow-up tests were conducted to evaluate pairwise differences. There was a significant difference in competency to utilize software technology between students enrolled in General Studies degree programs and students enrolled in Health-Related degree program (p = .028). The mean score for students within the General Studies degree programs group was 20.85 compared to the mean score of 25.86 for students within the Health-Related degree programs group, with standard deviations of 5.71 and 8.13 respectively. Table 2 presents mean scores and standard deviations for software technology competence based on degree programs and Table 3 presents the perceived competence to use software technology.

Table 2

Mean Scores and Standard Deviations for Software Technology Competence based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	23.28	7.01
General Studies	20.85	5.71
Health-Related	25.86	8.13

Note. Significant difference in means and standard deviations of General Studies and Health-Related degree program groups. P = .028

Table 3

Perceived Competence to Use Software Technology

Item	M[a]	SD
Software		
Microsoft Word	3.23	.734
Microsoft PowerPoint	3.08	.850
Microsoft Excel	2.62	.902
Microsoft Access	2.34	.904
Microsoft Outlook	2.63	.942
Video Editing Software	1.85	.964
Photography Editing Software	1.91	.972
Web Page Design Software	1.70	.934
Antivirus Software	2.09	1.019
Accounting Software	1.73	.887

[a] 4 = Expert Competence, 3 = Moderate Competence, 2 = Basic Competence, 1 = No Competence

Hardware Technology.
Table 4 reports mean scores and standard deviations for hardware technology competence based on degree programs and Table 5 reports the mean scores and standard deviations for the perceived competence to use hardware technology. Results showed no statistically significant differences for students' competency to utilize hardware technology based on their degree programs group [F(2, 96) = 2.384, p = .098].

Table 4

Mean Scores and Standard Deviations for Hardware Competence based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	41.84	11.24
General Studies	40.33	9.53
Health-Related	42.37	9.85

Note. No statistical difference among the three groups.

Table 5

Perceived Competence to Use Hardware Technology

Item	M	SD
Hardware		
Tablet	3.20	.849
Digital Camera	3.19	.825
Digital Video Camera	3.09	.892
Webcam	2.89	1.037
Laptop	3.40	.734
Scanner	2.99	.948
Headphone	3.49	.751
Microphone	3.23	.881
USB/Flash Drive	3.43	.789
Router	2.76	1.041
Smartphone	3.46	.759
Smartboard	2.48	1.119
GoPro Camera	2.07	1.121
3D Printer	1.82	1.091
Smart Watch	1.91	1.117

[a] 4 = Expert Competence, 3 = Moderate Competence, 2 = Basic Competence, 1 = No Competence

Technology Tools.
The mean scores and standard deviations for differences in students' competency to utilize technology tools are shown in Table 6 and the mean scores and standard deviations for technology tools are shown in Table 7. Results showed statistically significant differences for students' competency to utilize technology tools based on their degree programs [F(2, 96) = 5.435, p = .006]. Follow-up tests were conducted to evaluate pairwise differences. There was a significant difference in competency to utilize technology tools between students enrolled in General Studies degree programs and students enrolled in Health-Related degree programs (p = .004). The mean score for students within the General Studies degree programs group was 26.52 compared to the mean score of 34.65 for students within the Health-Related degree programs group, with standard deviations of 1.58 and 1.90 respectively.

Table 6

Mean Scores and Standard Deviations for Technology Tools Competence based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	29.84	9.42
General Studies	26.52	8.40
Health-Related	34.65	9.41

Note. Significant difference in means and standard of General Studies and Health-Related degree program groups. P = .004

Table 7

Perceived Competence to Use Technology Tools

Item	M	SD
Technology Tool		
Internet	3.49	.721
Cloud	2.59	1.100
Web Conferencing	2.72	1.134
Video Sharing	3.01	1.059
Facebook	3.29	.952
Twitter	2.69	1.268
Instagram	2.87	1.235
Vine	2.43	1.255
Social Media Management	1.93	1.139
Customer Relationship Management	1.98	1.052
Email Marketing	1.84	1.080
Organization	2.37	1.127

[a] 4 = Expert Competence, 3 = Moderate Competence, 2 = Basic Competence, 1 = No Competence

Need for Further Development of Skills.
Research Question 2 asked: To what extent do students enrolled in one or more career and technical education courses at a community college in a Southeastern state perceive that they need further development of skills in (a) software technology, (b) hardware technology, and (c) technology tools based on degree program?

Software Skills.
Table 8 presents mean scores and standard deviations for perceived need for further development of software skills based on degree programs and Table 9 presents the perceived need for further development of different software technology. Results showed no statistically significant differences in students' perception of their need for further development of skills concerning software technology based on their degree programs group [$F(2, 95) = 1.529$, $p = .222$].

Table 8

Mean Scores and Standard Deviations for Need for Further Development of Software Skills based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	13.95	3.44
General Studies	12.55	3.29
Health-Related	13.61	3.97

Note. No statistical difference among the three groups.

Table 9

Mean Scores and Standard Deviations for Need for Further Development of Software Skills

Item	M[a]	SD
Software		
Microsoft Word	1.67	.471
Microsoft PowerPoint	1.63	.486
Microsoft Excel	1.38	.487
Microsoft Access	1.28	.452
Microsoft Outlook	1.46	.500
Video Editing Software	1.24	.428
Photography Editing Software	1.28	.451
Web Page Design Software	1.20	.400
Antivirus Software	1.37	.483
Accounting Software	1.21	.405

Hardware Skills.
Table 10 reports mean scores and standard deviations for the need for further development of hardware skills based on degree programs and Table 11 reports the mean scores and standard deviations for the need for further development of hardware specific skills. Results showed no statistically significant differences for students' need for further development of skills concerning hardware technology based on their degree programs group [F(2, 94) = 2.663, p = .075].

Table 10

Mean Scores and Standard Deviations for Need for Further Development of Hardware Skills based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	24.12	4.36
General Studies	21.42	5.24
Health-Related	23.23	5.91

Note. No statistical difference among the three groups.

Table 11

Mean Scores and Standard Deviations for Need for Further Development of Hardware Skills

Item	M	SD
Hardware		
Tablet	1.68	.469
Digital Camera	1.74	.441
Digital Video Camera	1.66	.477
Webcam	1.60	.492
Laptop	1.73	.445
Scanner	1.57	.497
Headphone	1.80	.400
Microphone	1.72	.451
USB/Flash Drive	1.74	.437
Router	1.45	.499
Smartphone	1.68	.469
Smartboard	1.38	.486
GoPro Camera	1.28	.451
3D Printer	1.23	.422
Smart Watch	1.32	.469

Technology Tools Skills.
The mean scores and standard deviations for differences in students' perceived need for further development of technology tools based on degree programs are shown in Table 12 and the mean scores and standard deviations for the perceived need for further development of specific technology tools skills are shown in Table 13. Results showed no statistically significant differences for students' need for further development of skills concerning technology tools based on their degree programs group [F(2, 94) = 1.194, p = .308].

Table 12

Mean Scores and Standard Deviations for Need for Further Development of Technology Tool Skills based on Degree Programs

Item	M	SD
Degree Programs Group		
Workforce Development	3.21	.81
General Studies	2.94	.75
Health-Related	3.18	.85

Note. No statistical difference among the three groups.

Table 13

Mean Scores and Standard Deviations for Need for Further Development of Technology Tool Skills

Item	M	SD
Technology Tool		
Internet	1.75	.433
Cloud	1.45	.499
Web Conferencing	1.54	.500
Video Sharing	1.63	.484
Facebook	1.77	.421
Twitter	1.66	.476
Instagram	1.67	.472
Vine	1.52	.501
Social Media Management	1.27	.445
Customer Relationship Management	1.28	.452
Email Marketing	1.27	.448
Organization	1.40	.492

Perception of Ability to Use Tools without Assistance

Research Question 3 asked: Do students enrolled in one or more CTE courses at a community college perceive that they can complete basic computer tasks without assistance? Respondents were asked to answer Yes or No to items on a list of skills about their perceptions that they could complete tasks using those skills without assistance. The skills involved work with the software technology, hardware technology, and technology tools included in this study. Thirty-three skills were listed.

Table 14 reports the frequency and percentages of responses for the skills. Results indicated the nine basic computer skills that respondents identified as ones they were best able to complete without assistance were: Save a Microsoft Word document as a different file type (94.0%), Utilize spell check to edit documents (91.9%), Create headers and footers in Microsoft Word (91.9%), Create a folder on the desktop (89.2%), Copy/paste using shortcuts (88.4%), Create a table in Microsoft Word (87.3%), Empty the Recycle Bin (87.1%), and Open a link in a

Table 14

Ability to Complete Basic Computer Tasks Without Assistance

Task	Ability to Complete				Ma	SD
	Yes		No			
	f	%	f	%		
Utilize Spell Check to edit documents	137	91.9	12	8.1	1.08	.273
Create a table	131	87.3	19	12.7	1.13	.334
Create Headers and Footers	136	91.9	12	8.1	1.08	.274
Complete a Mail Merge	97	66.4	49	33.6	1.34	.474
Save a Word document as a different file type	140	94.0	9	6.0	1.06	.239
Create Formulas	102	68.0	48	32.0	1.32	.468
Edit Formulas	98	65.3	52	34.7	1.35	.478
Create Macros	68	45.9	80	54.1	1.54	.500
Create a presentation	124	84.4	23	15.6	1.16	.365
Add transitions to a presentation	114	77.6	33	22.4	1.22	.419
Add a video to a presentation	109	73.5	39	26.5	1.27	.443
Add a link to a presentation	116	78.4	32	21.6	1.22	.413
Create an email	123	83.1	25	16.9	1.17	.376
Add an attachment	117	80.1	29	19.9	1.20	.400
Create a signature	94	63.9	53	36.1	1.36	.482
Create a folder	105	70.9	43	29.1	1.29	.456
Add contacts	106	72.1	41	27.9	1.28	.450
Open a link in a new window in a web browser	127	87.0	19	13.0	1.13	.338
Clear browser cache	119	81.0	28	19.0	1.19	.394
Edit URLs to navigate	111	75.0	37	25.0	1.25	.434
Create bookmarks/favorites	122	82.4	26	17.6	1.18	.382
Utilize Boolean operators	54	36.7	96	63.3	1.63	.484
Manually run a virus scan	99	66.9	49	33.1	1.33	.472
Run a disk defragmentation	78	53.8	67	46.2	1.46	.500
Empty the Recycle Bin	128	87.7	19	12.9	1.13	.337
Complete a copy/paste using shortcuts	130	88.4	17	11.6	1.12	.321
Complete a cut/paste using shortcuts	128	86.5	20	13.5	1.14	.343
Verify physical connectivity to a network	112	76.7	34	23.3	1.23	.424
Determine IP address	96	64.9	52	35.1	1.35	.479
Create a folder on the desktop	132	89.2	16	10.8	1.11	.312
Zip/Compress a folder/file	101	68.2	47	31.8	1.32	.467
Unzip/Decompress a folder/file	98	66.7	49	33.3	1.33	.473
Change a folder/file name	131	89.7	15	10.3	1.10	.305

new window in a web browser (87.0%). These results indicate that students identified tasks related to word processing, organizing the computer desktop, and using a web browser as the primary ones with which they felt most confident and which they believed they could use without assistance. The mean scores and standard deviations for ability to complete basic computer tasks and frequency results are shown in Table 14.

The nine tasks for which respondents rated their ability to complete without assistance were Complete a mail merge (66.4%), Edit Formulas (65.0%), Create Macros (45.9%), Create a signature (63.9%), Manually run a virus scan (66.9%), Utilize Boolean operators (36.7%), Run a disk defragmentation (53.8%), Determine IP address (64.9%), and Unzip/Decompress a folder/file (66.7%). These responses indicate that these more advanced skills may be a much-needed focus in courses that the respondents complete toward the end of their programs.

Limitations and Recommendations for Future Research

A limitation for this study was the use of a self-reporting instrument. This instrument was used because of the availability and access to the population at the community college. Future research should include a skills-based instrument to overcome this limitation and ensure that accurate abilities are quantified.

Conclusions

The following conclusions were based on the findings of the study.

1. The perceived competency level to utilize software and technology tools is impacted by degree program. The perceived competency level to utilize hardware is not impacted by degree program.

2. Students do not perceive a need for further development of their technology skills with software, hardware, or technology tools.

3. Students' perceived ability to complete computer tasks without assistance varied with tasks with word processing, organizing the desktop, and using a web browser identified as those about which students felt most confident.

Recommendations

Based on the conclusions, the following recommendations are made:

1. A follow-up study that include performance tasks would be a suitable follow-up to this study.

2. Consideration should be given to requiring a technology examination upon enrollment at a community college to determine students' skill levels related to technology. This assessment would allow for appropriate placement in computer/technology courses.

3. Introduce a beginner-level computer course for students with limited computer skills. If a technology examination at the time of enrollment were required, students could be placed in this beginner course to allow them to progress successfully through their required computer courses.

4. Embed work that leads to competency for industry credentials in computer courses to validate skill development and to prepare students to enter the workplace with skills needed for success in their chosen fields.

5. Integrate technology campus-wide in all courses to ensure continued development of computer skills.

About the Authors

Chadwick A. Springer (sprinca@auburn.edu) is a Clinical Lecturer, Business/Marketing Education and Career and Technical Education, at Auburn University.

Leane B. Skinner (skinnal@auburn.edu) is a Professor and Program Coordinator, Business/Marketing Education and Career and Technical Education, at Auburn University.

Elisha Wohleb (wohleec@auburn.edu) is an Associate Clinical Professor, Business/Marketing Education and Career and Technical Education, at Auburn University.

Geana Mitchell (geana.mitchell@bscc.edu) is an Instructor and Program Coordinator, Management & Entrepreneurship and Office Administration Technology, at Bevill State Community College.

References

Alabama Workforce Council. (2018). Preparing Alabama's workforce for opportunity and growth. Retrieved from https://alabamaworks.com/wp-content/uploads/2018-12-27-AWC-Attainment-Report_final.pdf

Anderson, C., & Gantz, J.F. (2013). Skills requirements for tomorrow's best jobs: Helping educators provide students with skills and tools they need. IDC.

Apte, U.M., Karmarkar, U.S., & Nath, H. (2008). Information services in the U.S. economy: Value, jobs, and management implications. *California Management Review, 50*(3), 12-30.

Bailey, G., & Mountjoy, K. (2009, April). Technology used for teaching and management in the business education classroom. *Business Education Forum, 63*(4), 43-49.

Bernini, S. (2018, February). Contemporary tools for teaching career readiness. *Business Education Forum, 72*(3), 18-20.

Brown, H. & Finnell, A. (2020). Information technology. In B.C. McEwen, & M. O'Conner, & Brown, B. (Eds.), *Effective Methods of Teaching Business Education in the 21st Century.* (pp. 166-179). National Business Education Association.

Capella University. (2017, May 23). Five reasons to incorporate technology into your classroom. Retrieved from https://www.capella.edu/blogs/cublog/benefits-of-technology-in-the-classroom/

Careless, J. (2012, Spring). Learning and the new workplace: Impacts of technology change on postsecondary career and technical education. *New Directions for Community Colleges, no.*(157). Retrieved from www.wileyonlinelibrary.com

Cornelius, D. (2012, January 12). 20 ways to make tech work in schools. *Tech & Learning*. Retrieved from http://www.techlearning.com/article/52120

Cyberstates 2020. (n.d.). The definitive guide to the U.S. tech industry and tech workforce. CompTia. Retrieved from https://www.cyberstates.org/index.html#keyfindings

Dimock, M. (2019, January 17). Defining generations: Where millennials end and generation Z begins. Retrieved from www://pewresearch.org

Dukes, E. (2019, May 24). 5 ways technology in the workplace has improved our lives. Retrieved from https://www.iofficecorp.com/blog/4-ways-technology-has-changed-the-modern-workplace

Duncan, A. (2011, February 2). The new CTE: Secretary Duncan's remarks on career and technical education [Web log comment]. Retrieved from http://www.ed.gov/news/speeches/new-cte-secretary-duncans-remarks-career-and-technical-education

Fletcher, E.C. (2020). The business education curriculum in the educational system. In B.C. McEwen, & M. O'Conner, & Brown, B. (Eds.), *Effective Methods of Teaching Business Education in the 21st Century*. (pp. 166-179). National Business Education Association.

Foster, J., & Kelley, P., & Pritz, S., & Hodes, C. (2011, April). CTE'S focus on continuous improvement. *Techniques*. Retrieved from www.acteonline.org

Frey, C.B., & Osborne, M.A. (2013). The future of employment: How susceptible are jobs to computerisation? Retrieved from http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

Gay, L.R., Mills, G. E., & Airasian, P. (2009). Educational research: Competencies for analysis and applications. Merrill.

Gaytan, J. (2011, December). Integrating classroom instruction through technology-based games. *Business Education Forum, 66*(2), 44-48.

Goldenberg, B. (2015). Social CRM in action. *CRM Magazine, 19*(4), 8.

Green, S.B., & Salkind, N.J. (2011). *Using SPSS for windows and Macintosh: Analyzing and understanding data.* Pearson Education, Inc.

Harter, C. (2011, October). Making connections: Integrating computer applications with the academic core. *Techniques*. Retrieved from www.acteonline.org

Henderson, R. G. & Chapman, B. F. (2012). Business teacher educators' adoption of computer technology as a pedagogical tool. *NABTE Review, 35*, 30-36.

Jones, K., Leonard, L. N. K., & Lang, G. (2018). Desired skills for entry level IT positions: Identification and assessment. *Journal of Computer Information Systems, 58*(3), 214–220. Retrieved from https://doi-org.spot.lib.auburn.edu/10.1080/08874417.2016.1229144

Kolaski, R. (2018, June 21). The Role and Importance of Technology in Business. *Industry Today*. Retrieved from https://industrytoday.com/the-role-and-importance-of-technology-in-business/

Lewis, K. (2019, April). Re-energize your classroom with high-tech, low-tech, and no-tech teaching strategies. *Business Education Forum, 73*(4), 35-36.

Maehr, M.L. (1984). Meaning and motivation: Toward a theory of personal investment. In R. Ames & C. Ames (Eds.), *Research on motivation in education: Student motivation* (pp. 115-144). Academic Press.

Maehr, M.L., & Zusho, A. (2009). Achievement goal theory: The past, present, and future. In K.R. Wentzel & A. Wigfield (Eds.), Handbook of motivation at school (pp. 77–104). Routledge.

Mitchell, G.W., Wohleb, E. C., & Skinner, L. B. (2016). Perceptions of public educators regarding accessibility to technology and the importance of integrating technology across the curriculum. *Journal of Research in Business Education, 57*(2), 14-25.

Newman, D. (2012). 6 technology trends transforming the workplace. Retrieved from http://millennialceo.com/leadership/6-technology-trends-transforming-workplace/

O'Neill, M. (2013). Engaging workspace with technology: A planning approach to future-proof your investment. Retrieved from http://www.knoll.com/media/314/996/WP_EngagingWithTechnology.pdf

Pan, G., & Seow, P.S. (2016). Preparing accounting graduates for digital revolution: A critical review of information technology competencies and skills development. *Journal of Education for Business, 91*(3), 166–175.

Pintrich, P.R. (1999). An achievement goal theory perspective on issues in motivation terminology, theory, and research. Contemporary Educational Psychology, 25, 92-104.

Pintrich, P.R., & Schunk, D.H. (1996). Motivation in education: *Theory, research, and applications*. Prentice Hall Merrill.

Pritchett, C. C. (2012, February). Integrating web-based learning in secondary business education classrooms. *Business Education Forum, 66*(3), 47-50.

Rupton, T.J. (2016, Jan 13). 6 business technology trends for 2016. Retrieved from: http://thenextweb.com/insider/2016/01/13/6-business-technology-trends-for-2016/#gref

Schreiner, E. (n.d). How technology has changed in the 21st-century workplace. https://work.chron.com/technology-changed-21stcentury-workplace-18447.html

Senko, C., Hulleman, C. S., & Harackiewicz, J. M. (2011). Achievement Goal Theory at the Crossroads: Old Controversies, Current Challenges, and New Directions. *Educational Psychologist, 46*(1), 26-47.

Skinner, L.B. (2016). Digital media strategies for the business education classroom. In D.J. Fisher (Ed.), *Innovative Instructional Strategies in Business Education* (pp. 180-190). National Business Education Association.

U.S. Bureau of Labor Statistics (n.d). Occupational Outlook Handbook. Computer and Information Technology Occupations. Retrieved from https://www.bls.gov/ooh/computer-and-information-technology/home.htm

Washbon, J. L. (2012, Spring). Learning and the new workplace: Impacts of technilogy change on postsecondary career and technical education. *New Directions for Community Colleges, no.*(157). Retrieved from www.wileyonlinelibrary.com

Williams, K. S. (2009, December). The three r's plus one: The reality of new literacies required for success. *Business Education Forum, 64*(2).

Wohleb, E.C. (2016). Maximize learning with mobile technology. In D.J. Fisher (Ed.), *Innovative Instructional Strategies in Business Education* (pp. 166-179). National Business Education Association.

Wolters, C.A. (2004). Advancing achievement goal theory: Using goal structures and goal orientation to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*(2), 236-250.

