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CAREER TECHNICAL EDUCATION TEACHERS:

USING HANDHELD TECHNOLOGY TO TEACH ESSENTIAL SKILLS

By

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Abstract

This paper explores Career and Technical Education (CTE) teachers' perspective of in-class use of handheld technology in learning environments with effective pedagogical practices that lead the way to improving classroom teaching. The technology for this study encompasses laptops, iPads, tablets, and cell phones, collectively referred to as "handhelds." This study sought to consider teachers' own experiences with the use of handheld technology devices in classrooms. The goal of this study was to examine how handheld devices provide a few ways or methods whereby technology can be integrated into curriculum design to help teacher-student interactions and in-class participation in order to promote a collaborative learning space that supports the students' educational interests. Teachers with handhelds in classes may engage students effectively for learning and collaboration through the course content, using digital media to build collaborative learning environments. With handheld computers in class, the teacher can use different methods of teaching, including lectures, discussions, and small-group work to increase class participation (Sung, Chang, & Liu, 2016). Career and Technical Education (CTE) teachers use in-class handhelds as tools in constructive dialogue between teachers and students, thereby helping students to discover new meanings in their learning tasks. It can be used to help teachers meet their goals of helping students acquire in-depth knowledge of subject matter. The use of these technologies can create ways for teachers to engage students in learning in the classroom.

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CHAPTER 1

INTRODUCTION

Handheld devices in high school classrooms are an ever-expanding area in educational

policy making, professional development, and daily instructional practices. Handheld devices

have become an instructional tool in classrooms across the nation. As American culture is

progressively influenced by advances in innovation, teachers, including Career and Technical

Education (CTE) teachers, are confronted with the challenges of incorporating these devices into

their lesson plan designs to improve pedagogical practice in their own instruction. While teachers

recognize that handheld technology as a teaching tool is vital for student-centered learning in the

classroom and realize its potential in classrooms for encouraging participation and enabling

students to gain dual credits in specialized technical endorsement on secondary school diplomas

(American Institute of Research, 2013), many teachers still lack ways of including technology in

their daily instructional practice to utilize the opportunities for engaging students in their content

learning, in this ubiquitous technology-environment. The use of in-class handheld technology for

instructional purposes may provide opportunities to supplement instruction using online

resources to make student learning comprehensible. For teachers to successfully apply

technology to their pedagogical practice, they should explore the use of certain approaches in

their classroom teaching, teachers should:

Demand an approach to its instructional use in a learning task, which will include five

basic decisions: determining a learning goal, making instructional choices about the

nature of what should be learned, using assessment strategies that demonstrate what

students are learning, using activities to reinforce learning background, and applying

resources that best suit students' needs. (Harris & Hofer, 2009, p. 101)

Handheld devices can enhance good teaching practices to "provide opportunities for diverse talents and ways of learning" (Moallem, Kermanie, & Chen, 2005, p. 95). Veteran and new teachers may not feel well prepared to incorporate the use of handheld devices into their curriculum planning or lesson designs because of a "lack of knowledge and skills, unclear expectations, and lack of self-confidence in using technology in their teaching" (Park & Ertmer, 2008, p. 631). School leaders are encouraging teachers to use technology tools for teaching students in classrooms, but "many teachers are unsure how to integrate these technologies into classroom learning" (Burns, 2010, para. 1). Teachers can apply technology in their instruction to help their students develop the technological literacy skills necessary for using handheld devices as part of their daily learning activities. Handheld technology for instructional purposes can be used as a support to increase student engagement, respond to individual learning styles, facilitate teacher–student interactions, and to support students' learning outcomes. Research has uncovered findings that teachers view handheld technology devices as essential and important instruments for learning, and they promote students' academic interests as well (An, Alon, & Fuentes, 2015).

For in-class use of handheld technology to satisfy its promise as an added contributor to learning, it must be utilized to develop student engagement in an educational program (Murphy, 2003). Today's CTE teachers must be prepared to deliver instruction to their students to provide them with learning opportunities to reach their academic goals (Public Education Leadership

Program Coherence Framework, 2009) and to equip students with the skills required to be successful among the 21st century workforce. Handheld technology-supported instruction supports classroom teaching and helps students and teachers by providing significant opportunities for their learning. Luna Scott (2015) pointed out, "handheld devices are everywhere among students and have the potential to improve the dynamics of learning" (p. 8). District leaders have provided handheld devices to students to support their learning processes and enhance the learning of specific skills, such as technology literacy. Traditional teaching methods that focus on the teacher delivering a lecture while leaving students sitting passively as the teacher stands in front of them to deliver the lecture, are not effective (Bergen, 2009). Student-centered instruction, in which students direct their own learning and work collaboratively with other students, can be more effective.

Using technology for teaching in the classroom makes different demands on students and teachers, as both must enter into a partnership with technology in order to create an environment that supports their educational interests (Hopper & Simon, 1995). Previously, assumptions about teaching practices placed the teacher at the center of the instruction delivery. The prevalence of handheld technology has emerged as a part of classroom teaching alternatives to traditional teaching. Different ways of teaching through technology are common in classrooms which require student-centered instruction delivery respond to individual needs so that students can adequately understand the content of the subject. Student-centered instruction is active teaching in which students influence the content and direct their own learning to become independent learners (Asoodeh et al., 2012).

Some students come to school knowing how to use technology or having some technology skills, but teachers need to demonstrate the proper use of technology as a means to support higher-level instructional objectives for students. In light of this circumstance, teachers can find ways to support and develop their students' educational interests in a collaborative environment, thereby enhancing higher thinking skills in support of academic goals. Effective use of handheld devices "for course related and instructional purposes can provide a positive effect on their attention and learning" (Fisher, 2015, para. 2).

Purpose of the Study

The purpose of this study was to document how CTE teachers use handheld devices in their classrooms to influence student learning. The study also examined teachers' perceptions of their competence in integrating technology as a foundation for teaching to support students' educational interests. The study seeks to comprehend teacher perceptions regarding the use of handheld technology in classrooms and examines how it can be successfully used to drive learning and teacher-student collaboration for achieving the district goals.

Statement of Problem

Handheld technology use in high school classrooms is expanding, but many teachers have not fully integrated technology into their pedagogy practices, since they have not had the opportunity to see the possibilities of richly integrated technology (Hicks, 2011). School district leaders across the nation believe that technology use in classrooms is essential to achieving significant gains in both teaching for teachers and learning for students and provides personalized instruction for students with different learning styles as needed. When implemented

well, richly instructional content and digital learning resources can help meet the daily learning goals that can lead to improved student academic excellence, making the use of technology an essential tool in teaching and learning in classrooms (Grinager, 2006). While these devices are in the hands of teachers, unfortunately, many are not taking advantage of the possibilities for classroom use and perceive themselves as lacking knowledge about the proper use of these devices (Brown-Joseph, 2010; Ertmer, 1999). Policy makers should understand the barriers that prevent teachers' use of handheld technology devices in their daily instructional practices, which may directly or indirectly impede students' learning. While many classrooms are equipped with handheld technology devices as learning tools, many teachers fail to integrate the technology to support teaching and learning, because of the lack of training for teachers in using these devices effectively. Simply buying a professional saxophone will not make you an experienced saxophonist; infusion of technology in classrooms without adequate preparation on how to use it impedes the possibilities of better serving students' educational interests. Using handheld devices for instructional design requires teachers' competency to devise lessons with different instructional strategies, thereby expanding learning ways for their students and improving academic outcomes. Teachers using handheld technology through different methods are likely to see a substantial improvement in students achieving their academic goals. The use of instructional strategies that allow students to create their own learning with technology experience can enhance problem-solving skills to aid completion of authentic activities. Evidence suggests that "tablet devices have an overwhelming positive impact on students' engagement with learning" (Mango, 2015, p. 53). To determine why teachers lack ways to

implement in-class use of handheld devices in their lesson plan designs, it is imperative to consider teachers' perceptions of technology integration.

Statement of Significance

Handheld technology tools are now ubiquitous, and available to teachers and students in the classroom. Students, however, may be missing out on learning opportunities when those technologies are put to lower-order uses, rather than for higher-order skill development (Moersch, 2011). This study is significant, because it documents classroom teachers' insights on their pedagogical practices involving the use of handheld technology devices in the classroom as a supplement to teaching, thereby helping students reach their learning goals and acquire 21st century skills in secondary school education. School districts can utilize the findings from this study to improve knowledge of handheld technology instruction, and support teacher training through professional development.

Many school districts are expanding their educational reach by providing handheld technology devices for teachers and students to expand relevant experiential learning in order to support students' learning preferences. Teachers reported that students respond well to the stimulus of handheld devices because they get excited about learning, they stay engaged, and make corrections in real-time to complete their assignments (Lynch, 2015). Since handheld technologies are widely used in many schools to support both teaching and learning, teachers must learn to effectively apply these new strategies in their daily instruction to enable students to explore ideas and solve problems. For example, iPads have the potential to create more individualized learning and personalized assessments, and to foster a more student-centered

learning environment. This application, in turn, supports student skill development using new literacies to create meaningful interaction with technology tools (An et al., 2015, p. 23). Effective use of in-class handheld technology in teaching in the CTE curriculum can prepare students for entry-level employment. According to McIntosh 2013, points out that,

> The dynamic of skilled workers is changing, and is going to be replaced by a generation that looks at being technologically savvy, rather than job placement and career. CTE is in place to help balance these changing needs from one generation to another for both workers and careers. (p. 43)

Researchers suggest that the use of tablet technology in the classroom provides a meaningful collaborative activity that promotes learning through social interaction and challenges students' thinking processes (An et al., 2015).

The prevalence of technology integration has focused attention on the way teachers teach in classrooms (Purcell, Heaps, Buchanan, & Friedrich, 2013). Handheld technology has been a learning tool in the classroom environment for least a decade in some school districts. CTE teachers use handheld devices as a part of teaching in the classroom and in student learning. The advancement and utilization of new technologies have grown, but teachers may not be adequately trained to ensure their implementation. The Pew research survey of 2,462 teachers finds that digital technologies have helped teachers strengthen their approaches to teaching secondary school students in many ways. Teachers who were surveyed have this to say about the overall impact on their teaching and their classroom work:

Of those surveyed, 62% of teachers say the training for their own use of the technology is the key to increased technology use in their classrooms. The use of technology tools has added new dimensions to their teaching practice; agreeing with the statement that these tools have a "major impact" by increasing the scope of content and skills about which they must be knowledgeable. What's more, 68% report a "major impact" where schools provide formal training which allows for teachers to be effective, and, 85% of teachers find ways to learn to effectively incorporate these tools into their teaching (Pew Research Center, 2013, pp. 2-3).

Research Questions

Guiding this inquiry were questions about how CTE teachers use handheld technology devices to design pedagogy to prepare students to meet academic goals. The following questions guided this research:

1. How do CTE teachers describe the influence of in-class use of handheld technology devices for their pedagogical practices?

2. How do teachers perceive their competence to use handheld technology to support student learning?

3. How do CTE teachers characterize successful in-class use of handheld technology for student collaboration?

Conceptual Framework

The conceptual framework for this study was the connection between individual CTE teachers and computer self-efficacy in relation to the development of modern technologies and their extension to classrooms in US schools (Paraskeva, Bouta, & Papagianni, 2008, abstract). Research has indicated that teachers' attitudes toward technology integration substantially impact the successful implementation of these advancements in the classroom (Paraskeva et al., 2006, p. 1). The effective use of handheld devices to support both teaching and learning can increase student engagement and motivation; and accelerates learning. These technologies have the ability to transform teaching in a way that gives teachers access to other classrooms and resources, and enable teachers to improve their own instruction and personalize learning.

Self-efficacy has been observed to be an important factor influencing the decisions a teacher makes with respect to integration of technology for instructional purposes (Shifflet & Weilbacher, 2015). Sarfo, Amankwah, and Konin (2017) pointed out that "it is the teachers' skills, and self-efficacy beliefs, among others, that determine the choices they make about what, when, where and how to use, and integrate computers into teaching" (p. 20).

For teachers teaching students with technology in higher-order uses in classroom, schools should provide training for teachers to adapt technology to be able to "transform the learning content, the so-called Technological Pedagogical Content knowledge" (Montrieux, Schellens, & De Marez, 2015, para. 5). Self-efficacy beliefs lie at the core of our personhood, as a motivation behind the teachers' capabilities to produce effects (Bandura, 1997). In agreement with these researchers, it is suggested that self-efficacy is a barrier that needs to be overcome for teachers to

adopt technology in lesson plan designs (Ertmer & Ottenbreit-leftwich, 2010). Based on the current literature, two factors can influence teachers' self-efficacy; one factor is teacher's attitudes toward technology adoption in the classroom (Howard, 2009); a second factor is personal characteristics such as educational level, age, gender, and educational experience (Schiller, 2003). Schools should provide training to help teachers develop computer knowledge for understanding how to adopt technology for student learning.

Assumptions, Limitations and Scope

This study had some delimitations and limitations. The human subjects of this study were delimited to CTE teachers in the large urban district in a southern US school district. Teachers from this district were purposefully selected for participation because they are members of a group of teachers that are especially knowledgeable about or are experienced in the topic of interest (Creswell & Plano Clark, 2011). Another limitation of this study was the potential bias of the researcher. The principal investigator is presently a Campus Technology Specialist who integrates technology into his daily practices. Finally, the data collection occurred during the period from mid-October to the end of December 2017, and the information gained from this study is specific to that time frame.

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Definitions

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For the specific purposes of this study, the accompanying key terms are defined as follows:

Technology: Handheld computers and computer-related equipment (such as laptops, iPads, tablets, and cell phones), as well as educational and productivity software.

Technology integration: The inclusion of technology resources and its practices that engage

students in their class routines of school (resources such as handheld computer devices

and specialized software), in a way meaningful to them.

Professional development: "Activities that develop teachers and other educators'

to improve their knowledge, competence, skill and effectiveness" (Organization for

Economic Cooperation and Development, 2009, p. 49).

21st Century Skills: Critical thinking, problem solving, communication, collaboration, creativity,

and technology skills for teachers and students to succeed in school and work

(Partnership for 21st Century Learning Skills, 2011).

Student-Centered Instruction: An active exploration, construction, and learning that takes the

students' needs into consideration in order to solve the problem at hand.

Learning outcomes: A learning outcome is a statement of what the learner is expected to know,

understand and/or can do at the end of a period of learning (Donnelly & Fitzmaurice,

2005).

Summary

Over the years, the influx of handheld technology devices in classrooms has changed the

teacher's role and the ways teachers deliver instruction to their students. The handheld

technology devices for classroom instruction is a very in-depth review that outlines the several

uses of handheld technology and ways of incorporating those tools into the teachers' pedagogical

practice to solve these two problems: teacher training and professional development that

promotes their professional growth and promotes teacher-student interaction in the culture of

learning. Professional development "requires teachers to shift from old thinking with a totally new understanding of their role and its purpose" (Luna-Scott, 2015, p. 14). Teachers need to be given an opportunity to think about how this change can influence students in an environment of learning. The effective use of handheld technology needs to be a priority for the teacher to facilitate meaningful discourse between teachers–students in the classroom.

There are reasons why handheld devices are instituted in the classroom, the most important being that they have a promising future in the classroom. The reasons vary from making teachers improve their instruction to making learning more interactive between teacher-student and their peers in a collaborative environment which supports a student-centered learning culture. Handheld devices have become "a model tool for the classroom instruction in the United States schools" (Bebell & O'Dwyer, 2010; Fleischer, 2012; Zucker & Light, 2009), such that teachers and students use them for their daily routines. These handheld technology devices support development of 21st century skills that teachers need to promote innovation in education; not only does handheld computing deter them from traditional lecture-style teaching, it can promote innovative teaching methods such as cooperative learning (Lan et al., 2007; Roschelle et al., 2010). Therefore, handheld technologies can support the following dynamics of classroom teaching: collaboration, critical thinking, problem solving, communication, creativity, and technology skills for teachers and students to succeed in their educational pursuits.

CHAPTER 2

LITERATURE REVIEW

This study investigated Career and Technical Education (CTE) teachers' perceptions regarding the use of handheld technology and its potential to support students' academic goals. For this study, handheld devices are the portable computing devices such as laptops, tablets, iPads, and cell phone technology that pervade secondary classrooms as a part of everyday teaching and learning. The need for CTE teachers in classrooms of the 21st century to employ technology is now a reality, since technology has become a greater factor in supporting students in their education and should be a routine classroom experience. These technologies in classrooms have changed the way teachers deliver instruction to students. Ochola, Stachowiak, Achrazoglou, and Bills (2012) pointed out how handheld technology has influenced educational reform, indicating that preparing "classrooms for the future is about recognizing and embracing rapidly evolving handheld devices, enabling teachers to use technology as an effective tool for educating students, and preparing students to enter and successfully compete in the global stage" (para. 21). CTE teachers play a crucial role in students' education and making interactive teaching relevant to them. To accomplish these goals, CTE teachers must advance their training and help students in their academic goals to achieve desirable outcomes. In modern classrooms, teachers must help students develop new capabilities, so that they can achieve academic and career success after secondary school (Trilling & Fadel, 2009).

Although handheld technology devices are now omnipresent in classrooms, with devices such as iPads, tablets, laptops, and cell phones in the teachers' hands, there has not been 100%

integration by teachers of these devices into their daily instructional methods to support students' educational pursuits (Kopcha, 2012). The findings in the area of transformative technology suggest that schools should be "leveraging technology to become environments of teaching and learning that make students lifelong learners and prepare them for the future" (Groff, 2013, p. 9). Teaching and learning in secondary schools play an essential, everyday role at K-12 levels of education. According to Thieman (2008), "teachers need to experience alternative teaching and learning models and strategies as part of their own education" (para. 6). The first part of the literature review defines why technology is an essential tool for teaching in the classroom today, discussing the need for these devices in the classroom so as to develop 21st century learning skills. The second part provides the background, experiences with technology and the training needed by CTE teachers to apply technology meaningfully to pedagogical practice to achieve academic goals. The concluding part of this literature review points to the ways CTE teachers use handheld technology devices in the classroom for CTE-specific learning to improve teaching, thereby helping students take control of their learning in a cooperative learning environment.

The framework for 21st century skills requires that teachers develop the skills, knowledge, and competencies needed to ensure positive outcomes for students, based on the content areas; the competencies include 1) using multiple strategies to bolster instruction, 2) using new technologies to offer students more opportunities to be creative, and 3) collaborating with peers to discover new meanings. According to 21st Century Knowledge and Skills in Educator Preparation (2010), it is expected that teachers will be supported in their teaching to

deliver instruction that "successfully aligns technologies with the content and pedagogy and of developing the ability to creatively use technologies to meet specific learning needs" (p. 11). Classrooms are essential places for teachers to learn and practice strategies to support their teaching and learning that are responsive to all stakeholders in today's technological advancement space. It is imperative that teachers learn new skills to replace outdated ways of teaching throughout their lifelong careers. Updating skills can occur through professional development that supports classroom teachers and models the kinds of classroom learning which is needed (Minshew & Anderson, 2015; Storz & Hoffman, 2013).

Technology in The Classroom

There are many reasons why handheld technology is an essential tool for teaching in classrooms across the nation. For 21st century teaching to marry course content to skill development in high school education, teachers need to know how to apply technology meaningfully to instruction that supports academic goals. The Public Education Leadership Program (2009) points out that for teachers to motivate their students, "technology must be used comprehensively and purposefully to support students in mastering what students need to learn" (p. 16). Given the importance of technology in today's education, it is paramount for teachers to teach students at the high school level to support the goals of classroom objectives. Districts are providing teachers and students with their own handheld devices to support teaching and learning, keeping them invested in learning. The use of handheld technology is growing rapidly in classrooms across the United States. Schools across the nation are requiring technology additions into their curriculum, because many states' mandates require that standardized tests be

delivered through technology advancements and that digital content be provided to all high school students. The intention of these mandates is that teachers and students having handheld devices at their disposal will help teachers deliver personalized content to students, and enable teachers to provide an environment that facilitates each student learning at their own pace. The Palm Education Pioneers Teachers (2002) report indicates that students using handheld technologies "demonstrate increased student autonomy, and increased collaboration in learning" (p. 64).

Teachers are demanding technology in classrooms as a part of structuring an interactive process, and teaching through handheld devices has become part of the daily instructional activities. CTE teachers are also demanding technology as a necessity to support instruction in a cooperative environment, in order for them to actively engage students in individualized learning processes. High school testing is now an online protocol, but teachers must use technology in higher order thinking, not just in low-level tasks. Handheld devices with other technologies bring multiple resources for the teachers to share with students, allowing more students to work together as groups to construct in-depth meanings during the process.

Benefits of Technology in the Classroom

Technology is an integral part of our everyday lives, and consequently it must also form an essential part of all classroom functions. Technology is involved in almost everything teachers and students do in classrooms every day, including teaching and learning. Through the effective use of technology in the classroom, teachers can prepare students for 21st century learning skills. Handheld technologies such as laptops, tablets, iPads, and smartphones are becoming more

commonly available in most classrooms. These technologies are replacing hard-copy textbooks. Tablets are the new faces of textbooks in the classroom and they offer features in a different way, with potential to sustain the users' interest. Thus, they change the way teachers deliver instruction to their students in classrooms. Teachers are aware of the role and importance of technology in every classroom, and they need to become facilitators for the students, "this means that through continual work and bring new knowledge to the subject through own experience" (Johannesen & Eide, 2000, para. 7).

The impact handheld technology has had on the future of education has been the implementation of instant educational resources by teachers and students, resulting in cooperative learning groups where students engage with peers to discover new meanings. Research has shown that schools participating in the individual laptop rollout show significant gains in students' academic learning and assessments, compared to schools that did not employ handheld technology in their curriculum designs (Bebell & O'Dwyer, 2010). The use of handheld devices becomes the learning tool in an environment where teacher-student interaction is the focus of the instruction. Lam and Tong (2012) reveal that schools have shown "interest in replacing paper textbooks with e-textbooks on their handheld devices for learning tasks and the use these can be used to promote positive in-depth collaboration between student-teacher through mobile devices" (p. 387). Technology has changed the way instruction is designed. It is no longer "delivered", and the teacher is no longer the center of attention in front of the classroom, rather instruction is student-centered with the teachers as the facilitators. The influence of

handheld devices now allows for the use of technologies to promote student-centered interaction in an environment where educational values are a priority.

The Role of Handheld Devices in The Classroom

School districts have shifted their focus to employing handheld devices in classroom learning for more personalized, interactive content using digital devices. These devices in the new age "have become almost standard tools in education" (Lam & Tong, 2012, p. 387). Teachers often change their instructional practices over time when using these technologies with students to differentiate instruction and create more individualized learning. Keengwe, Onchwari, and Onchwari (2009) point out that "teachers take a leading role in designing appropriate learning environments that effectively incorporate technology to help their students learn well with technology" (p. 12). Activities designed by teachers have "inspired new ways for learners to connect with the content using handheld technology, students can have a more positive self-directed learning experiences" (Groff, 2013, p. 1). Teachers are using handheld technology to aid teaching by replacing writing on the traditional chalkboard; now students take notes on their handheld devices from information on the screen. This handheld computer with its capabilities also allows instructors to record and share lectures directly from their digital devices. In-class use of handheld technology with the teachers' support provides students opportunities to work in collaborative groups while constructing a new understanding of their experiences. Putting handheld computers in the hands of students makes learning more interactive, while students are engaging with others. Studies of handheld programs in schools report that they increase students' engagement in school and improve technology skills (Zucker & Light, 2009).

Research also points to the findings that handheld devices are mostly successful as part of balanced, comprehensive initiatives that address changes in educational goals, curricula, teacher training, and assessment (Zucker & Light, 2009).

Influence of In-class Use of Handheld Technology

The influence of handheld devices more generally has changed the way classroom teachers deliver instruction. The overarching intent of high schools across the country is clearly obvious—the requirement for the teachers to integrate technology in their lesson plans to support their teaching and increase student engagement. CTE teachers use and model different strategies with a handheld device to actively engage students and enhance learning for the digital natives. Use of a handheld device for instruction can help CTE teachers present information to students through different lenses to strengthen the instruction. Teachers can use handheld devices as information managers, to create and organize notes as documents, enter data and grades, and for daily attendance; all of these are "influential factors for instructional integration" (Souleles & Pillar, 2014, p. 115).

Through the appropriate use of handheld technology in classrooms, student-centered teaching methods allow learners to take control of their own learning through discovery and collaboration with other students. Students and teachers simultaneously decide what should be learned; in turn, this leads to "progressivism, social reconstructionism, and existentialism that place the learner at the center of the educational process" (Massouleh & Jooneghani, 2012, p. 51). By using a handheld device as a teaching aid, the teacher can creatively design lesson plans, and share with peers as resources. CTE teachers use handheld devices as a teaching tool to

provide instruction that engages students in constructing meaning from their learning experiences. Teachers use handheld technology, for example, to integrate the use of sound, movies, texts, oral and written language to supplement the classroom instruction. Teachers can use handheld devices to expand their teaching horizon to ultimately be creative with instruction delivery. These methods of handheld use as transformative teaching in classrooms are an important concept, providing information in multiple formats to students from various sources which can stimulate motivation and strengthen engagement" (Sung et al., 2016, para. 7). In the past, individual subjects were taught while teachers wrote on chalkboards accompanied by a passive pedagogical practice in the classroom. However, through the use of handheld devices, the students of today are actively engaged in the learning process.

CTE Teachers- Background, Experiences with Technology and Training Needed

Career and Technical Education (CTE) teachers are identified as those who develop and prepare students to acquire occupational skills to be utilized in a work force after high school. These teachers mostly come from industry with specific technical experience in the CTE program, allowing them to take part in the public education. Asunda 2011, posits that

> most Career and Technical Education teachers enter the teaching profession after obtaining industry experience. They tend to have personal experiences in skill based occupations and are constantly working to keep on top of trends in their specific field as they help students develop those same skills (p. 8).

CTE teachers instruct students in public schools, including middle and high schools, helping them acquire workforce skills and preparing students for college. Career and Technical

Education teachers instruct students in various specialized and vocational subjects, such as: information technology, business education, agriculture, architecture and construction, audio and video technology, and science, technology, engineering, and mathematics (STEM), to name just a few of the 16 major career courses offered through CTE programs. Teachers impart these vocational courses to help inculcate in their students the skills and knowledge necessary for the world of work. CTE programs are aligned with specific career paths to prepare students and develop in them the skills required in the workforce and post-secondary school. Asunda (2011) pointed out that Career and Technical Education (CTE) programs, as a large and diverse educational field that comprises a number of programs such as (agriculture, family and consumer sciences finance, marketing, health, trade and industry, and technology education) are accountable for preparing students to enter into the workforce (p. 1).

CTE teachers are involved in different tasks in classrooms, including offering both academic and career-oriented opportunities for students to gain work experience through job internship and industry certification opportunities. CTE teachers can teach secondary students in shops and in labs for most courses and help students understand the material through hands-on activities, experiential or work-based learning and by partaking in curricular options. Teachers plan daily lessons using instructional strategies to support learning goals in order to successfully support students in achieving academic goals. CTE instruction using different types of tools must be managed in the lab to safely accomplish an intended task. As with every teacher in other types of classrooms, CTE teachers are responsible for managing and monitoring their students' progress as well as meeting their educational needs.

Effective training enhances teaching and school leaders are finding ways to implement training to ensure that all teachers acquire and continue to develop the knowledge and skills they need to be effective in their practices (Asunda, 2011). The old models for CTE teacher preparation were not creating well-prepared teachers (Camp & Camp, 2007). The students in modern classrooms are becoming increasingly diverse, thus furthering the need to prepare teachers to work with all students (Asunda, 2011, p. 6). There is some evidence that indicates CTE teachers integrate meaningful project-based and real-world learning opportunities for students to apply their knowledge in real-world contexts.

> In CTE classrooms, students often take responsibility for aspects of their own learning and collaborate on project-based learning. An information technology teacher, for instance, may ask students to discuss approaches to solving a particular computer network problem, come to a common agreement, and share and defend their plan in front of the class. CTE teachers can provide models of how to embed opportunities for students to engage in peer learning and discussion in ways that promote learning, leadership, and communication skills. (Jacques, 2015, para. 3)

Teachers need training that will support their teaching practices to address the individual needs of every student through technology utilization. With better training and support, teachers can be more comfortable using technology for teaching that is relevant to students. Ongoing training that will help and support teachers to integrate technology into their lesson plans is becoming more and more necessary for teachers to become effective in the technology integrated classroom.

CTE Teacher Qualifications

The teacher's qualification or licensure into a CTE program is a standard classroom teaching certificate that enables a candidate to teach in one of the professional program clusters that fall under career and technical education courses. Teachers must hold a minimum of a bachelor's degree to be eligible to participate in the CTE program in public schools. A CTE teacher is defined as a highly qualified teacher, a candidate with a bachelor's degree, having attained a state certification, and demonstrated competency in their subject area (Association for Career and Technical Education, 2014). Many CTE teachers coming into public schools from the business or industry sectors are already familiar with the subject to be taught. Teachers in most CTE programs are given adequate support and professional development in order to effectively teach students so they acquire the necessary skills needed for the workforce (Conneely & Uy, 2009). In CTE program licensure, a candidate going through alternative certification needs 36 hours' coursework in the area of concentration, and 24 of those hours must be upper-level courses with a bachelor's degree from an accredited institution.

Pedagogical Practices

Teachers' preparedness is an important part of effective classroom instructional delivery. Teachers must first learn to integrate technology into their regular teaching method and then disseminate that technology as an effective tool to supplement classroom instruction. The teacher must be responsible for strengthening their teaching practices in the classroom. Consensus exists among teachers that improved teaching is an essential component to improved learning outcomes, and that kind of teaching should occur in every classroom. The teachers'

responsibility is to identify and implement best teaching methods (proven by research as effective) that fits the levels of all individuals in the classroom. Sandholtz, Ringstaff, and Dwyer (1997) identified five stages of instructional evolution for technology addition in the classroom (see Table 1).

Table 1

Instructional Evolution

Stage	Technology Integration
Stage 1 - Entry	Teachers are concerned with modern technologies integrated in classrooms and hoping that new teachers will come on board with these new technology tools. Teachers are trying to use them to support teaching and learning.
Stage 2 - Adoption	Teachers begin to include technology in their lesson plan designs, but attempted change still ongoing to move instruction forward. Teachers apply drill and practice or text based-software to support instruction.
Stage 3 - Adaptation	Modern technology use in class becomes the norm in classroom instruction delivery by the teachers. With the content-based software, teachers see their students produce better work and engage more while they use technologies that are in place for assignments.

| Stage 4 – Appropriation | Teachers begin to shift to technology as a tool and use it in new work practices to support instruction. Teachers are embracing these roles as new instructional patterns. |
| Stage 5 – Invention | Teachers are ready for better options in their classroom. They develop new ways of teaching students in a collaborative classroom culture. They become facilitators, using technology as an active tool to support learning by doing. Project-based instruction, group teaching, and independent paced instruction are common with teachers; in turn, this produces high-level skills in students, and the ability to discover their own learning experiences. |

Note. The model illustrates the five stages of the thought and practice exploited when integrating technology in classrooms. The five stages are entry, adoption, adaptation, appropriation, and invention. Adapted from Sandholtz et al., (1997, pp. 4-7).

Multiple Barriers to Implementation of Technology

There are various barriers to successful technology adoption experienced by teachers. The first is teachers' attitudes toward technology that obstruct the adoption of technology in classrooms (Howard, 2009), who states: "whether positive or negative, these attitudes affect how teachers respond to the use of technologies" (Sabzian & Gilakjani, 2013, p. 67). The end result indicates that teacher attitudes affect how students see the usefulness of computer technology in

classrooms (Teo, 2006). Evidence points to the negative impact of "teachers that were supposed to facilitate technology integration in classrooms and they did not simply because of insufficient or inappropriate training or lack of motivation to use this technology" (Mustafina, 2016, p. 323). Even teachers with appropriate training and fully equipped with technology to assist them in their instructional delivery, may not attempt in sufficient numbers to integrate technology into their teaching (Ertmer, 2005; Mueller, Wood, Willoughby, Ross, & Specht, 2008). Teachers' attitudes are very important and "are considered a major predictor to using new technologies in classrooms" (Albirini, 2006, p. 213). Research has shown that teachers who possess positive attitudes toward technology inclusion in classrooms are more motivated to apply them in their teaching practices (Mustafina, 2016, p. 323).

Additionally, teachers' personal characteristics can impede the in-class use of handheld technology in their daily instruction. These characteristics such as individual educational level, age, gender, educational experience, experience with the computer for educational purposes, and attitude towards technology use can influence the adoption of a technology (Schiller, 2003). Teachers are in a position to direct and employ the use of handheld computer technology into their pedagogies to support teaching, and subsequently students are the beneficiaries of the resulting outcomes.

Finally, a teacher's conceptualized knowledge and skills can be a determining factor in using the framework (Koehler & Mishra, 2009). The researchers point out that teachers' knowledge of the subject (CK) and knowledge of teaching methods and classroom management practices (PK) are important factors for teachers to successfully integrate technology into

instruction (Koehler & Mishra, 2009). Lack of knowledge about how technology is used in the classroom for teaching and its relationship to technology management skills is one of the most common factors identified by teachers as a deterrent to adding technology to their lesson plan designs. Teachers with limited technology experience and knowledge of how to utilize it contributed to the absence of technology in their daily instruction. Teachers' knowledge and skills in technology addition to classroom instruction plays "a significant role in their teaching, and can provide learning with innovative educational opportunities" (Hughes, 2005, p. 228). With an experienced teacher in the classroom, students can use technology as a tool for academic success. Teachers need professional development activities that provide them with knowledge of how best to use technology in depth to teach other teachers, how to operate more than the basic functions, and thus improves teachers' ability to help engage their students in a learning culture.

In-service Teacher Training

Every school leadership team needs to develop a plan for teachers' training to support school reform for failing schools. Implementation of in-service teacher training that focuses on the effective incorporation of technology into teaching must be supported by the policy makers. The teacher should complete initial technology training prior to entering the classroom to teach. Additional in-service teacher training can promote and support the school-based learning of teachers who are already working in the classroom to improve their knowledge skills and commitment to becoming more effective in using a variety of lesson plan designs (Manduku, Edward, & Cheruiyot, 2017, p. 190).

In-service teacher training need to be designed with the teachers' growth in mind, allowing them learn new methods of teaching, promote their development in pedagogy, while utilizing technology as a supplement in the delivery of classroom instruction. Evidence indicates that the application of technology requires training and such focused instruction helps students develop in their learning (Inan & Lowther, 2010). For a teacher to be an effective facilitator and coach, it is that teacher's responsibility to strengthen their pedagogical practices with student academic readiness in mind. As research suggests, some of the objectives of teacher training include: to promote teachers' improvement, to inform teachers of new knowledge, to prepare teachers for new roles, and to support teachers who are entering the education system (Bhan, 2006). These objectives of in-service teacher training can support teachers to thrive in the classroom. An unprepared teacher may not be able to adjust their teaching strategies as their more prepared peers would be (Bista, 2011). Therefore, training is important for teachers to promote continuous improvement, remove deficiencies, and release teachers' creativity in the classroom in order to implement pedagogical practices that fit the teaching levels required by the students.

Teachers' Professional Development

Since effective instructional content includes teachers' understanding the ways students learn, professional development should focus on the growth of teachers in developing their professional skills in the classroom. Professional development alludes to different types of educational experiences related to an individual's professional work (Quick, Holtzman, & Chaney, 2009). To improve teaching in the classroom, a teacher requires continuous professional

development and personal experiences for creating effective teaching to support the learning environment that serves the needs of stakeholders. According to Buabeng-Andoh (2012),

> It is a need for the policy makers to assess the process of professional development for not just providing professional development, but providing effective professional development for teachers using handheld computer technology as their pedagogical practices to support teaching, including training sessions, teachers' attitudes and perceptions, and analyzing the variables and constructs. (p. 138)

Professional development is an essential part of teachers' growth, if the session focuses on the subject-matter that is relevant to learning. Steiner (2004) noted that "content-focused activities had a substantial positive effect on enhanced knowledge and skills" (p. 5). Effective teaching should continue for CTE teachers to best serve the needs of the student populace. In addition, the attainment of newly acquired skills is among the reasons why teachers should be participating in professional development activities (Murray, 2010, p. 3). CTE teachers must understand and be willing to continually learn the technological advancements taking place in the real world. As a means of improvement in classroom instruction to help students acquire new skills needed to thrive in real-world situations, policy makers need to influence teachers' opportunities to learn new skills and develop teaching practices in the classroom. CTE teachers must use industry standards, for example, having a valuable opportunity to better align their instruction with academic learning. Traditional professional development is delivered through passive "sit and get" approaches (McLeskey & Waldron, 2002). This passive professional development relies on an expert in the field to model and disseminate information to the

audience (Desimone, 2009). However, teachers attending one-time workshops often don't change their practice to integrate technology into classroom instruction and fail to increase student achievement (Gulamhussein, 2013, p. 10).

Effective professional development that creates growth opportunities for CTE teachers to develop in their professional practice in the classroom is necessary for improving their teaching and for assisting students to grow in their academic learning while they are preparing to become the next generation of professionals in construction, information technology, banking, finance, and critical areas requiring real-world knowledge. Lewis et al.'s (1999) report shows that "some professional development programs are not carefully designed to provide continuity between what teachers need and what goes on in their classrooms. These activities are not likely to produce any lasting effects on either teacher competence or student outcomes" (p. 22). Technology can strengthen professional development by giving teachers online sites to use to interact with other teachers or professional development providers to support their work (Schlager & Fusco, 2003; Dede & Katelhut, 2009). Online professional development is a viable alternative to traditional face-to-face professional development, with the following benefits to CTE teachers: It can extend the reach of traditional teacher professional development in many ways. For example, its utmost benefit should be the improvement of student learning, as is the case for all quality professional development, and online professional development can allow more teachers to participate since travel is not necessary (Dede & Katelhut, 2009; Schlager & Fusco, 2003).

Implementing Technology For CTE-specific Learning

Handheld tools assist with role play to provide opportunities for students in their learning experience. Handheld use with role-playing in CTE-specific learning can help students gain a richer understanding of multiple perspectives through increased interaction with each other and help students to relate that learning their own lives. Class activities with simulation support can be effective ways of connecting students to new learning and prior knowledge. Contemporary handheld technology can provide a new way to teach in the classroom as an active learning approach to teaching. Technology as a teaching tool to support instructional strategies for active learning can take many forms, including writing, role-playing, constructing, experimenting, simulating, observing, and discussing as part of classroom engagement. CTE teachers use different instructional strategies with interdisciplinary connections in labs, having students take part in the role-play. For example, a technology tool such as an online packet tracer can provide an online based where students can take part in live video in the area of computer networking demonstrating the concept of configuring a computer network while students are experiencing a more realistic experience the role being played.

CTE teachers may also use technology as a tool to create and present instruction that is inviting and relevant to students' academic goals. With the same technology, teachers can use teaching strategies that are relevant to course content for students, and students can become engaged and active learners, making teaching and learning in secondary schools more engaging and relevant.

Technology Reshapes Teacher Roles

Due to the availability of different technology tools, teachers are asked to use these tools to support students' academic goals. In the past, textbooks were used as a major instructional delivery method, and students sat passively in their seats waiting for instruction from their teachers; there would be no talking, and the teacher was the center of the stage. Teachers were lecturers to students and provided information in support of their academic goals. Traditional teaching offers teacher-centered instruction, which means information is passed on to students from the teacher and collaboration among students is limited; this is not a preferred method of teaching. Constructivist pedagogy is a historic method of teaching that engages students in making connections and discovering new meanings in their academic goals (Bada, 2015).

The role of teachers is changing everyday due to the advancement of technology, and teachers face problems on how to use technology to effectively engage students in their learning. The inception of handheld technology in classrooms has changed the classroom discussion "from being mostly book-based to being e-book information retrieval with digital devices" (Tan Wee Hin, 2005, p. 290). With the teacher knowing how to guide and engage students in ways of discovering new experiences that challenge their existing knowledge, the teacher-student partnership can make teaching and learning become successfully attainable. In modern classrooms, teachers take into consideration the need to apply state and district curriculums to inform students in their academic goals. Teachers need to be able to use and effectively manage portable technology devices as part of an instructional delivery method in classrooms. Teachers as individuals need to make an informed decisions relating to classroom management, whereby

students receive education that is relevant to their academic goals. Teachers now work in less isolation and more collaboratively with their peers, parents, community members, and employers to set goals and learning standards for the knowledge and skills students must have while they are exploring their lifelong careers.

Use of Technology in Teaching CTE Courses

Handheld technology in CTE classes can create an environment whereby teachers help and guide students to find their own answers, and allow them to see the relevance of what the teachers are presenting to them. With handheld technology, teachers engage students in ways where they participate in their own education and take part in problem solving decisions that affect them. CTE teachers using handheld technology teach transferable skills that are valued and applicable to many career choices in the workplace, thus helping students prepare to join the workforce. With their handheld devices, teachers can engage students in experiential learning, where students acquire and apply knowledge and skills in a laboratory-like environment.

Teachers are finding ways to integrate technology into the classroom instruction that can help students achieve course objectives while they learn. For example, activities on handheld devices allow students to read directions, process information and complete work. This approach allows the teacher to adjust content to different skill levels and help individual students achieve their learning goals. Handheld technology can assist teachers to accelerate students' learning by discovery learning. CTE teachers provide instruction that is motivating to students and supports their academic growth. The National Board for Professional Teaching Standards (NBPTS, 2016)

points out that "through rigorous and relevant instruction, teachers motivate their students further by generating enthusiasm for the journey to college and career success" (p. 59).

Technology Helps Collaborative and Communication Practices

Teachers use handheld computer technology in class to support activities that can foster teacher-teacher or teacher-student dialogue in an environment where there is immediate interaction and feedback in problem solving situations. Enhancing teaching with handheld devices in class can be in the form of collaborative group quizzes or other low-stake assessments to help teachers assess what students know. Teachers can manage collaborative group quizzes with handhelds as a tool to teach and assess students' knowledge and their understanding of the content. When teachers employ a collaborative form of teaching in classrooms as an assessment strategy, students perform significantly higher (Shepard, 2000). Low-stakes quizzing helps the teacher to gauge students' knowledge acquisition. Teachers can use this type of practice to improve classroom instruction, where students are supported with immediate feedback (McDaniel, Agarwal, Hueelser, McDermott, & Roediger, 2011). Low-stakes quizzes enable retention, and function as a retrieval practice (Agarwal, Bain, & Chamberlain, 2012). The teacher sees this assessment as a very important practice to gauge and understand if learning is occurring in the classroom. Teaching with handheld devices is an activity that provides opportunities to work and learn together with fellow teachers to promote professional growth. This practice can be viewed as teachers working with their peers on different teaching styles, and in doing so, teachers express their views and experiences. Teachers can engage students in inquiry-based activities that promote new discoveries through their own investigation. From this type of inquiry

learning, there is a way to open inquiry where students formulate their own problems to investigate (Abdi, 2014, p. 38). Collaborating with other teachers is a foundation for building relationships with others and more than just meeting to share lesson plan designs. To improve classroom teaching, policy makers are calling for teachers to use the collaborative approach as one of the features of teaching. Leana (2011) pointed out that when a "teacher needs information and advice, that teacher goes to another teacher for help; this type of relationship can be thought of as trust, in which both teachers-students are benefitting from the practice" (para. 14). In addition, while peer collaboration has been recognized as an essential component for teachers' continuous learning, it is also evident that this much needed collaboration is happening on a limited basis (Stephenson, Warnick, & Tarpley, 2008).

With the advent of handheld technology in classrooms, the teachers of today can use technology tools to communicate with peers and students, because one-to-one dialogue and sharing of work and ideas encourage active participation in classrooms. Classroom handheld technology addition offers the possibility of improving pedagogical practice (Tingir, Cavlazoglu, Caliskan, Koklu, & Inte-Tingir, 2017), given the vital advantages of portability and one-on-one communication (Roschelle, 2003). With handheld classroom-based devices, teachers can establish a real-time communication and involve different collaborative groups between students and teachers to evaluate understanding (Zheng, Yang, Cheng, & Huang, 2014).

Teachers' Comfort and Perception of Technology

Research shows that teachers who were highly educated and skilled with technology are likely to use technology to perform a specific task (Brown, 2014). The teacher's self-efficacy

also plays an important role in the decision to use technology. Higher self-efficacy may lead to a teacher's comfort in integrating technology into instruction. Technology training can enhance teachers' comfort levels, helping them gain an insightful understanding of using technology as a supplement to improve teaching. Teachers' comfort levels can help them use technology as a tool to widen their knowledge based as a leverage to meet the students' needs in classrooms and to support curricular goals.

Technology related training makes a difference in how teachers perceive technology integration in classrooms. Research shows that teachers hold different views towards technology use in classrooms; teachers with high comfort levels may increase their use of technology and use it more creatively (Almekhlafi & Almeqdadi, 2010). It is important to note that teachers' knowledge and comfort levels can lead to benefits in the acquisition of knowledge. Brown (2014) points out that "teachers viewed computer technologies as an important teaching and learning tool when they themselves were comfortable using them" (p. 8).

Conclusion

The research presented here reveals, to a significant extent, how handheld technology acts as a supplement aids teachers' pedagogical practice. There are many examples where teachers' use of handheld technologies in the classroom and the benefits of their application in teaching to improve academic outcomes have been shown to make teaching practices more student-centered and encourage cooperative learning and collaboration. Roschelle, Rafanan, Estrella, Nussbaum, & Claro (2009) indicate, "students seeing themselves as resources instead of as competition make classroom learning enjoyable by learning to be more active participants in

their own learning" (p. 2). Handheld technology devices are replacing textbooks; teachers can teach students just about anything, using these computer technologies. CTE teachers can use handheld technology to connect classrooms at different locations, or in the same geographic location, as in the form of virtual academic field trips, where students are given opportunities to experience real world learning through handheld computer technology.

Training and professional development must be ongoing, to keep teachers up to date and constantly improve their technology knowledge to support current classroom teaching. With handheld technologies, teachers are finding new ways for application of these devices, and the relevance of these computer devices is allowing schools to use mobile technology for cooperative learning methods in classrooms. Teaching with these devices plays an essential role in classrooms of the 21st century, and its frequent use supports the learning process students face every day. These technologies have shown their potential for expanding access to education in different forms to improve classroom teaching. By using handheld devices, teachers are able to connect to other teachers in a way that was not possible in school in the past. The computer technologies such as laptops, tablets, iPads, and cell phones can be used to connect many places instantly, whereby teachers can share and express ideas with other teachers in different classrooms. When teaching with technology, resources are available at teachers' fingertips to support classroom teaching. A teacher using handheld technology for teaching can help students develop new knowledge by reducing barriers to instruction (Rosenshine, 2010). The teacher uses technology in a variety of courses for different purposes, including updating curriculum, to

access other authentic resources online that can be used to inform students during their learning

tasks, and as teaching methods by means of improved instruction practices.

CHAPTER 3

METHODOLOGY

A case study approach was employed in this study, to investigate Career and Technology Education (CTE) teachers' perceptions of handheld technology utilization for instruction. The purpose of this study was to discover how instructors of the *Principles of Information Technology* course perceive their use of handheld devices, since these devices provide opportunities for students to become digital literates in their academic learning. The following questions guided this research:

1. How do CTE teachers describe the influence of in-class use of handheld technology devices for their pedagogical practices?

2. How do teachers perceive their competence to use handheld technology to support student learning?

3. How do CTE teachers characterize successful in-class use of handheld technology for student collaboration?

Principles of Information Technology teachers were interviewed. The interviewer documented the resulting conversations. This case study included 8 *Principles of Information Technology* teachers in a large urban district in southern US. A case study methodology is recommended when trying to understand a specific situation (Yin, 2009), "its principle being the need to investigate an event in depth and in its natural context" (Crowe et al., 2011, para. 6). For

this research, the specific situation was CTE teacher perceptions about providing technology-supported learning to engage students in learning skills.

Setting

The site was a large suburban school district in southern United States. Eight teachers from four early college high schools' *Principles of Information Technology* faculty were interviewed. These participants were from the following schools: High School 1, High School 2, High School 3, and High School 4. Participants' confidentiality was maintained using pseudonyms. The participants are *Principles of Information Technology* teachers who use handheld technology as instructional tools to teach or support technology literacy in problem solving in the classroom. A letter was sent to teachers meeting the criteria, inviting them to participate in an interview.

Participants and Sample

The first step in data collection was to identify the participants and sites to be studied. Creswell (2012) points out that,

> The process of collecting qualitative data is to identify the people and places you plan to study. This involves determining whether you will study individuals or entire organizations (e.g., schools) or some combination. (p. 141)

Purposeful sampling was used to select the participants. With this purposeful sampling, the researcher intentionally selected participants who could provide relevant information and understand the central phenomenon (Palinkas, 2015). Eight Principle of Technology CTE teachers were identified, both males and females who share common characteristics. The data

was collected only from the purposeful sample of CTE teachers, as they were representative of the population. Allen et al. (2004) explained that "it is best to form a group on similar characteristics" (p. 25), who will create great discussion with stream of individual laughs of given topic (Grudens-Schuck, Allen, & Larson, 2004). In this case study, sampling included the following steps:

- Identifying teachers who met the criterion of using technology to create new and different learning experiences for students.

- Identifying teachers who met the criterion of using technology for instruction and taught *Principles of Technology courses*.

- Identifying teachers who met the criterion of using technology as a pedagogical practice for over three years in the classroom. A teacher with less than three years teaching experience in the district is considered a probationary teacher.

These criteria addressed the participant selection process: teachers who use technology in classrooms regularly for instruction, and who teach CTE courses and use technology to plan lessons and structure collaboration into course design. The criteria for participation were the following: participant is a Career and Technical Education teacher in the urban district in large urban southern US schools, who are teaching the same courses with handheld technology for instruction, and three or more years of teaching service. *Principles of Information Technology* teacher participants are a mix of males and females, so the sample will include the same ratio by gender as the district at large. This inquiry is focused on obtaining data from this purposeful sample of CTE teacher participants.

Letters of invitation to the interviews were sent out to the potential participants. A record of those agreeing to participate was retained and appointments made by phone. Draft consent letters were sent to those who agreed to be interviewed. When permissions were received from the participants to be interviewed and agreeing to be part of the study, the interviews took place.

Data analysis

The interview question responses resulted in transcripts that were coded and analyzed for common and divergent themes. Once the interviews were completed, the notes and recordings were examined, tabulated and the evidence obtained from the study participants recombined. Creswell (2012) points out that "this analysis initially consists of developing a general sense of data and then coding the description and themes about the central phenomenon" (p. 237). In this way, interview notes were transcribed by copying what was said into a word-processed document.

Interviews were conducted with the participants using open-ended questions to explore their lived experiences, in regard to how CTE teachers characterize successful classroom technology utilization for student collaboration, perceive their competency to use handheld technology to connect with their students in classrooms, and currently employ handheld technology to support student learning and engagement. Qualitative data analysis was carried out, including reviewing transcription and notes to make sense of transcript data through a coding protocol.

To ensure internal validity, the researcher followed the strategies recommended by Creswell (2014), so that the data collected were most appropriate for this study "as well as using

different criteria for judging the quality of qualitative research" (Morrow, 2005, p. 250). The researcher used strategies to establish credibility, including member checks. Data from interviews were transcribed verbatim and coded, then themes are derived from the codes to produce an understanding of the findings (Sargeant, 2012).

Follow up questioning was used to ascertain that the participants' responses were clearly presented. This method was used to rephrase and re-ask questions so that responses could "provide the best explanation of what is going on in an inquiry" (Srivastava & Hopwood, 2009, p. 1). Generally, the researcher used the same words used by the participants when examining and coding the information, to ensure that the data was representative of their responses.

Coding is an iterative process that happens over and over during the data transcription, noting frequently used words and phrases. Saldana (2016) suggests that "the quantitative analytic process of coding is cyclical rather than linear" (p. 45). Next, the data (common words and phrases) were grouped into specific units of information in relation to their textual contents which included labeling concepts and developing categories in term of their textual contents. Participant responses were analyzed into emergent themes about the central phenomenon. Their responses were re-examined in a way that allowed their characteristics and meaning to be better understood.

Here is a visualization of the five major steps in this process by examining the "bottom-up" approach to analysis in Figure 1.
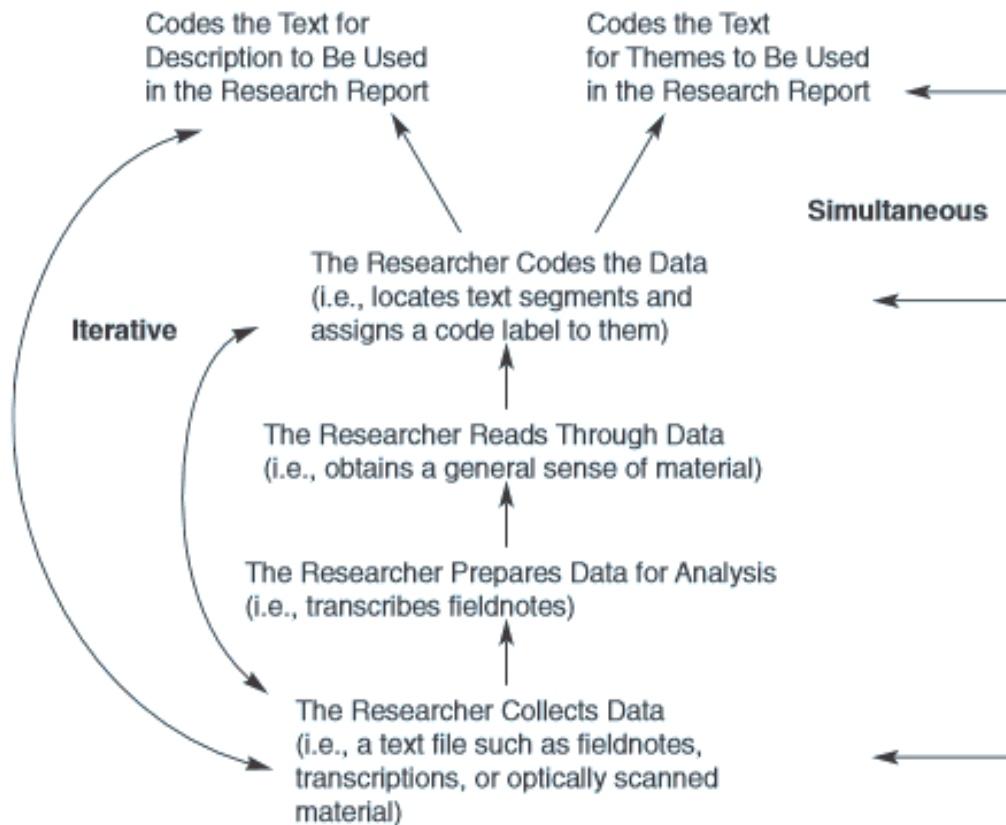
Figure 1. The Qualitative Process of Data Analysis. Adapted from Creswell, 2012.

Participant rights

For this study, the University of New England IRB protocols were instituted to protect the human subjects' confidentiality. The participants involved in this study were contacted and informed consent forms were sent to all the parties involved in this study. Every CTE teacher who was identified as a participant was reminded that participation was optional.

Potential limitations

A purposeful sampling protocol was used in this study to select CTE teachers as participants. Some of the participants were familiar with the principal investigator, so caution

was exercised to reduce any possible unintended coercion and ensure that participation was voluntary. The researcher refrained from any discussion of the research with the member group on this study. Also, the researcher had the participants review their responses to check for accuracy.

The population size of the district suggests that 8 participants are not a fair representation of all CTE teachers from schools in the large urban district in the southern United States. Participant responses were based solely on *Principles of Information Technology* teachers' perceptions, so findings may not be generalizable outside of this research. Likewise, the CTE teachers might have incorrectly represented their opinions during the interviews, which might have influenced the validity and reliability of results. The researcher consistently compared the data in a form member-check, to reduce inconsistencies in the study. As a technology specialist and the agent of this study, the researcher abstained from making inquiries that might lead to the inference that there was a right answer, and maintained a neutral stance throughout the process.

CHAPTER FOUR

FINDINGS

The purpose of this qualitative study was to discover how Career Technology Education (CTE) instructors of the *Principles of Information Technology* course perceived their use of handheld devices to provide opportunities for students to become digital literates. This chapter presents data gathered from interviews with CTE teachers who integrate technology into their instruction. The interviews were designed to capture participants' lived experiences as early adopters of integrating technology into CTE instruction. The data about technology integration in CTE teaching and learning draws on the responses from interviews with *Principles of Information Technology* teachers who primarily teach CTE courses. Guiding this inquiry were questions about how CTE teachers use handheld technology devices within their pedagogy to support student learning.

1. How do CTE teachers describe the influence of in-class use of handheld technology devices for their pedagogical practices?

2. How do teachers perceive their competence to use handheld technology to support student learning?

3. How do CTE teachers characterize successful in-class use of handheld technology for student collaboration?

Analysis of data started in progressive stages, whereby first coding was applied, breaking down the data into concepts and categories. The codes were identified by highlighting examples within the transcripts as well as participants' quotations that aligned with the language of the

participants. Following the first coding, re-reading the concepts and categories allowed the researcher to separate data into themes. During this thematic analysis, the researcher identified four larger themes from the participants' responses.

The areas covered in this chapter include a description of participants, a review of the data collection and analysis, strategies used to ensure the trustworthiness of data, presentation of findings, and a summary of the findings on the interview content collected from the *Principles of Information Technology* teachers during the study.

The Participants

The researcher identified 8 CTE teachers from both genders who teach the same courses in similar types of high schools. Teachers meeting the criteria for inclusion in the study:

- Are *Principles of Information Technology* CTE teachers

- Teach the *Principles of Information Technology* course in one of four high schools

- Have used handheld technology as a teaching practice for more than three years in the classroom.

To protect the participants' identity, they were given the following pseudonyms: Cross, Hook, Bronte, Dupin, Travel, Vine, Water, and Alcott. These teachers provided a description of their daily teaching practices with the use of handheld devices that lead to a technology-enriched instruction. With the use of face-to-face interviews, helpful data was collected for this study contributing to in-depth understanding of *Principles of information Technology* teachers' experiences using handheld technology for instruction.

Table 2

Teachers and Experience Level

Participant	Educational Background	Community	Experience in Public Education	Years Using Technology to Support Instruction
Cross	Master's degree	High school 4	5	5
Hook	Master's degree	High school 4	17	7
Bronte	Bachelor's degree	High school 3	3	3
Dupin	Bachelor's degree	High school 4	5	4
Travel	Master's degree	High school 2	6	3
Vine	Master's degree	High school 1	7	6
Water	Bachelor's degree	High school 3	7	3
Alcott	Master's degree	High school 2	6	3

The range of formal preparation and years of experience is represented.

Participants' Descriptions

Cross

Cross has 5 years of teaching experience in education, and he has been using technology for teaching his classes since he started working with his current school district. He has been at his current assignment teaching Business and Information Technology to students in grades 9 through 12 in all classes for 5 years. Cross and students use school-provided handheld devices to support daily instruction to students to increase engagement. He invited the researcher to come to his class during one of the collaboration trainings organized by two schools. All teachers have interactive smartboards and handheld devices as a part of everyday use in the classroom. During

the class period, he switches between the laptop and smartphone to show a deep understanding of what they are learning.

Hook

Hook has 17 years of experience in public education and 7 years of experience in technology use in the classroom to aid his teaching practice. He invited the researcher to visit his classroom where he teaches *Principles of Information Technology*. In the room, there was an interactive smartboard and handheld device on the desk. Hook uses smartphones and laptops in the classroom, believing they can assist learning to promote students' academic excellence.

Bronte

Bronte has been a teacher in a public secondary school for three years and has been using handheld device technology in her teaching for approximately the same number of years, since she began as a first-year teacher. She teaches *Principles of Information Technology* to students in grades 9 through 12. She uses different technologies in the classroom to aid her teaching: from the laptop to audio and video resources which students can access through their smartphones.

Dupin

Dupin has been a teacher in public school for five years, and she teaches content in *Principles of Information Technology* and Principles of Business to students in grades 9 through 12. Dupin has been using handheld device technology for instruction delivery for the past four years in her classes for learning that is an improvement over the alternative instructional methods. She makes use of a variety of technologies in her classes, including the Interactive smartboard, PowerPoint, videos, laptop and the Internet to present content to students.

Travel

Travel has been a teacher in public secondary school for six years, and teaches content in *Principles of information Technology* to 9th through 12th grade students in his district. He also teaches Algebra 1 to high school freshmen and laptops are an essential platform for providing the content for the use of digital resources, including demos for graphing, Kahoot, and other technology forms.

Vine

Vine has been teaching at the secondary school level for seven years and using technology in his classes for approximately six years. He uses different technologies in the classroom, including laptop, smartphone, and the Internet, as well as email to give feedback on assignments to his students. This teacher delivers the curriculum to students of 9th to 12th grades.

Water

Water is a teacher with seven years of teaching experience and has been using technology in his class for three years in public secondary education to aid students in their academic learning. He completed his bachelor's degree in secondary education in the large urban district in the southern United States. Water and students use technology in their daily teaching and learning respectively to improve learning engagement in the classroom. He utilizes a variety of technology in the classroom to engage in instructional support that students take advantage of in their learning.

Alcott

Alcott has been a teacher for 6 years, and has been using technology in the classroom for the past three years. She teaches STEM education classes: *Principles of information Technology* and Introduction of Engineering curriculum, to help students improve their educational pursuits. She uses the online platform to add substance to the subject they are studying during the class period. Alcott received her bachelor's degree in Business Management from a Southern university.

Data Collection

After receiving the Institution Review Board (IRB) approval from the large urban district in the southern United States to commence the data collection from the identified sites, a letter was sent to each of the four building principals indicating the researcher's intention to conduct interviews with their Career Technical Education (CTE) teachers. All the building principals agreed, and the researcher provided details of the research study and how it will influence the teachers' role in teaching to make learning interesting to students. The support letter from the IRB (Appendix A) was sent to the school district before approval (Appendix B) was granted permitting access to the identified sites to begin data collection.

The data were collected from all the identified participants during interviews. All participants were asked the same structured interview questions and provided an opportunity to clarify their responses. Participants responded to 12 main questions during interviews (see Appendix D) to contribute to an understanding of their use of technology in classrooms.

Data Analysis Method

This study used qualitative analysis to interpret the essence of participants' experiences of using handheld devices for teaching in their classrooms. The researcher began working with data for transcription at the end of the first interview. A member check was conducted by sharing the transcripts with the participants. This approach gives the researcher an opportunity to improve the exactness and believability of a study and therefore forms the filter through which the data are examined across all participants (Sutton & Austin, 2015).

Both the initial interview responses and the member check review or additions and clarifications were considered when determining what the data revealed, and to enhance understanding of the data by identifying themes and patterns. Through thematic analysis, the researcher was able to "distill words into fewer content related categories, with the purpose of providing knowledge, a representation of facts and a practical guide to action" (Elo & Kyngäs, 2008, p. 108).

Follow up questioning was used to ascertain that the participants' responses were clearly presented. This method was used to rephrase and re-ask questions so that responses could "provide the best explanation of what is going on in an inquiry" (Srivastava & Hopwood, 2009, p. 1). Generally, the researcher used the participants specific language when coding and excerpting the information, to ensure that the data represented their responses.

<div align="center">

Presentation of Findings

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After reading and rereading notes and transcripts of the audio recordings of the participants' oral interviews, coding data, and adhering to processes recommended for

interpretation of content, themes were identified. The data collected was analyzed through a coding process that included identifying themes or patterns. The researcher began the process by identifying codes, creating categories, and then developing themes and patterns from the participants' responses. An analysis of the transcripts revealed eleven sub-themes, which were combined into four major themes drawn from the participants' oral interviews, as follows:

1. teachers' use of technology makes learning interesting and engages students in classrooms,

2. teachers have the knowledge and understanding to incorporate technology in classrooms in a way that facilitates teaching and learning,

3. technology helps students make sense of their academic learning, and

4. teachers use technology to support student understanding.

The analysis of this data showed a picture of teachers' perception of in-class use of handheld technology in learning environments with effective pedagogical practices that lead the way to improving teaching in the classroom. These four themes with definitions and examples are presented below:

Table 3

Themes, Sub-themes, and Examples

Themes	Sub-themes	Examples
Theme 1: Teachers' use of technology makes learning interesting	Making instruction relevant,	"I used Kahoot with other instruction as a game to get students to compete in answering

and engages students in classrooms.	Cooperative classroom activities	questions in order to elevate their attention span and to try to win a price." (Cross) "I used Quizlet live in the classroom as a group, where students compete with another, and watch them talking and sharing information." (Bronte)
Theme 2: Teachers are knowledgeable and understand how to incorporate technology in classrooms in a way that facilitates and improves instruction.	Teacher knowledge, Comfort levels with technology	"I am a different teacher now compared to the teacher I was fifteen years ago because of technology integration into instruction. It provides an immediate feedback on student learning and to make necessary adjustment to lessons." (Bronte)
Theme 3:	Enthusiastic Increase student interest in learning,	"The students are enthusiastic to take something and use it in a real-world situation, where they were

Technology helps students make sense of their academic learning.	Develop solutions to problems	able to design and see the product using technology." (Hook)
Theme 4: Teachers use technology to support student understanding in a collaborative environment.	Collaboration, Engagement, Students' relationship to peers, Control their learning	"It allows them to use google classroom or other apps in the hub for collaboration to depend on their peers." (Travel) "I found a google document as an essential tool for collaboration, I let students used it in the classroom to present their projects in the Cyber Security where students take part." (Bronte)

As depicted in Table 3, the four themes and eleven sub-themes identify common experiences among the participants. These themes are reflective of the responses gathered from the interviews and emerged from the coding process.

Theme 1: Teachers' use of technology makes learning interesting and engages students in classrooms

The first theme revealed from the participants' interviews was how handheld device technology use makes learning interesting and engages students in different classes. Most

participants described the utilization of technology as a tool for supporting instruction in classrooms. Technology integration within instruction and assessment allows teachers and students to apply computer and technology skills to teaching, learning, and problem solving. The use of technology does not replace the teachers but enhances their daily pedagogical practice. Teachers are excited by technology and interested in the ways in which they can use it to help their students understand the content better, solve problems, and find their own problems.

The participants believed that handheld technology integration in classrooms is usually beneficial for daily instructional practices to support learning and enable students to personalize learning and express what they have learned. Bronte mentioned:

I used dynamic geometry application on the laptop computer where the students explore graphs and the properties of geometric objects in the classroom, then, they discuss and analyze their exploration, which they then copy and paste into their OneNote book and register the activity they did with exploration.

In addition to district-provided handheld devices for teachers and students and the online portal, there is an abundance of resources available to teachers in the form of software. Integration of technology use varied from teacher to teacher, as preparation time for using technology in classrooms is not the same.

Water mentioned how he uses technology integration in his classroom: "In my classroom, I let the students use laptops and the textbooks to create a chapter presentation to improve the content understanding. Students will use the presentation software to show their work in the

classroom." Alcott commented that she incorporated handheld device technology in her classroom, which led to her response:

> Students used their laptops to complete an interactive lesson through fixing image lighting, and they carefully had to go in and follow the specific instructions to determine whether they will be able to make adjustments and apply the correction.

This theme described the participants' perceptions on how handheld device technology was incorporated into their everyday pedagogical practice to help students in their academic outcomes. Participants in this study indicated that the use of technology to support learning of their students has allowed them to make connections between their pedagogy and their use of technology in classrooms. Teachers also mentioned that the presence of handheld device technology in classrooms has provided meaningful opportunities for students to gain deeper understanding of the course content.

Cross also reflected that technology integration into classroom activities is motivated by students, further he said: "Students are naturally attracted to technology and motivated by lesson designs with technology integration, tool of this generation". Travel also elaborated on the use of technology in classrooms which "provides opportunities to participate in a group like setting, having students sharing their responses with peers, students feel more confident and in control of their education". It was also indicated by Hook that the use of technology in the classroom has the following opportunities:

> students of nowadays have grown from infant to adults and already using the technology, and so, all we are doing is putting technology to use for the educational purposes,

something that they are already very familiar with, which makes them more in line, to be
interested in their learning.

Theme 2: Teachers have the knowledge and understanding to incorporate technology in classrooms in a way that facilitates teaching and learning

Cross, Hook, Bronte, Dupin, Travel, Vine, Water, and Alcott reflected that technology is an essential tool for teaching to make learning more fun and interactive, and customizable, which in turn provides opportunities for a student in an active learning environment, and connections to the real world. Cross began by discussing what had impacted his teaching during class time delivering lesson plans to students:

Technology has prepared me and influenced my role in teaching because it makes things interesting and relevant for students in the 21st century. It takes them from sitting in rows, and gives them more of an internet activity, and a role in learning. For the kids nowadays, they have grown up from infants to adults, already using the technology. And so, all we are doing, is putting technology to use for their education to use for their educational purposes, something they have very familiar with, which makes them more in line, to be interested in their learning.

Hook mentioned using technology as a tool for communicating better with students, but commented on how it helps him to enhance his teaching strategies:

Well, the role of technology and my teaching, it helps you and for myself, it helps me grow as a teacher. Where it allows me to… come and address a certain concept to

students using technology that I probably wouldn't have reached that particular concept without technology.

Bronte described how using technological tools in the classroom in different ways has helped him to increase students' learning:

It has influenced me in so many ways. I could say that I am a different teacher now compared to the teacher I was thirteen years ago, and everything is because of technology. I can see how you can use technology for students' learning activities in my own strategies. You can have immediate results about the students' learning progress, and from those results you can adapt to your teaching strategies. It has been efficient for me.

Dupin commented on the use of handheld device technology during class time while delivering instruction to students:

It allows you to be student-centered not teacher dependent in the classroom. In the past, what I did in my class was direct teaching to guide students in their learning. I was completely in control of the class always, because of technology implementation in my lessons I could manage my class a lot easier by facilitating more than directly instructing in different area of the daily activities. It made teaching in the classroom more easier for me to take my hands off the class a lot more.

Travel talked about the technology training he had received that relates to improving his teaching practice in the classroom:

It allows me… to reflect as a teacher. I can adjust my classroom instruction because there are times that technology can help the teacher better understand students needs and so

having been trained to use a particular technology. Technology allows me as a teacher to reflect and adjust my teaching.

Travel went on to add:

Other technologies provide resources for teachers and students; with these technologies, I could put formative assessments online, just as a living document that students can check their progress, where I can give feedback to them. Allows me to give more assessments to keep on assessing my students to meet their needs

Relating his experience of the classroom, Vine responded during the interview as using technology as a tool to affect his teaching, and revealed that:

Technology has been helping me with the creation of students' learning environment, making instruction as a student-centered classroom. I let students use their handheld devices to get their hands-on activities during the learning process to transform teaching into a model of connected learning.

Water also revealed his experience of including technology in the lesson plan designs during class time, he conveyed:

I have incorporated technology into my teaching. So, I am more flexible, efficient, and effective with the use of technology in delivering instruction to my students and helping them to improve their learning. Many students are aware of technologies; they are not new to them, because they can create an environment fits for the principle of learning.

Alcott described her use of technology in the classroom to provide alternative learning strategies, allowing students to master the material: "Well, it has given me more options on how to scaffold

instructions and how to check for understanding more quickly. So, it is beneficial for me… and delivering my instruction to students."

She had this to add:

> I had gone to training and that has been beneficial to me. They taught me basically how to embed videos, those kind of things, and to post discussion board with the lesson plan to assist students grasp the content better.

Vine commented on accessibility, based on his experience in the classroom:

> The way I set up on the web, my students are prepared to solve and analyze information. They can view videos, take notes, and ask questions to help them as they go through the problem-solving process. So, it is not just them sitting and watching or getting assignments on there. It is an interactive based learning, and I think that's very helpful for the students.

The participants in this study have experienced the impact of technology on their pedagogies as influencing students' learning in the classroom. Teachers use technology to make learning meaningful for students and they engage more in their learning. All participants said that technology is a good use of their classroom instructional time for connecting with students in a student-centered learning environment. These teachers also mentioned that the use of technologies in preparing lesson plan designs has guided them through their daily instruction delivery.

Theme 3: Technology helps students make sense of their academic learning

The participants see technology as a teaching and learning tool, and make use of it in the classroom to aid secondary school instruction. Besides the importance of the teacher employing technology in the classroom is an essential tool for secondary school students to support their academic learning and gives students opportunities to work together with their peers, bringing about mutual gains. Some examples of the participants' responses are recorded below as illustrating their ability to use technology to motivate students to engage in an environment conducive to learning: Cross pointed out that in his classroom, "I usually have my students work in a group-like setting, assign them datasets as a group-like learning approach in which scholars moved to different groups to assist their peers understanding the pieces of the lesson".
Bronte commented on the use of technology in her classroom, involving students taking active roles in their education. She responded:

> Absolutely, the use of handheld device technology influences in so many ways. I would say the students feel a natural attraction towards technology. They feel originally motivated in the use of technology, but what I found more interesting is that, students who did not normally participate in class activities, kind of quiet and don't say much during class time, and ones that are confident sharing their answers during class activities. With technology integration in classroom instruction and learning, these students are more confident in sharing their experience and taking control of their learning in a group setting.

Travel also stated the following about using technology to involve her students in the classroom:

I think handheld device technology influences their engagement in classrooms by making

students more accountable for their learning pace. With Plicker simulation application

during the instructional time, students give responses to questions to access their

progress. Also, it allows students to manipulate different variables like for example,

increase or decrease the mass of an object and what happens to the force. It allows the

students to think more creatively.

Vine talked during the interview about using technology as an interactive tool to motivate his

students in the classroom, when he stated:

Well, it allows me to do small group interaction with a different situation for my students

learning goals. The students work at their own pace using different applications, books

online, assignments online and watch videos. The students can get help while working on

their class work.

Alcott also contributed to using technology in a student-centered classroom to increase student

engagement with the learning process and mentioned that:

Technology use in the classroom makes learning more fun for the students if the content

is right to justify the use of that technology. Through the use of videos and

documentaries, online [instruction] can be more engaging for them to use handheld

devices.

With this theme, teachers are using technology to promote students' learning potential in

the classroom construct. One should view teachers' technology use as supporting the acquiring

and building of knowledge in an environment that is comfortable to students. It is also used for

collaborative learning among students, where different strategies are employed to help students work together to achieve instructional objectives. Teachers use this constructivist theory to assign an active role to students in their learning process, so that students take control of their academic learning.

Theme 4: Teachers use technology to support student understanding in a collaborative environment

Seven of eight participants recognized the contribution of handheld device technology use in their everyday practices, and furthermore, they responded to the types of technology being used during their instructional practices in classrooms and what impact that use was having on the content delivery to support students' academic learning. In this study, during the data coding, the participants' responses were all connected to teachers' practices in classrooms. Cross stated the following during his interview, about the importance of technology accessibility in the classroom to enhance teaching:

> I used Kahoot as a game that students like to be able to get into the competition, and what happens is that it has multiple questions I can use for a review, the students get points, it encourages students to answer questions correctly because of the stoke of the competition. It helps the students to elevate their attention span on the questions to try to win a prize.

Hook responded to the individual use of technology and its accessibility in the classroom to provide access to teaching materials and facilitate classroom discussion for students to understand the subject matter:

Well, this past week… the students have their laptops where I was able to have them

designing pictures using the equation of a line in the Demo graphing application, while

students are restricted in the domain and the range. They were able to produce pictures

using their laptops to design pictures and write the equation of a line.

Access to technology in the classroom influences Bronte's teaching practice. She contributed her

personal experience with technology use in her lesson plan designs, thus:

In all my classes, I used the dynamic geometry application on the laptop computer. The

students explore the graphs and the properties of geometry object, they discuss, analyze,

and they copy and paste their findings on their OneNote notebook to record and register

the activity they did with exploration.

Dupin contributed to the idea of using technology to support instruction in the classroom, saying,

"In the course that I teach, we (teacher and students) used the online platform, where an

abundance of technology applications is housed for instructional purposes to help students see

the lessons through the videos." In addition, during Travel's interview, he expressed his

perspective by explaining, "We used the handheld devices in a simulation of projectile motion,

and for the formative assessments with the Plicker application to access the understanding of my

students." Travel had this to say about his use of technology in the classroom to provide support

for students' daily learning objectives, "I integrate technology usage in my classes, allowing

students to collaborate, for example, using a google classroom platform from the district hub and

other application in combination to drive my instruction."

Vine detailed that, for him, technology use during the class was a priority for delivering instruction:

Well, it allows me to do small group interaction with different situations for my students' learning goals. So that… the students can work on their own pace. Students have access to programs, online books, assignment online, as well as videos. Students can do their assignments online, they can get help on the task they are working on at the same time.

Alcott's experience with technology accessibility in her classroom was as follows:

"It makes learning more fun for the students, if the topic is boring, then through the videos, documentaries online, and it can be more engaging for them to… use handheld devices and it helps them again to be engaged."

Except one, the rest of the participants mentioned that the availability of different types of technologies in classrooms allows them to teach students to connect them to their learning. Each type of technology has potential for educating students in a specific learning content. In a course designed to teach about Information Technology, the teacher may introduce software through a video presentation in classrooms to help students have a deeper understanding of the topic through modeling the process that students will complete.

Cross responded as to the ways he allowed his students to employ technology use in their daily activities:

Students are prepared to use technology, that is if we are looking at how students are using social media nowadays, as well as communicating with their teachers. It is very

prevalent. My students used a variety of technology tools to complete assignments, and

create projects that reflected what they have learned in the classroom

Hook expressed his view, stating: "Students can distinctly use their technology devices to dissect

the slope of a line, *use* search engines to find information on the Internet, and use other

technologies for the check mechanism on their answers to assignments."

Bronte went further, explaining what her students have accomplished using technology in her

classroom:

> I think the students have more tools in their possession to analyze and consume
>
> information if technology is available to them. Students had the opportunity to with an
>
> activity where they connected sensors to their laptops, and model some graphs, and from
>
> the graphs, they had the opportunity to analyze the representation of the graphs based on
>
> the experiment they were modeling. They could see the coordinates of the points
>
> representing the graphs, So, that's an interesting example, how students can use
>
> technology to solve problems, and connect with some other subject area.

Travel believed that if students have access to technology in the classroom, more assignments

could be completed during the class period:

> Students like technology, as a resource; they use it to find the meaning of words or a
>
> concept they do not understand during the class period by googling it. It is just there at
>
> their fingertips. Students used other technology tools to support their learning process in
>
> the classroom to complete their assignment on time; for example, the use of technology
>
> helped students to gain an understanding of graphs and the motion of objects.

Alcott revealed that students' use of technology has facilitated student learning by working with other students to stay on task and to take ownership of their learning:

> They are pretty much prepared, they know how to find credible sources instead of just relying on things like Wikipedia. So, they know how to search for credible sources to determine whether their sources are fake news or whether it is real or authentic.

These findings demonstrated that the students' use of technology is essential to their learning in a current classroom environment. Students depend on these technologies to extend their learning beyond the teaching in the classroom and enable them with learning options. Technology use beyond classrooms allows students to explore other areas of the subjects to manage their learning. Teachers allowed them the use of technologies, including smartphones, iPads, laptops, and tablets, to complete their assignments and to create projects as part of the lesson plan designs.

Summary of Findings

In this section, the four themes identified were: 1) Teachers' use of technology makes learning interesting and engages students in classrooms; 2) Teachers have the knowledge and understanding to incorporate technology in classrooms in a way that facilitates teaching and learning; 3) Technology helps students make sense of their academic learning; and 4) Teachers use technology to support student understanding in a collaborative environment.

In theme 1, teacher's descriptions of their use of technology to make learning interesting and engaging students in classrooms were presented. The analysis of the transcripts indicated that many teachers view technology as a tool to support their teaching and learning. Teachers

believe that integrating technology into instruction creates new opportunities for students by bringing real-world problems into the classroom to explore. According to responses given by teachers, they use technology to make learning more fun, flexible, and engaging, which makes students willing to become part of the classroom learning environment. Teachers mentioned the use of technology in ways that open possibilities for bringing different students together and providing them with the opportunity to create an authentic discussion.

The second theme reflects descriptions by teachers about knowing how and having the understanding to incorporate technology in classrooms in a way that facilitates teaching and learning. Teachers use a variety of methods to affect their teaching, so that students can have a deeper conceptual understanding of what they are teaching them. Teachers discussed how they used technology in their classrooms to support students' academic learning, and to assist them in presenting information to students in a clear manner. The data showed many teachers integrate technology into teaching as a bridge to different learning styles in students. Teachers are finding ways to determine how to use handheld devices in classrooms to impact their teaching and how to deliver instruction to students in a meaningful manner.

The third theme addresses the factors described by teachers that relate to technology helping students make sense of their academic learning and engaging in their education. As teachers reported, they encourage a student-centered learning environment, trusting the learners to take an active role in their education and believing in their capacity to lead. They claimed that technology can be very effective; each participant found ways to incorporate technology into the lesson plan designs to support the purposes of learning. As technology is becoming more and

more important, teachers described the essential changes that they see happening in classrooms due to technology. Teachers are becoming facilitators rather than lecturers. As a result, students are taking control of their learning while discovering new meaning. With technology integrated instruction, teachers become facilitators, and they are there to coach and support their students while they guide their own learning.

The final theme illustrates the social dynamics teachers described while using technology for collaboration to improve students understanding in classrooms. Teachers use technology to expand collaborative relationships with their students and ensure that students share their knowledge, treat each other with respect, and support to reach their best with relevant instruction, leading to high levels of understanding. Collaborative learning environments as reported by teachers provide students with a framework that structures learning objectives of what is being taught. Teachers believe that, collaborative learning environments also provide options for activities and assignments that include facilities for sharing and discussions. These options give different student an opportunity to capture their interests and encourage them to assess what they learn.

<div align="center">**Conclusion**</div>

The findings suggest that teachers use technology to support students' understanding in the classroom. Many participants in this study understand the role of technology tools in classrooms. These participants used a variety of tools to provide feedback to students and assess how well the students understand the subject matter. There is no limit to the way teachers can use technology as an instructional aid. Integrating technology into lesson plan designs depends on

how well the teachers use technology in the classroom to help students deepen their

understanding of new information. The findings showed that when students are adept at using

technology in classrooms, they use it build deeper understanding of the concepts being covered.

Students using technology in classes go beyond what they are learning and engage themselves in

other ways to learn.

CHAPTER 5

CONCLUSION

The researcher conducted this case study to document Career Technology Education (CTE) teachers' experiences with the use of handheld technology devices in classrooms. Handheld device use in secondary schools continues to be viewed as a support to teaching and learning in education to improve academic excellence for students and to accelerate their learning. To improve access to these devices, schools around the nation have provided to students and teachers personal handheld devices to promote innovative teaching methods such as exploratory and cooperative learning and learning outside the classroom, which contribute to greater student engagement (Sung et al., 2016).

The importance of this study is providing teacher perspectives on the implementation of handheld technology. The study adds to the body of knowledge about the pedagogical role that technology plays in instruction to increase student engagement in academic learning. The findings of the last chapter suggest that student use of technology in classrooms was encouraged by CTE teachers in their daily activities for the students because of its potential to increase engagement in learning. This conclusion is supported by the findings from the participant interviews carried out during the course of this study, where the identified themes reflect the impact of the use of handheld devices in classrooms for teaching and learning.

Eight *Principles of Information Technology* teachers representing four different early college high schools teaching similar courses were chosen to participate in this study. All participants were interviewed about how they integrated technology into their daily lesson plan

designs to influence learning engagement of students. The responses from the participants articulated the current use of technology in their pedagogical practices within their daily experiences. After the data collection, the data was analyzed and coded to document the participants' current in-class use of technology integration experiences. Within the context of this study, the researcher identified common themes that emerged from the content of the interviews. These will be presented and aligned with the findings of what other researchers have discovered and to the conceptual framework for this study.

Additionally, the findings in this study provide the foundation for specific recommendations for future research on promoting higher student academic achievement through the integration of technologies into instruction and equipping students with the essential skills required to succeed in their academic learning.

Interpretation of Findings

In this study, the common themes identified by the researcher showed that the use of handheld device technology in the classroom assisted teachers in their pedagogical practices to improve the delivery of instruction. To answer the research questions, participants described the use of in-class handheld device technology to provide authentic learning experiences to students, where they discover their own learning in the process. The findings revealed that participants believe that technology integration in classrooms increases learning engagement in the content being taught and students' interest in their learning. Four common themes emerged from the teachers' responses during the analysis of the data.

The first theme revealed that the participants reported that their use of technology makes learning interesting and engages students in classrooms. The second theme identified was that teachers had the knowledge of and the understanding to incorporate technology in classrooms in a way that facilitates teaching and learning. A third theme indicated that technology helps students make sense of their academic learning. The fourth theme revealed that teachers use technology to support their understanding in a collaborative environment.

Research Question One

Research question 1 asked: How do CTE teachers describe the influence of in-class use of handheld technology devices for their pedagogical practices?

The first research objective was to describe how teachers incorporated handheld device technology and technology's influence on their teaching practices. Most teachers responded by discussing the utilization of technology as a tool supporting instruction in classrooms and making learning more engaging and fun for students. Technology integration in support of teaching is to allow teachers and students to apply computer and technology skills to teaching and learning and problem solving. The use of technology is not replacing the teachers but enhancing their daily pedagogical practice. Teachers are excited by technology integration and interested in the ways in which they can use it to help their students understand the content better, solve problems, and find their own solutions.

CTE teachers discovered that students' use of handheld devices increases their rate of completing assignments, as they used handheld devices to write notes, browse the Internet, make presentations, do homework, take tests online and were provided with immediate feedback on

assessments. These teachers made changes to their teaching methods to link their students to course content and resources to help them improve their own instruction and personalize learning when they had opportunities to use handheld devices to create learning effect. CTE teachers connected students to the real-world problems by introducing them to workplace competencies that broadly prepare them for a transition into the workplace. And, CTE teachers provided practical learning experiences to students in form of hands-on activities and skills to improve employability for the 21st century. Considering Asunda's (2011) research on career and technical education teacher preparation trends, as he states: "education for employability, broadly conceived and for the long term, and as generally and specifically provided through CTE is within the purview of public education at the secondary, post-secondary, and adult levels" (p. 10). Drawing findings from this research question, teachers want students to be problem solvers and collaborative team players, and they strive to personalize responses to students' needs. Technology should be integrated into their everyday classroom activities, so those tools can help students to achieve academic learning objectives and prepare for the world of work.

Research Question Two

Research question 2 asked: How do teachers perceive their competence to use handheld technology to support student learning?

This research objective was to describe the participants' perceptions on how handheld device technology was incorporated into their everyday pedagogical practice to help students attain required academic outcomes. CTE teachers have the knowledge and understanding of how to implement technology use to support students' learning. CTE teachers use digital literacy in

subjects of the curriculum to address the changing nature of the 21ˢᵗ century education required

by the workforce. These teachers use their competence with technology as a lever to drive

instruction in classrooms for different purposes, such learning tools and information tools. CTE

teachers believe that teachers' skills and schools' structural support are essential for instructional

delivery, making teaching and learning in classrooms more relevant and engaging; ensuring

students are equipped with technical and employability skills to enter career fields. CTE teachers

implement and modify their instruction practices in response to the needs of students in

classrooms now and relevant to their future academic interests. Teachers make choices about

teaching strategies "to meet daily learning goals for students and improve student's outcomes in

various environments and postsecondary readiness" (NBPTS, 2016, p. 53). For example, a

Principles of Information teacher and other teachers worked cooperatively and addressed their

students' interests by creating a joint Cyber Security Project requiring students to apply

knowledge learned in CTE classrooms and present it campus-wide. CTE teachers guide students

to their future career to help them see the relevance of what they are learning.

All participants recognized the contribution of handheld device technology use in their

everyday practices, and furthermore, teachers described the types of technology being used

during their instructional practices in classrooms and what impact that use was having on the

content delivery designed to support students' academic learning. Each participant could

describe their perceptions of using technology to support their pedagogical practices in the

classroom. Participants reflected that technology is an essential tool for teaching to make

learning more interactive, fun, and customizable, which in turn provided opportunities for teachers to create a student-centered learning environment and connections to the real world.

Besides notebooks, laptops, tablets, iPads, and smartphones are additional learning devices for contemporary classrooms. Teachers are using these handheld devices to assist them in reinforcing and expanding content. Videos, interactive presentations, and audio visuals are among the other technologies that keep students actively engaged in their lessons. The adoption of handheld devices in the classrooms has changed the way students approach their learning, as these devices have become learning tools that provide interactive media as part of the classroom instruction (Montrieux, Vanderlinde, Schellens, & De Marez, 2015). Students are apt to learn when teachers present lessons in ways students can interact with, such as hands-on learning that drives authentic understanding. Technology in classrooms can improve teaching practices by adjusting the lesson plan designs and instruction to meet the needs of students through differentiated instruction and improving remediation for students to succeed in their academic pursuits. Smith and Thorne (2007) revealed that "Technology improves performance when the application adjusts for student ability and prior experience, and provides feedback to the student and the teacher about student performance or progress with the application" (p. 8).

Research Question Three

Research question 3 asked: How do CTE teachers characterize successful in-class use of handheld technology for student collaboration?

This research objective sought to describe how the CTE teachers characterized successful in-class use of handheld technology for student collaboration and create environment that

increases student performance. CTE teachers apply strategies to achieve greater student

academic learning in secondary schools to make teaching and learning in classrooms more

rigorous, thereby providing students with opportunities to participate, learn about and experience

careers of technical education. It indicated that participants used technology integration in CTE

classrooms to make learning relevant, and encourage changes in the roles and responsibilities of

students, offering the chance to increase students' interest in their learning. For example, in a

Principles of Information Technology class, teachers had students use multimedia elements to

vary content delivery. Instruction included were graphs, sound effects, images, and short video

lessons in order to help students understand the learning objectives. Teachers believe that

technology is well designed for collaborative work environments, since students can use it to

influence their participation in the learning process work without being in a similar location.

CTE teachers use technology to increase student collaboration through work-based experiences,

classroom projects, and career related activities sponsored by organizations (NBPTS, 2016).

When technology is used as a collaborative tool in a way that can promote student engagement to

mimic their everyday experiences outside the classroom, the activity tends to be more

meaningful to them. For example, using a tool like Twitter platform to encourage student

collaboration to bring what the students are already familiar with into the classroom increases

student engagement. CTE teachers find ways to integrate technology in the classroom that can

prepare students for postsecondary opportunities and possible connections for them based on

industry demands. Technology can promote student exploration through collaboration, and

teachers must have the capacity to use this tool to implement multidisciplinary lessons in the

classroom. In this environment, change in the content strives toward one of the defined learning objectives the students need to acquire.

Implications

Handheld devices are becoming a force for good in the classroom across secondary schools in the nation. However, teachers must not consider in-class handheld device technology as the primary contributor to student learning. Teachers as facilitators and coaches need to guide their students to use technology in ways that promote students' academic pursuits. Research has indicated that the use of in-class handheld devices offers students the potential to construct and share knowledge in classroom environments (Montrieux, Vanderlinde, & De Marez, 2015).

Teachers' comfort with technology will be reflected in the implementation and overall use patterns in the context of facilitating students' engagement. With an adequate comfort level among teachers using technology, they have found ways to transform learning in the classroom so that the experience of student learning is beneficial for the teacher and students. Teachers can provide positive modelling for students to embrace technology, that technology in the classroom is a part of the current classroom environment and cannot be ignored.

Limitations and Recommendations for Further Study

One of the limitations of this study is that generalizations can't be provided from one case study. Given that one researcher collected data within his home district, readers may question bias in the research that may influence results. Utilizing diverse methodological designs will generate additional data to add to this study's results. A qualitative case study can be criticized for its lack of generalizability and the tendency for a researcher to have a biased

interpretation of the data. A purposive sampling was used to select eight participants who are Career Technical Education teachers and allow the researcher to answer the research questions. These participants were Career Technical Education (CTE) teacher identified within four high schools in a large urban school district in the southern United States who teach similar course content.

This study revealed findings from the eight participants from four "early college" high schools in the large urban district in southern United States. These findings are drawn from the participants' responses obtained during the structured interviews about how they use in-class handheld device technology to enhance CTE instruction. According to Hew and Bruch (2006), "self-reported data may not give an accurate depiction of how technology is used because teachers' beliefs, intentions, or perceptions do not always translate into practice" (p. 246). It is recommended that future inquiries investigate in-class use of handheld device technology in other districts.

This study also focused on CTE teachers teaching similar courses in four different high schools in the same district, who had used different types of technologies to teach students in CTE classes to achieve academic excellence in classrooms. The general findings about handheld device technology use in the classroom describing the specific pedagogies and perspectives of teachers should be evaluated in the context of other studies, along with the technologies that encouraged and supported this change.

This study's findings showed that teachers are using technology as a part of their pedagogical practice. It is recommended that, to continue to increase the ease of in-class

handheld device technology use for teachers, this technology should be available to them for use within the classroom and beyond to constructively design lesson plans to fit the principles of students' learning. A school district's professional development goals that are consistent with the school improvement plans can support this recommendation.

This study found that each of the participant teachers used technology as a collaborative tool to provide instruction to students every day. It can be argued that this use of handheld device technology can provide new teaching approaches and change in beliefs (Montrieux, Vanderlinde, & De Marez, 2015). The researcher recommends future research to investigate how in-class use of handheld device technology can hinder collaboration with peers during class lesson activities. It is also recommended that further research investigate how the use of handheld device technology skills translates into improved teaching.

<div align="center">**Recommendation for Action**</div>

The following recommendations for action for teachers were derived from the lessons learned in this qualitative case study, based on the participants' experiences of using in-class handheld device technology for teaching:

- Teachers should maintain an interest in new technology and know how it fits with improving their pedagogies in the classroom. The use of technology in the classroom needs to be a proactive practice of teachers.

- Teachers should use technology to better provide personalized learning experiences driven by students' interests, strengths, and needs.

- Teachers need to learn about certain strategies that can help students with different learning styles achieve attainable objectives. Technology must be used to guide educational experiences that reflect students' learning strengths.

- This district should implement strategies to encourage teachers to create integrated lesson plan designs that could help students achieve their daily intended objectives. Students need adult supervision to develop them in the current environments in the technology infused classrooms.

Conclusion

Integration of in-class use of handheld device technology in the classroom has been observed across the secondary schools in a large urban district in the United States. Whether or not the teachers are appropriately applying this technology into their pedagogies to teach students to take advantage of their academic excellence depends on the teachers' beliefs. During the investigation of this study, teachers expressed a positive attitude and competence toward the use of technology in their teaching lesson designs. Each research question and the findings were clearly identified and analyzed through the lens of the coding process.

The following four themes emerged from the data collected from the teachers during the structured interviews: (1) Teachers' use of technology makes learning interesting and engages students in classrooms; (2) Teachers have the knowledge and the understanding to incorporate technology in classrooms in a way that facilitates teaching and learning; (3) Technology helps students make sense of their academic learning; and (4) Teachers use technology to support student understanding in a collaborative environment.

These themes can help educators and policy-makers understand how teachers are using in-class handheld device technology to support their teaching roles in the classroom. Teachers can now expand their technology-based instruction to include other technologies (google docs, Microsoft 360, Moodle platform, etc.) in the curriculum. The findings indicated that the teachers were comfortable in using technology in their teaching practices to influence the students' learning, and therefore, other teachers can risk adopting it into the curriculum to make their teaching more effective, because it is important for teachers to strive for excellence in their work, since that improves student performance outcomes. District leaders must support the teachers in their technological skills to make learning more interesting and meaningful for students.

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Appendix A

Interview Protocol

Introduction: I am a doctoral student through the University of New England. I am studying how in-class use of handheld technology provide support for students' academic excellence. Your input will be valuable for improving teachers' pedagogical practices for the school district and other similar communities. I will ask you a series of questions and then allow time for more comments and questions from you at the end.

Demographic information (if not already collected through our conversations; otherwise, verify responses to warm-up the conversation.)**:**

What is your name? _____ (will be kept confidential)

School? _____ (will be kept confidential)

Phone Number? _____

Email? _____

Job Title? _____

Approximately how many students are in your classroom? _____

How long have you been teaching this CTE course? _____

What is your gender? __ Female   __ Male

Which age range are you in? __ 25-30 years old, __ 31-39 years old, __ 40-49 years old, __ 50-

59 years old, __ 60+ years old

What is your race/ethnicity? ___ Caucasian/White, __ African American/Black, __ Hispanic, __

Bi-racial, __ Other

What is your native language, first language? __ English, __ Foreign, __ Other _____

Which grade level of students are in your class?

___ 9th grade, ___ 10th grade, ___ 11th grade, ___ 12th grade

If you act as a CTE teacher providing support to students' learning with handheld technology to influence their engagement in the classroom, provided your ***answers based on your teaching methodologies and experience in integrating technology into your lesson plan designs in the classroom.***

1. How long have you incorporated handheld devices in your classroom-based teaching?

2. Can you give me an example of a recent lesson where you used a handheld device in combination with other instruction?

3. Can you describe how in-class use of handheld devices influences students' engagement in classrooms?

4. How does in-class use of handheld device technology address students' learning in collaborative group?

5. How has technology prepared you in college as a student?

6. How has technology training influenced the role of your teaching?

7. Have you attended professional development training that supports using handheld devices? Can you describe specific training that influenced your teaching practice using handheld devices?

8. Has your use of handheld devices change over the time you have used them? Can you describe a lesson you taught previously without a handheld device, and now use the handheld technology?

9. How prepared are your students in using technology for communication? Can you give me an example of what they need to know, or what they have learned in your class?

10. How prepared are your students in using technology for analyzing and problem solving? Can you give an example?

11. Do you have recommendations for the effective implementation for handheld device use in the classroom teaching?

12. What other questions do you have for me?

Thank you for your time and for sharing with me your experience with in-class handheld device use in the classroom to support students' academic learning. This information contributes to the understanding of current practices and how we can improve the initiative for the future. Don't hesitate to contact me whenever with any questions or comments. You are welcome to review the dissertation before and after it's completely done.