Transdisciplinary, Academically-Integrated, Themed (TAIT) Units
in the Career and Technical Education Classroom

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The journey from the first term in a doctoral program to degree conferral is one that one does not take alone. I have had several individuals who have supported me throughout this journey. First and foremost, I would like to thank my partner, Pete, who has been by my side every step of the way; from small celebrations of completing a course or chapter of my dissertation to times when I broke down along the way. He has been my cheerleader, my hand holder, and my chief chef when I was too busy to prepare meals during this journey. Thank you also to my parents, Don and Shirley, who have provided their moral support and interest as I underwent this monumental task.

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Abstract

The revision of the Carl D. Perkins Career and Technical Education Act in 2006 mandated the integration of core academics into the career and technical education (CTE) classroom. The purpose of this Stakian case study analysis was to examine the process by which one CTE high school located in the northeastern United States created and implemented transdisciplinary, academically-integrated, themed (TAIT) units in the CTE classroom and its relationship to student learning and engagement. Beane’s (1997) Curriculum Integration Theory was used to examine the perceptions of six teachers – three academic integration teachers and three technical education teachers directly involved in the creation and implementation of these units with high school juniors and seniors within their technical classrooms. The data showed that both academic integration and career and technical education teachers perceived that student motivation, engagement, and learning was increased in the presence of a TAIT unit as a teaching tool. Four types of social integration involving students was witnessed within the TAIT units including student-to-student integration, student-to-society integration, student-to-nature integration, and student-to-family integration. The education-to-career connection between the application of the units and students’ chosen career field facilitated learning in what was believed to be a greater breadth and depth of academic concepts compared to more traditional classroom learning. Implications for practice and future research are discussed.

Keywords: CTE, career and technical education, trans disciplinary, thematic units, teaching
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Chapter I: Introduction

Statement of the Problem

The academic knowledge required for the career and technical education (CTE) student has increased over the last several decades. Today’s skilled trade workers are required to possess a greater background knowledge as to why a system works using critical thinking and problem-solving skills. For example, when criminal justice students examine blood spatter, they do not only need to calculate the angle and direction of the origin, they need to identify the impact velocity and the direction of the cast off, triangulating the attacker’s position. Additionally, a tradesman must understand how to manipulate the process; such as a carpenter who needs to know not only how to calculate a roof ratio but also know when one is preferred over another to accommodate for certain climate conditions such as heavy snowfall. The individuals responsible for the education of career and technical education students are entrusted to embed inquiry-based learning and higher-level thinking skills from a core academic perspective within their lessons to greater facilitate these skills when the student enters the workforce. The curriculum taught within these classrooms must meet not only industry standards, but state and federal education standards as well, and prepare students for entry-level positions within their career field or tertiary educational opportunities.

The purpose of this study was to examine the process of creating and implementing transdisciplinary, academically-integrated, themed (TAIT) units in the CTE classroom and its relationship to student motivation, engagement, and learning. This researcher examined how the implementation of a TAIT curriculum impacted student motivation, engagement, and learning measured by teachers’ observations, final product output, and teachers’ perceptions throughout the implementation process. As defined by Drake & Burns (2004), “in the transdisciplinary
approach to integration, teachers organize curriculum around student questions and concerns. Students develop life skills as they apply interdisciplinary and disciplinary skills in a real-life context” (p. 3). The units examined in this study create cross-sections into the chosen career path of the technical core of the given classroom. The Foundations of Education class studied communicable diseases and prevention through the story of Mary Mallon in the Typhoid Mary TAIT unit, and the human and economic costs involved with lead ingestion in the Flint Water Crisis TAIT unit. The Criminal Justice class studied the ante- and postmortem physiological effects on a human body after a trauma or event and the role of forensic pathologists in an investigation in the Mechanism of Death TAIT unit. The Animal Science class examined animal digestion, cost of feeding, and animal food packaging in the Animal Digestion and Feeds TAIT unit. Finally, the Hospitality Careers and Culinary Arts classes learned about the process of manufacturing maple syrup and the industry in the Northeast U.S. through the Maple Sugarin’ TAIT unit.

Figure 1. Drake & Burns (2004) Transdisciplinary Approach
The initial suggestion that education and occupation have a direct link is explored in Dewey's (1916) *Democracy and education: An introduction to the philosophy of education*, where he states that "education through occupations combines within itself more of the factors conducive to learning than any other method" (p. 361). Since that time, the link between education and occupation preparation has been explored further and has facilitated the concept that core academics can be taught within the context of vocational education, pushing districts and schools to pursue the integration of academic and vocational education.


All career and technical education secondary programs that receive federal funding fall under the auspices of the Carl D. Perkins Career and Technical Education Act (Perkins IV), requiring that core academics be integrated into technical classes. The Perkins Act was first authorized as the Carl D. Perkins Vocational and Technical Education Act in 1984. The primary purpose of this Act was to increase the quality of technical educational programming in the United States. The Act has undergone multiple revisions since that time, the first revision occurring in 1990 and its most recent revision passed in the U.S. House of Representatives in July 2016, and is awaiting approval in the U.S. Senate at the time of this writing. In 2006, the
Act was reauthorized as the Carl D. Perkins Career and Technical Education Improvement Act of 2006, dedicating $1.3 billion in federal funding to career and technical education programs through 2016 (“American Youth Policy Forum”, n.d.).

The existence of the Perkins Act as a legislative factor in CTE education requires teachers to create innovative curricular strategies that both teaches the required academic and technical elements as well as motivates students within their learning. This researcher asserts that the implementation of TAIT units within the CTE environment meets both of these criteria.

**Justification for the research problem.** Perkins IV legislation requires that CTE teachers have a minimum of two documented lessons where they have collaborated with academic teachers (transdisciplinary units) to integrate core academics into the CTE classroom (Senate Report 109-065, 2005). At the study site, this was previously done with integrated lessons in isolation covering core academics based upon the technical teacher’s needs. For example, the English teacher may push-in to a class to assist with technical writing of resumes, or the mathematics teacher would push-in to do a lesson on personal financial management. While some multidisciplinary lessons may have been sprinkled throughout the technical classes, it fell more within the realm of the exception rather than the norm. With New York’s adoption of the Common Core State Standards in both English language arts and mathematics, students are required to be proficient in both critical thinking and problem-solving skills (“Welcome to EngageNY | EngageNY,” n.d.). The paradigm shift to inquiry-based lessons and technical application presented the academic integration team with a new challenge on how to best meet these demands. The implementation of TAIT units within the CTE classroom provides a relevant teaching tool for technical teachers to meet these requirements.
Mustafa (2011) reviewed various curriculum integration models and noted that models based on real-life problems enhanced higher thinking skills. These higher-thinking skills will prove to be advantageous to students who possess them in both tertiary educational settings as well as upon entering the workforce as the skill set required in the job market is fluid; however, the ability to use deductive reasoning and logic within a variety of settings will be an asset to those ready to engage in the 21st century economy. Students who graduate secondary education in pursuit of tertiary education are often woefully unprepared to meet the minimum academic prerequisites for entry into freshman-level mathematics and science classes at their tertiary institutions; requiring remedial coursework at the institution prior to admittance to these 100-level classes. This translates into additional time and expense on the part of the student in an era of increasing student loan debt and loan defaults. Increasing the breadth and depth of core academics within the CTE classroom may help to close this gap so that students are truly meeting the definition of “college ready” upon secondary school graduation.

Deficiencies in the evidence. While the literature has examined both thematic units as a form of curriculum integration in an academic classroom as well as curricular integration in the CTE classroom, there is no definable research examining the impact of student learning and engagement through transdisciplinary, academically-integrated, thematic units in the career and technical education classroom. As a result of this lack of research in the literature, practitioner knowledge and implementation of units of this kind is at best limited in practice. The researcher aspires to introduce TAITs as an effective teaching tool that promotes both student learning and engagement within the technical classroom while framing such concepts in a manner that best facilitates the critical thinking and problem-solving skills that are needed in the 21st century workforce.
Relating the discussion to audiences. According to the National Center for Education Statistics (2008), career and technical high schools compromise 3.7% of all high schools in the United States. Additionally, 82.7% of all high schools in the United States offer some type of career and technical education coursework. All entities that receive federal funding through the Perkins IV Act, must comply with core academic integration into technical classes. Therefore, all programs that receive Perkins IV funding may consider the implementation of transdisciplinary, academically-integrated, thematic units as a potential teaching tool for satisfying the academic program requirements to receive federal funding. As a result, this study will be of interest to CTE administrators and educators who are looking to align current teaching practices to the mandates outlined in Perkins IV as well as the Common Core Learning Standards, Next Generation Science Standards, and technical core or Career Development and Occupational Studies (CDOS) standards.

Significance of Research Problem

High school students are expected to be “college and/or career ready” upon graduation. For career and technical education students, this expectation traditionally translated into preparation for entry-level positions within their chosen trade. Many two- and four-year tertiary education institutions are now offering advanced training in technical subjects, opening the options for CTE students after secondary school graduation. The 1990 revision of the Carl D. Perkins Career and Technical Education Act created a federal mandate that all secondary career and technical education programs must integrate core academic content within the technical classes.

The lack of college preparedness is evidenced in the number of remedial courses offered on college campuses across the country. For many of our career and technical education students
who pursue tertiary education, a natural progression is to enroll in a two-year community college program. A cursory review of a community college in Broome County, NY shows that for the Fall 2016 semester, there are 106 remedial courses offered for students not meeting the minimum proficiency for introductory college-level coursework in the subjects of biology, computer science, chemistry, literacy, mathematics, and physics (“SUNY Broome”, n.d.). The demand for these courses is a direct result of students graduating from secondary school academic programs inadequately prepared to begin tertiary studies. All of the 74 remedial courses offered during the Fall 2016 semester have per-credit-based tuition attached to them; however, none of the credits obtained in this coursework is applicable to any degree program. In the case of mathematics, students may need to enroll and satisfactorily complete several semesters of remedial coursework before qualifying for an introductory credit-bearing mathematics course that is applicable to a degree program sequence. This comes at a great expense both in terms of time and finances for students entering post-secondary education. At a tuition rate of $184.00/credit hour and 4800 potential remedial credits taken by students in the 74 classes offered, the cost of remedial classes to students enrolled in these classes at SUNY Broome during the Fall 2016 semester was $883,300.00.

Research Questions

The two research questions that guided this study were:

1. What are the perceptions of career and technical education teachers and academic integration teachers regarding student motivation, engagement, and learning with the use of transdisciplinary, thematic, academically-integrated units in the CTE classroom?
2. How do career and technical education and academic integration teachers perceive transdisciplinary, academically-integrated, thematic units facilitate student learning, social integration, and classroom democratization in the CTE classroom?

**Positionality Statement**

I began my career as an educator in 2001 when I graduated as an adult non-traditional student with my undergraduate degree and secured employment at a private high school in Rhode Island. Prior to my career in education, I was involved in several capacities in the medical profession in professional, clinical, and business owner/proprietor roles. As a high school student in the mid-1980s, I enrolled in, and graduated from, a nursing program through my local Board of Cooperative Educational Services (BOCES) who was the provider of career and technical educational programming for my local school district. It was at this juncture in my life that I was first exposed to secondary career and technical education which, at the time, was still referred to by its previous name, vocational education.

I have lived in my current county for the past twelve years, having been employed as a secondary educator in two districts during that time. My current district, where I have worked for three-and-a-half years, was the research site for this study. I am employed as a science integrationist, one of four academic integrationists, on a team within a career and technical education high school in the northeastern United States. With my guidance, the 2015-16 school year was the first year the team worked collaboratively to create and execute transdisciplinary themed units into CTE classrooms to teach academically-related concepts.

The selection of my employer as the research site for my study does impact my perceptions of the process of academic integration. The recognition and understanding of my own potential biases and attitudes must be acknowledged to minimize any influences that could
affect the validity of my study (Briscoe, 2005). I must be cognizant of the potential for the “othering” effect in selecting both members of my team as well as technical teachers with whom I directly work as interview candidates. I must ensure they are forthright in their responses and not choosing to respond in a manner that they perceive will please me (Briscoe, 2005). As such, I took steps to recognize and minimize my bias throughout the research process. Reflective memos were written throughout the data collection and analysis processes to document the thoughts of the researcher through the process. Maxwell (1996) cites that this practice is a way to “facilitate reflection and analytic insight” (pp. 11-12).

**Theoretical Framework**

Curriculum that is used for integration purposes is defined as ‘thematic curriculum’ as it does not segregate based upon subject area, but rather expands all subject areas into a relevant theme (Quinn, 2013). The thematic units examined in this case study involve real-world problems, either from a historical perspective or current social issues. This study utilizes Beane’s (1997) Curriculum Integration Theory as a theoretical framework. Beane (1991) asserts that subject areas are “territorial spaces carved out by academic scholars for their own purposes” and “their boundaries limit our access to broader meanings” (p. 9). From Beane’s viewpoint, the two primary goals of curriculum integration are social integration and democratization of the classroom. This study examined not only how TAIT units influence student motivation, engagement, and learning but also the role of social integration and classroom democratization within the context of the units.

Curriculum integration was first proposed in the academic literature by John Dewey (1916) in his book, *Democracy and education: An introduction to the philosophy of education*. Dewey advocated the teaching of academics through occupations, thus integrating scholarship
into function. Curriculum integration was revisited in 1937 when L. Thomas Hopkins (1937) penned the book, *Integration: Its meaning and application*. Hopkins (1937) asked the question, “What is the relation between education and social progress?” (p. 22). Curriculum integration theory then found itself on the back burner in the educational world until the last quarter of the twentieth century. It was revitalized in the 1990s when Beane (1997) provided the interpretation of curriculum integration theory that is serving as the theoretical framework for this study.

Beane (1997) describes classrooms as organizing centers that represent problems or issues that connect school-based curriculum with the outside world. Due to these organizing centers, the knowledge that lies therein is more accessible for students and, in turn, “more likely to help them expand their understanding of themselves and their world” (p. 2).

The two main goals of curriculum integration include social integration and classroom democratization.

**Components of the theory.** Curriculum integration, as interpreted by Beane (1997), encapsulates four major aspects: the integration of experiences, social integration, the integration of knowledge, and integration as a curriculum design. The knowledge that individuals hold about themselves and the world is a direct result of their experiences. Integrative learning involves experiences that help shape us into the individuals that we are; embedded in such a way that they are a part of our being. Social integration is constructed from ideas that compromise our general knowledge and concepts we learn in a structured setting without regard to our past or future. This is much like the “general education requirements” one must undertake in the pursuit of an undergraduate degree. Social integration, however, is not limited to the learning of a predetermined selection of subjects but rather can be organized around personal and social issues, thus integrating general knowledge into a medium that is relevant to the learner.
The integration of knowledge refers to the way individuals organize and use knowledge. For example, when faced with a problem or issue, an individual will access the knowledge and skills he possesses holistically in an attempt to reach a resolution. One does not segregate knowledge into compartments specific to subject areas with rigid boundaries; rather the knowledge we possess is fluid, melding into a singular knowledge appropriate in the context of the problem or issue at hand. The separation of subject and skill that occurs throughout the day in a traditional schooling environment is inefficient at best when it comes to the utilization of such knowledge in a real-life situation. “When we understand knowledge as integrated, we are free to define problems as broadly as they are in real life and to use a wide range of knowledge to address them” (Beane, 1997, p. 8).

The final aspect of integration is integration as a curriculum design. Curriculum is organized around significant world problems and issues, providing an element of relevance from a personal or social perspective. Teachers deliberately plan the transfer of knowledge in relation to these problems. The knowledge gained through this process is not merely for replication on an assessment but rather to address the issue. Application of this knowledge is then utilized in a culminating project or activity, allowing students to make meaning of the knowledge and experience the democratic process of problem solving (Beane, 1997). Beane’s concept map in relation to curriculum integration is shown in Figure 2.
Critics of the theory. Badley (2009) discusses four kinds of resistance to curriculum integration: (1) linguistic and usage limitations of the term, (2) practical and institutional difficulties related to implementing integrated curriculum, (3) psychological and social aspects, and (4) several epistemological dimensions of resistance to integration. Linguistically, he claims that the term integration has a status as a slogan, encounters difficulty identifying where integration occurs, and causes confusion with related terms such as interdisciplinary. Institutionally, he argues that teachers may be under the directive to provide an integrated curriculum without adequate and appropriate professional development necessary to understand its meaning and implementation while maintaining the appropriate depth in specific subjects, due to lack of knowledge of a content area by the instructor. Logistical challenges under this same heading include lack of collaborative planning time, assessment of integrated lessons, scheduling, and the need for reform of teacher education programs to support an integrative teaching methodology. From a psychological and social aspect, Badley contends that the habits of teachers would lead to resistance on the part of the teaching industry who are not always the
most receptive to change. Additionally, content- and grade-level teachers may lose their sense of identity teaching integratively versus their identification as a subject or grade-level specialist. Finally, Badley (2009) argues that disciplinarily is a social construction and the products of "historical and discursive processes" (p. 129).

Badley (2009) is not alone in his criticisms of curriculum integration. Rooks and Winkler (2012) argue that "cooperating disciplines may not share tacit values and assumptions, theories, epistemologies, notions of adequate proof, methodologies, and the ways disciplines interact with society" (p. 3; Lélé and Norgaard, 2005; Schoenberger, 2001). From a practical standpoint, they cite issues with time scheduling, keeping all members up to date on project developments, changes in personnel on a team, and issues with building trust amongst team members as potential barriers to the implementation of an integrative curriculum (Rooks and Winkler, 2012, p. 3; Suarez-Balcazar et al., 2006). Tra and Evans (2010) also discuss potential challenges for team members including the time required to acquire knowledge of the subject and research the culture of the unfamiliar discipline and acquiring a collaborative attitude including good communication, respect for other disciplines, and understanding other’s point of view.

Beyond the interpersonal conflicts that occur within a team environment, teachers interested in pursuing an integrative curriculum approach to teaching encounter additional challenges. These include trying to convince administrators of the paradigm shift that occurs moving from a subject-based curriculum to an integrative curriculum and lack of curriculum materials, resulting in the need for teachers to generate their own. The generation of original materials requires not only time but could potentially require additional outside funding as well (Huntley, 1998).
**Rationale.** Students in the career and technical education classroom spend the majority of their time working experientially within their trade. This may include time within an on-site laboratory setting such as an auto repair shop, temporary home building site, or an on-site animal shelter. Students in technical classes whose work-related-experience sites are not located on campus are transported to businesses off-site such as local nursing homes, hotels, etc. where their experiential learning takes place. As students are often not in a traditional classroom, it is necessary to bring both academic and technical knowledge into the problems and issues they are facing in their apprentice-like roles. An integrative approach to teaching and learning best serves this need as the knowledge conveyed from teacher to student is in a real-life context and not compartmentalized by subject area. For example, an animal science student who is working in the reception center of the shelter must utilize business soft skills, English writing skills, and mathematical skills simultaneously when registering and processing clients’ work orders.

**Application to the study.** The units and technical teachers chosen for this study were intentional to best demonstrate the use of transdisciplinary integrative learning in the CTE classroom through thematic units as defined by Beane’s (1997) four major aspects as previously defined. Beane’s Curriculum Integration Theory is appropriate to the research question in that integration within a CTE classroom should not be focused solely on a single discipline. Rather, it assumes a broader narrative in which themes relative to the technical area are explored through multi-content lenses in relation to the problem at hand. This gives students the opportunity to explore a common problem or issue from a myriad of approaches while appreciating that real-life experiences and problems do not have a singular focus but rather are complex and multidimensional.

**Summary**
Today’s career and technical education student must be well-versed not only in technical knowledge but also in academic knowledge. The Perkins Act has mandated that all secondary CTE programs integrate core academics into their technical programs. This has resulted in the need for specialized educators known as academic integrationists, teachers who are trained within a specific discipline or disciplines but work within the context of the technical trades in conjunction with the technical expert teacher to provide programming in applied learning to the CTE student. The use of transdisciplinary, themed, academically-integrated units provides a new methodology to potentially facilitate student learning and engagement, social integration, and classroom democratization within the technical classroom; bringing strong academic concepts into real-life problems that require more complex problem-solving skills on the part of the student.

The literature review in chapter two examines the scholarship on Curriculum Integration Theory with an emphasis on student learning, student engagement, and college and/or career readiness of secondary school students. Chapter three describes the research design for this study.
Chapter II: Literature Review

Introduction

Career and technical education has been a cyclical topic in the academic literature since the early years of the 20th century. Driven by the workforce needs of the nation, career and technical education has transformed from an exclusively male-dominated field designed to keep young men enrolled in secondary school, to today’s present model that embodies more technology-driven career choices and often includes dual-credit coursework to encourage its students to pursue tertiary education. Since the time of the Smith-Hughes Act of 1917, the U.S. Government has directed the path of CTE through federal legislation. This literature review will examine the evolution of the legislation of CTE, its impact on curriculum, and the subsequent impact on the teaching and learning of CTE students.

The organization of this literature will follow a flow process model. After introducing the Carl D. Perkins Career and Technical Education Act, the review examines the advantages and pitfalls of implementing a transdisciplinary, academically-integrated, thematic (TAIT) unit approach to the secondary CTE classroom. Second, the review provides an overview of the benefits of this method on student learning and retention. Third, the review discusses the use of a thematic approach regarding student engagement and motivation. Lastly, the review discusses the importance of how the implementation of this style of an integrated curriculum influences college and career readiness upon secondary school graduation.

Carl D. Perkins Career and Technical Education Act

State and federal laws create mandates and play a significant role in the direction of the secondary school and career and technical education reform, including graduation requirements, student testing, evaluations, material selection, and teacher certification (Castellano et al., 2003;
“Since the passage of the Smith-Hughes Act in 1917, the federal government has been involved in the provision of vocational education to high school youth” (Castellano et al., 2003, p. 246). One federal mandate that had a significant impact on career and technical education is the Carl D. Perkins Career and Technical Education Act. Revisions within 2006 Perkins Act included: an increased accountability of the integration of vocational and academic curricula within the CTE classroom (Castellano et al., 2003). This revision required CTE programs to restructure the delivery and content of instruction in the technical classroom to include greater levels of core academics such as English language arts, mathematics, and science. The rationale for this generates from learning theorists who have advocated for a more constructivist method of learning. The deliberate linking of multiple curricular areas into meaningful, connected patterns is supported by brain research and meets the needs of students as well as state and federal requirements (Lake, 1994). “An enduring argument for integration is that it represents a way to avoid the fragmented and irrelevant acquisition of isolated facts, transforming knowledge into personally useful tools for learning new information” (Lipson et al., 1993, p. 252). The integration of core academics within the technical classroom is not without pushback by outside industries, however, especially among those whose business margins stand to decline in the face of new regulations. Textbook publishers and some universities stand to reduce their profit margins in the face of subject desegregation and, as a result, push against the inclination for curriculum integration (Beane, 1995). This is due, in part, to the fact that multidisciplinary concepts that are presented in a CTE context are personalized to meet the knowledge and experiences of the teacher and the students. In transdisciplinary, academically-integrated, themed units (TAIT), the ideas for such units are often generated through student inquiry and often are incited by events that are socially relevant.
and/or in the news. An example of this was a unit that was created last year in response to the Flint water crisis, where students in a Foundations of Education class began to question how such an event could occur and what could be the long-term effects from the situation. Due to the time-sensitive relevance of student inquiry to current events, the inclusion of such events in a textbook would not occur until the next edition was published, often several years after the event. Textbooks tend to be static in the information presented, whereas TAIT units are more fluid in their nature due to the fact that they are created in response to a specific event or student inquiry and are malleable in that its creators are the teachers who are responsible for the facilitation of the lesson or group of associated lessons.

The federal mandates that now govern CTE are quintessentially Deweyan, who advocated for the use of academics in the context of vocation. Dewey (1916) referred to this concept as “education through occupations”. In the 1930s, the progressive movement advocated for a problem-centered curriculum (Etim, 2005; Beane, 1993). In 1956, Dewey called for a balancing of the needs of the learner, demands of society, and the subject content (Etim, 2005). The idea of curriculum integration was dormant from the 1960s until the early 1990s (Beane, 1996). “Beane traces his intellectual roots, not just to Dewey, but to the more radical wing of the progressive education movement, the social reconstructionists, who sought to build a new, more just, equitable social order in the 1930s” (Gehrke, 1998, p. 256). Castellano et al. (2003) stated, “all students should have the opportunity to learn school subjects with work as the context of their learning” (p. 244). Federal and state legislators continue to shape the future of career and technical education, as their job is far from complete.

In the 1990 revision of the Carl D. Perkins Career and Technical Education Act, the integration of core academics into the CTE classroom was a central focus. Since that time,
schools of technical education have incorporated curriculum specialists in working collaboratively with technical education teachers to create and sustain curricula that contain not only the technical learning standards but also core academic standards. “...secondary CTE programs must provide rigorous academic development and rigorous career development if they are to prove beneficial to students” (Castellano et al., 2003, p. 245). Unfortunately, “CTE instructors are often marginalized, reduced to being mere implementers and assessors of what others have decided should be learned, taught, and assessed” (Billett, 2014, p. 10). For teachers to be curriculum leaders, this perspective must shift significantly.

Curriculum integration is “a pedagogical approach that is standard-centered and focuses on a theme organized around real-life issues and problems drawn from several subject areas” (Etim, 2005, p. 3). Hopkins (1937) tells us that it “refuses to lend itself to mere definition” and “suggests something positive, dynamic, and constructive”. He continues to state that it is “neither datum nor a consummation” but rather a “mode of participation and growth” (p. 50). In this context, he refers to it as the wholeness of knowledge. Beane (1995) quips that curriculum integration is “a way of thinking about what schools are for, about the sources of curriculum, and about the uses of knowledge” (p. 616).

The research site for this study was an educational collaborative located in the northeastern United States. Within its home state, it is one of the few educational collaboratives that is expanding both in programming and enrollment, as others are facing declining enrollment numbers, fewer technical programs, and cutting back on shared services offerings to cooperating districts. The status as an educational collaborative makes it unique from other districts in the area, as the student population is from more than two states, four counties, twenty cooperative school districts, and specializes in programming for students who enroll for a myriad of reasons.
The career and technical high school division at this location is the home for approximately 1100 students annually, some of whom attend a full-day program; however, the majority of these students attend a half-day program within career and technical education classrooms.

**Implementation of a Transdisciplinary, Academically-Integrated, Thematic Program**

A transdisciplinary, academically-integrated, thematic (TAIT) program is not something that one initiates on a whim. Rather, multiple discussions must occur amongst team members and buy-in by all involved participants must incur to ensure success. Once determined that this is the direction a team or school commits to pursuing, the work commences. The transdisciplinary approach begins with an organizing center and identification of the main concepts, but then involves the question of which various subject areas may contribute (Beane, 1996). “Teachers work first as generalists on integrative themes and secondarily as content specialists” (Beane, 1995, p. 620).

As a team-centered approach, a consensus is imperative through the steps of the planning process. The process, as outlined by Etim (2005), involves eight steps. First, the team brainstorms potential themes for the unit from social issues relevant to the trade from either a historical or present-day perspective. Second, the team selects a theme from those proposed in the first step. Based on the chosen theme, the team forms essential questions. Next, a timeframe for teaching the unit is laid out. The learning objectives and desired skills for the unit are determined. Next, working in collaboration with the technical teacher, the team implements the unit in the classroom over a predetermined timeframe. A culminating event occurs that reinforces the objectives and learning from the unit. Finally, an assessment occurs to measure the accomplishment of the goals from the unit. This process is demonstrated in Figure 2 below.
While the overall process of implementation between educators and scholars is relatively consistent, the literature shows that there are some differences in the initial stages of the process. Tomlinson (1998) suggests that concepts, not topics, be used in the integration process. Beane (1995) cites that the “central focus of curriculum integration is the search for self- and social meanings” (p. 616). Using Etim’s model, this is possible if objectives for the unit are structured accordingly.

Regardless of the path one takes to go from fresh idea to unit completion; the literature discusses both benefits and potential obstacles and pitfalls of implementing this type of methodology. A deeper examination of these claims is outlined in the next two sections.

Benefits. The integration of CTE and academics provides a context for the learning of academic skills that will ultimately be necessary for the workplace (Hoachlander & Yanofsky, 2011; Stone, 2005; Threeton, 2007). Beane (1995) speaks to the larger continuum of gained
knowledge with the utilization of thematic units. “... the use of real-life themes demands a wider range of content, while the placement of that content in thematic contexts is likely to make it more accessible for young people” (Beane, 1995, p. 618; Iran-Nejad et al., 1990). Bartlett’s (1932) research referred to this as simplification by integration, proposing that individuals function better in the context of real-world problems because they possess a natural talent to “integrate the influences of multiple sources that simultaneously bear on these problems” (Iran-Nejad et al., 1990, p. 510). In the context of thematic units, these multiple sources are represented by the different content areas that are integrated within the thematic unit. Aikin (1942) reviewed the Eight-Year Study completed in the 1930s that determined a separate-subject approach toward schooling resulted in poorer standard measures of school achievement than a curriculum which embraces an integrated approach (Beane, 1995). The use of themes results in higher-order thinking and increased learning through greater accessibility. This would be congruent with Bartlett’s (1932) psychological study findings. Beane (1996) supports this concept when he further states that curriculum integration involves the “application of knowledge rather than merely memorization and accumulation” (p. 8). Rooks & Winkler (2012) support Beane’s claim when they cite, “among the advantages of multidimensional interdisciplinarity are that students learn that knowledge is not compartmentalized and that in the real world, knowledge is transferable and cumulative” (p. 3; Garkovich, 1982).

The decompartmentalization of knowledge allows for a greater fluidity, providing the students to transverse previously-held borders between subjects. Interdisciplinarity “allows students to understand how to marshal a wide range of skills and knowledge bases to solve pressing social, economic, and technological problems” (Rooks & Winkler, 2012, p. 3; Klein & Newell, 1997). Teachers who use curriculum integration “transform their classrooms into places
of high pedagogy. And for this reason, the stories from those classrooms have given curriculum integration a credibility that other approaches have never had” (Beane, 1996, p. 10).

Implementation of thematic units into school curricula is not without its challenges, however. The next section explores some of the obstacles that curriculum integrationists face when trying to adopt this paradigm shift.

**Barriers and pitfalls.** The obstacles to the implementation of a transdisciplinary, academically-integrated, thematic unit curricula are multifaceted but certainly not insurmountable. Beane (1996) cites six specific obstacles teachers face when attempting to implement a curriculum integration methodology: (1) academics, text, and test publishers make money off of subject-centered curriculum; (2) historically, teachers who engage in curriculum integration send fewer students to the office for behavioral issues. Therefore, their classrooms are disproportionately increased with students with behaviour issues, (3) administrative support versus parents who demand advanced-level classes that are segregated by subject, (4) criticisms from other teachers who fear change, (5) colleagues who teach trivial thematic topics, and (6) misinformation is given by speakers and consultants about curriculum integration and lump all thematic teaching into a single grouping. This section of the chapter will focus on the sources of criticisms to academic integration, teacher apprehension to its implementation, and concerns from outside the school community.

**Criticisms.** Critics of curriculum integration contend that the process will “destroy the integrity of the disciplines of knowledge” (Beane, 1995, p. 620). Beane (1996) cites two points of criticism about curriculum integration: (1) politically right-wing individuals with a narrow educational focus, and (2) proponents of standardized tests who question how students involved with curriculum integration will fare on such exams. Involvement of the political right resulted
in the passage of one of the most subject-centered educational reform bills, No Child Left Behind (NCLB), during the George W. Bush administration. In 2003, Bush’s administration attempted to eliminate CTE and argued that it was ineffective in its ability to improve the academic achievement of students (Friedel, 2011). In 2006, Congress reauthorized the Perkins Act (Perkins IV), which placed a greater accountability on the integration of academic standards within the CTE classroom.

Humans often meet the idea of change with resistance, and teachers are not immune to this phenomenon. Teacher apprehension and resistance to the implementation of curriculum integration comes from a handful of sources. First, teachers may “feel threatened by a curriculum which they have no familiarity and uncomfortable when they are asked to teach what they do not know” (George & Alexander, 2003, p. 109). For most teachers who are content specific, their background knowledge in another content area may be limited to a single introductory-level course taken to fulfill a degree requirement during their undergraduate studies. The aforementioned phenomenon is particularly the case in the content areas of science and mathematics. Some teachers, who previously felt they were “experts” in their given content area, have expressed a feeling of loss of their identity when switching to an integrated curriculum (Beane, 1995). Etim (2005) cites additional challenges teachers encounter with curricular integration include lesson planning; they must be deliberate and involve the inclusion of challenging acts for students. Depending on the content participating in the activity, this may be exacerbated by the lack of background knowledge issue referenced above. Additionally, the location of resources for planning an integrated curriculum and sifting through various media and information to extract meaning prove to be challenges expressed by teachers new to the curricular integration process (Etim, 2005).
Finally, some sources outside the school building have expressed or been the source of concerns about curriculum integration. Parents of students enrolled in an integrated class have expressed a fear of the unknown, the *different* (Beane, 1995). Introduction of the Common Core State Standards (CCSS) in 2010 for grades K-12 in language arts/literacy and mathematics has added a frustration component for educators with planning an integrated curriculum. In the state where the research study site is located, a teacher’s annual performance evaluation is directly linked to student performance on state examinations, the English and mathematics examinations are written utilizing the CCSS. A study by the Editorial Projects in Education (EPE) Research Center, surveyed 600 K-12 teachers about their readiness to meet the challenges brought forth by the CCSS. Nearly half of the teachers surveyed indicated that they felt unprepared to teach to these standards (Gewertz, 2013).

**Summary.** In summary, the academic literature outlines several benefits to academic integration that is relatable to the career and technical education classroom. These advantages include: (1) a larger continuum of knowledge can be explored through a thematic context; (2) higher-order thinking processes are encouraged; (3) a greater accessibility of knowledge is available to students; (4) increased fluidity of student thinking; (5) promotion of democratic processes within the classroom through the consideration of social problems; and (6) the context by which learning occurs is relatable to the workplace, thus eliminating the question of “why are we learning this?” Beane discusses what Hopkins (1937) called the *wholeness of knowledge.* “Young people and adults have been led to believe that the purpose of education is to master or ‘collect’ facts, principles, and skills that have been selected for inclusion in one or another subject area instead of learning how those isolated elements might be used to inform larger, real-
life purposes” (Beane, 1995, p. 618). The use of transdisciplinary, academically-integrated, thematic units supports the latter through the desegregation of subject areas.

Barriers to curriculum integration have included reluctance on the part of the teachers due to the amount of time involved in the creation of materials and level of comfort outside their specialty. Additionally, some parents express concern that their children are not on the traditional educational path with scripted textbooks and modules. Finally, the adoption of the CCSS in this decade has created an additional learning curve to the curricular integration process. In the next section, curricular integration and its impact on student learning and the retention of academic material will be examined.

**Student Learning and Retention**

This next section will address the impact of transdisciplinary, academically-integrated, themed units on student learning and retention as supported in the academic literature.

**Student learning.** Students who enter technical education classes in their junior year, in general, possess only the minimal science and math coursework required for high school graduation; consisting of one life science course, one physical science course, and one algebra course. The determination of the content of these courses occurs at the state department of education and is contingent on passing a statewide examination for credit. Many students describe these areas as a weakness in their academic career and may be reluctant when first confronted with STEM-based topics in an integrated unit. Any hands-on laboratory experiences using authentic equipment and involving real-life science experiences is limited to the supplies and funding of the individual school districts. The scope of the learning in these experiences is often very narrow, additionally restricted to the knowledge and expertise of the instructor. Bryce (2010) advocates that “…real science should be pursued in school” (p. 592). The use of real-life
experiences, even in a simulated setting, promotes decision-making and problem-solving skills that students will need post-graduation.

The traditional school schedule tends to make learning fragmented, with students moving from one content area class to the next. Each classroom is an island with its own topic, a set of objectives, and agenda. Palmer (2009) tells us, “much of what students experience as they move from one class to another, and from one subject to another, feels to them (or is, actually) unconnected to a larger and meaningful whole” (p. 27). This fragmented learning does not result in the progressive building of ideas.

Students learn more when they engage with lessons that are connected and anchored in the major concepts or big ideas, thematic curriculum units, and explicit opportunities to access what they already know and can do before engaging in new experiences that build on them. (Palmer, 2009, p. 27).

When lessons show connections between the academic material as well as the theme of the integrated unit, it promotes a learning environment where both a greater breadth and depth of learning can occur (Lipson et al., 1993).

Considering the physiology of the brain while learning, Beane (1996) cites “the brain processes information through problems and connections with an emphasis on coherence rather than fragmentation” (p. 8). The days of rote learning and memorization are no longer the standard in classroom instruction. In the research of Caine & Caine (1991), they cited that the brain may resist learning fragmented facts presented in isolation. When concepts are taught within a meaningful context with an experiential component, learning is believed to occur not only faster but also more thoroughly. Johnston et al., (2013) state, “it is becoming increasingly apparent that today’s students should be expected to move beyond learning subject-specific facts
and figures, towards acquiring a broad range of competencies which include complex skills and deep content knowledge” (p. 423). This type of learning piques our higher-order thinking skills, relying on our prior knowledge to build on new learning. “We learn by associating the new with the old, and by comparing what we think and already know with new knowledge and experience” (Palmer, 2009, p. 27).

The current movement toward an integrated curriculum, then, has its basis in learning theorists who advocate a constructivist view of learning. There is a body of brain research that supports the notion that learning is best accomplished when information is presented in meaningful, connected patterns. This includes interdisciplinary studies that link multiple curricular areas. There are many examples in the literature of such efforts by K-12 teachers, as well as those teachers involved in vocational education and higher education (Shoemaker, 1991, pp. 793-797).

Lipson et al. (1993) concur with the aforementioned researchers in the belief that an integrated curriculum provides students a context in which learning becomes meaningful:

An enduring argument for integration is that it represents a way to avoid the fragmented and irrelevant acquisition of isolated facts, transforming knowledge into personally useful tools for learning new information. (Lipson, et al. 1993, p. 252).

Curriculum integration fosters a highly creative and thinking learning environment that today’s career and technical education student needs to be successful in the workplace after graduation. By building upon prior knowledge and expanding it to new academic ideas in context, educators are building students who are more apt to engage in critical thinking and problem solving. Like creating a wedding cake, we build upon the layers of learning, slowly adding the new concepts, allowing them to shape and rise in a layer before cementing a new
layer of learning on top. This process continues until we have built a multilayered, solid entity of knowledge.

In the next section, how transdisciplinary, academically-integrated, thematic units influence the retention of academic concepts in the CTE student is discussed.

**Academic content retention.** Several studies have demonstrated that hands-on units, if regularly incorporated during classroom instruction, can enhance cognitive achievement (Gerstner & Bogner, 2010; Freedman, 1997; Stohr-Hunt, 1996; Thair & Treagust, 1997). The implementation of experiential and hands-on learning opportunities results in better long-term retention of academic concepts for students. A 2006 study by Handler and Duncan found that students who participated in an experiential-based lesson were able to recall the concepts covered in that lesson one month after the fact without any review or prompting.

The constructivist view of learning “places the teacher as a guide to the learning process which, in turn, enables the student to ‘construct’ and develop his or her knowledge” from the thematic unit (Etim, 2005, p. 173). It is reasonable that students experience a similar effect when given the opportunity to study core academic concepts in the CTE classroom through the implementation and delivery of a transdisciplinary, academically-integrated, thematic unit-based lessons. Students who can make connections between the academic content and themselves, or in this case their trade, facilitate the process of students becoming more responsible for their learning and become more self-directed and independent learners (Pate et al., 1997).

**Summary.** Students need the opportunity to apply their academic knowledge to real-life problems while developing 21st-century skills and abilities. The use of transdisciplinary, academically-integrated, thematic units in the CTE classroom serves two purposes: (1) to increase student learning of core academic concepts about the technical trade through hands-on
experiences, and (2) to increase student retention of those concepts, as demonstrated by Handler and Duncan (2006).

The next section of this literature review will examine the use of these units on student motivation and engagement in the classroom.

**Student Motivation and Engagement**

Student motivation and engagement are be linked to student success. This next section discusses how both of these elements are impacted through the use of transdisciplinary, academically-integrated, thematic units in the CTE classroom as supported by the scholarly literature.

**Student motivation.** According to Armbrecht et al. (2014), “it is important to improve teaching methods that increase student motivation, not only to enhance their capacity for understanding, but also to generate a greater level of interest in the study [of chemistry] for their future professional life” (p. 1439). While chemistry is only one core academic subject, this statement applies to any content area that integrates into the CTE classroom. The addition of transdisciplinary thematic-based lessons permits students the opportunity to participate in and gain a deeper understanding of many situations in their daily lives that are influenced by academic concepts. From the food one eats, the medicine one takes, the alternative fuel vehicle that transports them to their classes, or the paper on which they take their class notes, all of these items are influenced by knowledge gained in an academic context. Providing students with the opportunity to learn about these daily influences in their lives and participate in experiential, thematic-based activities to further explore and inquire about the academic influences on these items, motivates the learning process within students. “Original research projects generate a considerable amount of enthusiasm among the participating young adults, and there can be little
doubt that they provide a better learning method than reworking tired experiments” (Burton, 1987, p. 293).

When students can make connections to the material they are studying and how it relates to their lives or potential plans, they are more apt to be motivated to learn. The applicability of problems into real-life context appears to be a longstanding motivating factor for students to learn within an integrated curriculum. In 1965, Vars reported that motivation for learning was increased in the presence of “real” problems to which students could relate. “Interest and importance contribute, respectively, to intrinsic and extrinsic motivational patterns that are determining factors in learning and behaviour, understanding how these two dimensions interact with each other and with knowledge and attitudes provides a baseline for the design of improved education strategies” (Fonseca et al., 2012, p. 130). When concepts are taught in a connected manner, students are better able to see their applicability to their interests or, in this case, their chosen trade. “If we teach connectedness and integration, they learn that. If we teach separation and discontinuity, that is what they learn. To suppose otherwise would be incongruous” (Humphreys, 1981, p. xi).

**Student engagement.** Student engagement is defined by Chapman (2003) as “students’ cognitive investment in, active participation in, and emotional commitment to their learning” (p. 1). The Australian Council of Educational Research offers a different definition, “students’ involvement with activities and conditions likely to generate high-quality learning” (ACER, 2008, p. vi). For the purposes of this research, student engagement will include a blending of these definitions, students being on task, generating questions, and actively participating in classroom activities that are designed to promote high-quality learning. The relative approach of using transdisciplinary thematic units as a medium gives students the chance to learn core
academics effectively while avoiding typical attention/focus issues associated with students at this age level. “An approach centered on real world problems can help to counteract the typical lack of attention characterizing [teenage] students” (Celestino & Marchetti, 2015, p. 1359).

According to the social cognitive approach, the way in which youth develop and exercise personal efficacy in the domain of a career and technical education during high school can play a key role in their motivation and academic engagement toward setting a course of study in a particular career path. (Loera et al., 2013, p. 174; Bandura, 2006).

Students in classrooms involved with curriculum integration “become actively involved in their learning” (Springer, 2003, p. 15; Etim, 2005). Jacobs (1989) reported that an integrated curriculum provided a direct correlation with increased student self-direction, higher levels of work completion, better attitudes toward school, and increased school attendance. In Zepke & Leach’s (2010) study, they found that when students were enabled to work autonomously and enjoy learning relationships with others, students were more engaged and felt competent to achieve their own objectives. “Self-determination is enhanced where supportive social-contextual conditions exist to promote feelings of competence or self-efficacy” (Zepke & Leach, 2010, p. 170). When students are able to make connections between core academic areas and their lives outside the classroom environment, they are more engaged in their learning.

**Teachers as engagement agents.** In the literature review conducted by Kuh et al. (2006), teachers and teaching was at the heart of student engagement. Mearns et al. (2007) cited a teacher’s perceived approachability and preparedness for a lesson had a direct impact on students’ commitment to work harder. Bryson & Hand (2007) found that teachers who set high expectations and standards for students in the presence of a supportive environment have students who are more likely to be highly engaged in the classroom. The collaboration and work
required by a team of teachers in creating transdisciplinary, academically-integrated, thematic
(TAIT) units lends itself to increased student engagement as determined by Mearns et al. (2007).
Teachers who intentionally plan challenging and enriching educational experiences for their
students are successful in engaging students (Zepke & Leach, 2010).

**Implications.** Increased student learning and engagement within the CTE student
population contributes to many positive effects, most notably students are better prepared for
entry into the job market and/or continuing their education at a tertiary center of learning. Both
of these will be discussed in further detail in the next section. Additionally, students who are
engaged in school are more likely to attend school, have lower drop-out rates, complete their
programs, and serve as productive members of their respective communities (Jensen, 2013).

**Summary.** The implementation of transdisciplinary, academically-integrated, thematic
units as a teaching methodology for core academics provides students within the CTE classroom
the opportunity for greater learning and engagement, as outlined above. The result of this is that
students are more likely to complete their 2-year CTE coursework and are better prepared for the
next chapter in their lives, albeit direct entry into the workforce or continuing their education at a
post-secondary learning institution.

**Career and College Readiness through Thematic Units**

As students approach the completion of their secondary studies, educators and school
administrators begin to focus on preparing students for the next step in their professional lives.
For the CTE student, this entails readiness to enter directly into the workforce and/or education
continuation through tertiary-level programming. This section will explore how the use of
transdisciplinary, academically-integrated, thematic units within the CTE classroom prepares
students for this next stage.
College readiness. A 2013 study by Ramma et al. found that there was a gap between the secondary and tertiary levels of education, especially regarding science and technology. The number of remedial courses at colleges, especially community colleges, has increased exponentially over the past twenty years. Chapter I explored the number of seats required at a local community college to compensate for the high number of students requiring remedial coursework before beginning credit-bearing work. A percentage of both adult learners and recent high school graduates are entering their freshman year with placement scores that do not qualify for entry into the lowest level of credit-bearing classes. A study by Shimony et al. (2002) cites 68% of freshmen entering at City University of New York’s (CUNY) 4-year colleges require at least one non-credit remedial class to improve basic skills. At the 2-year college level, this percentage of remedial-need students increases to 86% of incoming freshmen noted in the same study. This phenomenon is not limited to New York high school graduates; however, as similar results were noted in Florida, Connecticut, Tennessee, New Jersey, and Oklahoma (Shimony et al., 2002). This results in students taking one or more semesters of remedial classes to bring their requisite knowledge to the base level for 100-level courses, especially in science and mathematics. The result of this is that additional monies are being spent by the student on tuition and fees to enroll in remedial coursework before registering for entry-level coursework, and extra time of a year or more may be required to complete the prescribed curriculum to accommodate remedial coursework. Ultimately, this may negatively influence the number of students who complete a program to graduation. At the technical high school examined in the Shimony et al. (2002) study, lessons within the medical laboratory technology program were designed to integrate mathematics, English, and science around CSI-type themes to increase student interest and provide a discovery-based model of curricula. As a result, their study found
that students who graduated from this program entered college better prepared than their peers from other schools, had fewer required remedial courses, obtained higher grade point averages once in college, and had higher retention/completion rates.

**Improved marketability in the workforce.** Over the last several years, the advances in information and communication technology have required individuals to have a very distinct skill set for work in the 21st century (Johnston et al., 2013). The integration of authentic themed units into a CTE curriculum provides students with a host of skills that are transferrable to outside areas. For example, students who gain practice and experience utilizing technology such as the Microsoft Office Suite to create reports, spreadsheets, presentations, and research can transfer those highly-sought-after skills in other areas (Mattoon, 1998).

Integrative thematic units promote inquiry-based learning, deductive reasoning, analysis, and problem-solving skills from students. All of these attributes foster self-efficacy and the ability to work independently. “For prospective employers, too, there is surely much to be gained from the availability of a future workforce which can work as independents” (Burton, 1987, p. 293).

For students, acquisition of the skill set required to perform work in a transdisciplinary setting provides them with a greater opportunity within the workforce, a distinct asset in economically depressed areas such as that serviced by the research site. Three of the major hiring career fields locally are: (1) health care, with three hospitals in the region and numerous medical clinics, (2) education, with fifteen public school districts in the county as well as a handful of faith-based schools, and (3) engineering, with defense contractors BAE Systems and Lockheed Martin located in the region. In each of these industries, the ability to effectively
problem solve and use higher-level thinking skills found in thematic units is a prerequisite for entry-level employment.

**Implications.** From a local economy standpoint, the availability of highly-skilled workers promotes the advancement of medical- and nonmedical-based industry, including a higher level of access to healthcare services in the region. Additionally, if the younger generation can generate a middle class to upper middle class income locally, the migration rate of families and workers from the study site region will decrease, helping to stabilize housing equity, support local businesses, and support rural school systems which are struggling with insolvency issues due to declining enrollment.

**Summary.** The implementation of transdisciplinary, academically-integrated, thematic units in the CTE classroom provides opportunities for a much-needed skill set regionally to facilitate both workforce opportunities for graduates as well as post-secondary educational opportunities. As mentioned above, the number of students who lack an understanding of basic STEM concepts expected at the college freshman level indicated by the high number of preparatory level courses required at the local community college. Enrollment in these courses increases the student’s debt burden upon leaving the tertiary institution and indirectly influences the amount of capital available for investment in the local economy.

Summary

The purpose of this literature review was to examine the use of transdisciplinary, academically-integrated, thematic units in the career and technical education classroom. An examination of the overall benefits of its implementation, as well as the reported obstacles and pitfalls was presented. A discussion of the effect on student learning, retention, motivation, engagement, as well as career and college readiness also transpired. The literature demonstrates
that students who are provided opportunities to conduct a relevant study within their technical trade classrooms are more likely to be engaged and motivated in their learning than those not provided these opportunities. The knowledge and experience students obtain in the process of the thematic units provide additional skills that are transferable to the workplace environment.

In the next chapter, the research design, research questions that guided the study, research methodology, data collection methods, demographics of the study participants, data storage, and Institutional Review Board protections are discussed.
Chapter III: Research Design

This chapter reintroduces the research questions to the study as well as describes the research design used to investigate the experiences of both academic and technical teachers using transdisciplinary, academically-integrated, thematic (TAIT) units within the career and technical education classroom. The chapter also describes study participants, recruitment, data collection, data storage, data analysis, and trustworthiness. The concluding section of this chapter discusses the protection of human subjects in the study.

Research Questions

As outlined in Chapter I, this study examines the experiences of career and technical education teachers as well as academic integration teachers concerning the implementation of transdisciplinary, academically-integrated, thematic units. To that end, the research questions used to guide this study are reiterated below:

1. What are the perceptions of career and technical education teachers and academic integration teachers regarding student motivation, engagement, and learning with the use of transdisciplinary, thematic, academically-integrated units in the CTE classroom?

2. How do career and technical education and academic integration teachers perceive transdisciplinary, academically-integrated, thematic units facilitate student learning, social integration, and classroom democratization in the CTE classroom?

These questions guided the researcher to collect data through semi-structured interviews with participants and document analysis of lesson plans written to guide the units, as well as examples of student work to understand the participants’ experiences with the use of the units.
The research questions utilized in this study are shaped by a constructivist paradigm. Features of constructivist designs include “the adoption of a position of mutuality between the researcher and the participant” (Mills et al., 2006, p. 8). The ontology of a constructivist paradigm believes that there exists multiple, constructed realities, rather than a single true reality (Ponterotto, 2005). This gives rise to a qualitative design. Qualitative designs are empirical procedures designed to describe and interpret the experiences of research participants in a context-specific setting utilizing purposeful sampling with design flexibility (Patton, 2002).

Methodology

Upon review of multiple qualitative and quantitative research designs, the investigator decided that the nature of this research would be best served through a case study analysis. The rationale for this selection was to focus more on the quality of data rather than quantity, and the researcher’s interest in eliciting more in-depth responses to understand the experiences of the teachers than would be permissible through other methods (Maxwell, 2004). The construction meaning from the collective experiences of the participants is the objective in this study (Seidman, 2015).

Research Tradition

This study incorporated a case study analysis utilizing Stake’s approach. It included the experiences from three academic integration teachers and three technical classroom teachers, resulting in a balance of academic-to-technical teacher ratio. Case study analysis has been explored by both Yin (2003) and Stake (1995). A distinct difference between these two researchers is the method utilized to guide the research process. Yin is a proponent of using “prepositions” to guide the process while Stake prefers “issues” (Baxter & Jack, 2008). A constructivist paradigm is a basis for both researchers’ case study analysis. “Constructivism is
built upon the premise of a social construction of reality” (Baxter & Jack, 2008, p. 546; Searle, 1995). Stake is a proponent of epistemological traditions in qualitative case study; whereas Yin tends to be evasive in epistemological commitment (Yazan, 2015).

**Site and Participants**

The research site for this study was a career and technical high school located in the northeastern United States. The school is part of an educational collaborative that services fifteen school districts in a two-county geographical area as well as some outlier districts who contract services due to lack of similar programming in their region. The high school offers 26 technical programs and has an enrollment of approximately 1100 students annually. The students enrolled in the programs attend a half day for career and technical education classes and attend their home district or alternative placement for a half day of academic programming.

The participants in this study included three academic integration teachers employed by the school with specialties in English, Mathematics, and Science. They represent 75% of a four-person academic integration department, with this researcher representing the remaining 25% of the department. Also, three technical teacher participants were selected who are also employed by the school. The three teachers selected actively participated in the implementation of transdisciplinary, academically-integrated, thematic units with the academic integration team over the previous calendar year. The selection of participants was purposeful and not random to meet the criteria for individuals at the test site who have taught with the units (Creswell, 2009).

**Data Collection**

Data collection for a case study analysis can take one of two predominant forms: Yinian or Stakian. Yin advocates researchers use six sources of evidence: documentation, archival records, interviews, direct observations, participant observations, and artifacts (Yazan, 2015, p.
A Stakian method of data collection is not as well-defined, as Stake (1995) argues in his book that, “there is no particular moment when data collection begins” (p. 49). Whereas Yinian researchers have a definitive pathway by which one performs case study research, Stakian researchers allow the data collection process to make modifications to the inquiry process. “Stake’s protocol suggests preparing a data gathering plan which should include ‘definition of case list of research questions identification of helpers, data sources, allocation of time, expenses, intended reporting’” (Yazan, 2015, p. 143; Stake, 1995, p. 51). A significant difference found between Yin and Stake is the allowance of quantitative data in the analysis. Yin advocates for mixed methods and the incorporation of quantitative data in case study analysis, whereas Stake’s qualitative-only data collection stance in case study, prohibits the consideration of quantitative data (Yazan, 2015). Stake’s process of data collection follows a holistic inquiry model and includes direct observation, participant observation, interviews, audiovisual material, documents, reports, and physical artifacts.

Data collection for this study consisted of semi-structured interviews with each participating teacher and document analysis which included lesson plans and other instructional materials as well as student work.

**Semi-structured interviews.** Yin (2009) cites the interview as “one of the most important sources of case study information”. Each participant in the study underwent an initial semi-structured interview with the investigator. The interview followed the conversational approach of Rubin & Rubin (2012). Participants were contacted by the investigator via a recruitment letter (Appendix C) and once amenable to participating in this study, they chose the time and location for the interview. The interviews lasted less than 60 minutes in length. The purpose of this interview was to inquire about each participant’s experience with the creation,
implementation, and reflection about the use of transdisciplinary, academically-integrated, thematic (TAIT) units within the career and technical education classroom and their perceptions on how such units influence student motivation, engagement, and learning. After the interview had been transcribed, each participant was provided a transcribed copy of the interview to check for accuracy and provided the opportunity to clarify any statements. Each participant was provided the opportunity to meet with the researcher a second time to elaborate on any parts of the interview they felt were unclear or not fully expressed. The researcher planned for a second follow-up interview to be scheduled at the participants’ convenience after they had the opportunity to review the initial transcript if the researcher had any follow-up questions or needed further clarification on a previously-asked question. None of the participants desired to meet with the researcher formally to discuss the contents of the transcript. After review of data from the first round of interviews, the researcher asked clarifying questions to the participants via email and telephone communication. Transcripts from the telephone conversation were provided to the participants in the same manner as previous and each participant was able to further clarify or modify any statements s/he felt did not accurately reflect his/her thoughts. After initial data analysis had been performed, the researcher again contacted the participants for the purpose of member checking.

**Document analysis.** The researcher examined documents relative to the targeted lessons. These documents included lesson plans, student handouts, examples of student work, and instructional materials utilized by the participants. In addition, the researcher’s thoughts were recorded in the form of notes taken about these documents. These notes were also used as a source of data for the study. The use of documents in a case study analysis is supported by Yin
(2009), “for case studies, the most important use of documents is to corroborate and augment evidence from other sources” (p. 103).

**Reflective memos.** The researcher took notes of her thoughts and impressions digitally in a Microsoft Word document immediately following each interview and during the reading of the transcripts as recommended in Miles, Huberman, & Saldaña (2014). The notes reflected body language and tone reflected throughout the interviews on the part of the participants as well as other non-verbal communication methods that were not illustrated on the interview transcript. These notes were reviewed throughout the data analysis process.

**Data Storage**

The protection and confidentiality of data was paramount in this study. All interviews were digitally recorded, and those recordings were stored on a secure digital data storage device and placed in a safe at the home of the researcher. Copies of lesson plans, paper documentation, and student artifacts were scanned to digital files and kept on the same digital storage device. Paper copies of documentation were returned to the participants after these documents were made into a digital format. The researcher was the only individual with access to the data. All materials will be destroyed and/or deleted three years after the conclusion of the study by the researcher.

**Data Analysis**

Data analysis via Stakian approach places as much credence to the first impressions of the researcher as the final compilations of the data. The researcher’s observations and impressions are then pared down until the final level of analysis. While Stake recognizes that more structured protocols, such as Yin’s, can help researchers differentiate obtained data from prior knowledge and, in turn, decrease the incidence of misperceptions, he gives greater value to
the researcher’s intuition and impression over the use of a more structured protocol (Yazan, 2015; Stake, 1995).

This researcher collected data from a variety of sources including semi-structured interviews, teacher lesson plans and lesson materials, researcher notes, samples of student work, and her own memos taken immediately after each interview and while reviewing documents. Multiple data sources were utilized to reduce the risk of limiting the study. As outlined in Merriam (1998), analysis occurred throughout the study. This researcher was intentional to take careful notes during the review of the data to capture her thoughts through the process. This researcher performed a cursory review of all textual data to look for repeated responses. These were noted, and separated into categories. Additionally, any responses deemed to be of particular interest or unique were noted and either placed within a pre-existing category or an additional category (Guba & Lincoln, 1981).

Using Saldaña’s (2015) *The coding manual for qualitative researchers* as a guide, this researcher employed an inductive analysis using in vivo and pattern coding with NVivo 11 software. First-round coding was done through in vivo coding after reading through the researcher’s observation notes and the transcripts from the interviews. This was done for the purposes of “breaking down the data into discrete parts, comparing them for similarities and differences” (Saldaña, 2015, p. 115; Strauss & Corbin, 1998, p. 102). In vivo coding provided the researcher a starting point for analytic leads for further exploration. Second-cycle coding was done using pattern coding for the purposes of condensing large amounts of data into a smaller number of analytic units as well as searching for the development of major themes within the data (Miles et al., 2014). Saldaña (2016) cites the pattern code as “a stimulus to
develop a statement that develops a major theme, a pattern of action, a network of interrelationships, or a theoretical construct from the data” (p. 238).

**Trustworthiness**

Before the findings were presented in the study, they were validated to the best of the researcher’s abilities. As qualitative research done via this methodology was done within a positivistic paradigm, Stake contended that it was nearly impossible to apply the concepts of validity and reliability to the research (Yazan, 2013). Stake (1995) cited, “most qualitative researchers not only believe that there are multiple perspectives or views of the case that need to be represented, but that there is no way to establish, beyond contention, the best view” (p. 108). He did, however, offer “…four strategies for triangulating data: data source triangulation, investigator triangulation, theory triangulation, and methodological triangulation” (Yazan, 2013, p. 146).

After the data had been analyzed, member checking took place. All participants in the study were given the opportunity to review the draft report to ensure that the researcher interpreted their thoughts appropriately. In accordance with Lincoln and Guba (1985), this step in the analysis process is “the most critical technique for establishing credibility” (as cited in Creswell, 2013, p. 252).

The presentation of findings of the case study “…focuses on defining the audience, composing textual and visual materials, displaying enough evidence for a reader to reach his or her conclusions, and reviewing and rewriting until done well” (Baskarada, 2013, p. 13). When presenting the findings, the researcher considered the audience that will be reading the study, as each audience has its set of needs. The language and terms utilized in the findings were common
use within the industry. Both tables and graphics were used to illustrate the findings. The researcher’s writing was articulate and clear for the reader.

**Protection of Human Subjects**

This study was conducted at a single site, a career and technical education high school located in the northeastern United States. Informed consent (Appendix D) was obtained from all participants before any data was collected. Participant confidentiality by the use of aliases protected the privacy of the participants. Due to the use of human subjects in the study, approval from the Institutional Review Board (IRB) at Northeastern University was obtained before any data collection or analysis took place. IRB approval to begin this research program was obtained on October 16, 2016 (Appendix A).

In chapter IV, a description of the data obtained will be discussed in greater length. Additionally, this researcher’s findings from the data analysis are presented later in Chapter V.
Chapter IV: Findings

Introduction

As stated in the first chapter, the purpose of this study was two-fold; the first objective was to examine the perceptions of CTE and academic integration teachers about student motivation, engagement, and learning during instructional delivery via transdisciplinary, academically-integrated, thematic (TAIT) units within the career and technical education classroom. The second objective was to examine how do CTE and academic integration teachers perceive that student learning, social integration, and classroom democratization is facilitated through the use of TAIT units in the CTE classroom.

This study documented the perceptions of six teachers employed at a career and technical education high school. The previous school year, 2015-16, was the first year one to three TAIT units were implemented in each of five career and technical education classrooms. This study focused on the perceptions of teachers involved with instruction within the aforementioned five CTE classrooms. The units reflected in this study covered the topics of maple sugaring, Typhoid Mary, mechanisms of death, the Flint water crisis, and pet nutrition and animal feeds. The researcher utilized several sources of data for collection and analysis. Yin (2009) advocates for the use of varied sources of evidence as “any case study finding or conclusion is likely to be more convincing and accurate if it is based on several different sources of information” (p. 116).

The findings revealed that the perceptions of both academic and technical teachers are that student motivation, engagement, and learning are increased in the presence of a TAIT unit. The findings also suggest that not only the breadth of learning is increased, but also the depth of learning that occurs. Finally, the findings explain the teachers’ perceptions as to how student learning, social integration, and classroom democratization are facilitated within a TAIT unit.
School Profile

The school selected for this study is a career and technical high school located in the northeastern United States. According to the Student Data Center at the school, the demographics of the 2016-2017 student population consist of 1028 enrolled students with an ethnic distribution of 910 Caucasian students, 77 African American students, 26 Hispanic students, 9 Asian students, 5 American Indian students, and 1 Pacific Islander student. Of the enrolled students, 38% are classified as students with disabilities (SWD) and have either an individualized education plan (IEP) or 504 plan in place. The federal school lunch data shows that 31% of the students enrolled in programming at this high school are eligible for free or reduced-price lunch (FRPL). The average daily attendance rate is 94%, and the program pass rate is 94% with a 78% pass rate on national trade/certification examinations. The program completion rate was 97% for students in 2015-16, all of whom completed their coursework with an employment certificate. Additionally, 33% of completers were New York state technically endorsed. The school serves twenty individual school districts over two counties in two states.

The criteria for selecting the school was its implementation of the transdisciplinary, academically-integrated, thematic units within several CTE classrooms over the past school year. Two members of the academic integration team, including this researcher, presented this teaching strategy and their initial experiences by both teachers and students during the New York State Association of Career and Technical Education’s annual conference in Albany, NY in June 2016.

Study Participants
Purposeful sampling selected the teachers who volunteered to participate in this case study. A total of eight teacher participants qualified for this study, and six agreed to participate after receiving an invitation (Appendix C) and informed consent (Appendix D) to participate.

Table 1. Participant Information

<table>
<thead>
<tr>
<th>Teacher (pseudonym)</th>
<th>Content Area Taught</th>
<th>Number of years at the institution</th>
<th>Number of years in education</th>
<th>Teacher Certifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrs. E</td>
<td>English Language Arts</td>
<td>4</td>
<td>12</td>
<td>English 7-12; Literacy (birth to grade 12)</td>
</tr>
<tr>
<td>Mr. S</td>
<td>Science</td>
<td>7</td>
<td>9</td>
<td>Physics 7-12; Mathematics 7-12</td>
</tr>
<tr>
<td>Mr. M</td>
<td>Mathematics</td>
<td>15</td>
<td>20</td>
<td>Mathematics 7-12; School District Leader</td>
</tr>
<tr>
<td>Mr. L</td>
<td>Criminal Justice</td>
<td>15</td>
<td>22</td>
<td>Public &amp; Private Security</td>
</tr>
<tr>
<td>Mrs. P</td>
<td>Animal Science</td>
<td>7</td>
<td>7</td>
<td>Agriculture; Animal Science 7-12</td>
</tr>
<tr>
<td>Mrs. T</td>
<td>Foundations of Education</td>
<td>19</td>
<td>19</td>
<td>Home Economics</td>
</tr>
</tbody>
</table>

From the six participants who agreed to be a part of this study, three teachers were career and technical education state certified teachers and three teachers were state certified in at least one of the academic content areas they teach. It is notable that Mr. S., the science integration teacher, is certified in physics, although he teaches all disciplines that fall within the “science” category including biology, chemistry, geology, and general science. It is notable that he is also a certified mathematics teacher. Mrs. T., the Foundations of Education career and technical education teacher, is certified in the career field of home economics, although her classroom content area focuses on early childhood education. Prior to becoming a full-time teacher at the
study site, she was a director of religious education at her local parish. The other four teachers who participated in this study hold teaching certifications specific to the content area that they teach.

Each of the academic integration teachers have teaching experience outside of the study site, specifically in a “traditional classroom” where they taught multiple sections of a course within their content area on a given day. Two of the career and technical education teachers’ paid teaching experiences are limited to the study site, and the third career and technical education teacher, Mr. L., spent seven years at another educational collaborative within the state teaching the same content. Prior to entering the educational field, Mr. L. spent approximately ten years as a law enforcement officer.

**Data Analysis**

Qualitative data analysis is comprised of three parts: “Noticing, collecting, and thinking about interesting things” (Khandkar, n.d., p. 1; Blumer, 1969). As data is collected, it is reviewed and the researcher may notice new things or need to give them greater thought. As data in this process is reviewed multiple times, it is often necessary to reexamine previously-collected data and reanalyze (Khandkar, n.d.). Noticing in this context refers to jotting down notes of things that the researcher notices during the course of an interview or looking at documents or artifacts. Both Miles et al. (2014) and Groenewald (2008) discuss the importance of jotting down notes or memoing on the part of the researcher as key components of qualitative data analysis. Figure 4 illustrates the workflow of qualitative data analysis.
During the course of evaluating the transcribed interviews, the researcher noted common themes which emerged within the six teachers’ responses. Miles and Huberman (1994) and Patton (2002) suggest early and concurrent analysis during the process of data collection. This researcher examined the documents initially to look for emerging themes that best represented the characteristics of the research questions. This researcher then assigned codes that best represented the relevant information in the data (Saldaña, 2016). Richards & Morse (2007) state that coding is a form of linking in that “it leads you from the data to idea, and from the idea to all the data pertaining to that idea” (p. 137). Keeping cognizant of Khandkar’s workflow diagram, the researcher recognized that the act of coding qualitative data is cyclical, resulting in further teasing out of the data until a large number of codes can be condensed into a more concise number. This researcher embodied a coding style that Saldaña (2016) refers to as a “splitter”; one who splits the data into small codable moments as opposed to a “lumper” — defined as one who uses a single code to label a larger segment of data such as a paragraph. As a result, the first round of coding resulted in a great number of in vivo codes.

**Teacher Interviews**

Six teachers were interviewed for this study. Each of the academic integration teachers was interviewed one-on-one in a private office within the Academic Integration Center at the school at a time of mutual convenience for both this researcher and the participant. The career
and technical education teachers’ interviews were held in the CTE teacher’s classroom outside of scheduled class hours to maximize the comfort of the teacher.

After the interviews had been transcribed, they were sent to each teacher for verification of accuracy. Once returned from the interviewees, this researcher uploaded the transcripts into the NVivo 11 software to assist in the analysis process.

**First-round coding.** Due to the ontological nature of the research questions of this study, it was decided that the first-round coding would utilize in vivo technique. This approach is supported by Saldaña (2016) as a method to “prioritize and honor the participant's voice” (p. 106). The researcher reviewed the transcripts line by line, selecting key text and tagging it throughout the document. In vivo coding utilizes words and phrases of the participants to develop codes (Saldaña, 2016). This resulted in 534 coded selections. These selections were then looked at holistically for emerging themes.

**Second-round coding.** Pattern coding was the second-round coding technique applied. Saldaña (2016) describes pattern coding as “a way of grouping those summaries into a smaller number of categories, themes, or concepts” (p. 236). The selected text entries were initially placed into one of thirty categories created by the researcher based upon the patterns noticed. Using Beane’s (1997) Curriculum Integration Theory, social integration on the part of the students and the lesson design was defined not only as interactions between students but also between students and society.

After second-cycle pattern coding occurred, the researcher examined the transcripts once again and assessed the codes used. Codes that were similar or repetitive in nature were condensed into a single code, and codes that were outliers or no longer needed were eliminated. Miles and Huberman (1994) discussed the paring down of data:
Data reduction is not something separate from analysis. It is part of analysis. The researcher’s decisions – which data to chunks to code and which to pull out, which evolving story to tell – are all analytic choices. Data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that final conclusions can be drawn and verified (p. 11).

At this point, the data was examined to look for themes that had emerged across all facets. Creswell (2013) defines themes as “broad units of information that consist of several codes aggregated to form a common idea” (p. 186). The placement of codes into themes allowed the research to interpret the data meaningfully. Theming of the data in this manner resulted in seven distinct themes: Connections, social integration, student engagement, student learning, student motivation, TAIT units, and teachers. A table illustrating these seven themes and the categories from which they were created is listed below.

Table 2. Coding Categories and Themes

<table>
<thead>
<tr>
<th>Second-Cycle Coding Themes and Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connections</td>
</tr>
<tr>
<td>Career</td>
</tr>
<tr>
<td>Connections</td>
</tr>
<tr>
<td>Current Events</td>
</tr>
<tr>
<td>Relevance</td>
</tr>
<tr>
<td>Story</td>
</tr>
<tr>
<td>Social Integration</td>
</tr>
<tr>
<td>Student-to-Family</td>
</tr>
<tr>
<td>Student-to-Nature</td>
</tr>
<tr>
<td>Student-to-Society</td>
</tr>
<tr>
<td>Student-to-Student</td>
</tr>
<tr>
<td>Student Engagement</td>
</tr>
<tr>
<td>Engagement</td>
</tr>
<tr>
<td>Student Learning</td>
</tr>
<tr>
<td>Activities</td>
</tr>
<tr>
<td>Assessment</td>
</tr>
<tr>
<td>Breadth</td>
</tr>
<tr>
<td>Depth</td>
</tr>
<tr>
<td>Differentiated</td>
</tr>
<tr>
<td>Hands-On</td>
</tr>
<tr>
<td>Higher-Level</td>
</tr>
<tr>
<td>Thinking</td>
</tr>
<tr>
<td>Learning</td>
</tr>
<tr>
<td>New Learning</td>
</tr>
</tbody>
</table>

| Student Motivation                        |
|   Motivation                              |

| TAIT Units                                |
|   Disciplines                            |
|   Future                                 |
|   Length                                 |
|   Obstacles                              |
|   Standards                              |
|   TAITs                                  |

| Teachers                                 |
|   Collaboration                          |
|   Demographics                           |
|   Role                                   |


Follow up interviews. After second-round coding occurred, the researcher took the opportunity to schedule follow up interviews via telephone or videoconferencing based upon the preference of the participants. The purpose of the follow up interview was two-fold; first to provide an opportunity for member checking with the first interview transcript, and also to gain a greater insight into the participant’s thinking about the use of the TAIT units and expand further on questions the researcher had after the first interview. These interviews were short in duration, lasting less than thirty minutes. The interviews did not result in the creation of any additional themes or categories by the researcher; rather they resulted in a deeper understanding of the creation and use of the units for the researcher.

Member checking. Creswell and Miller (2000) define member checking as the “taking data and interpretations back to the participants in the study so that they can confirm the credibility of the information and narrative account” (p. 127). In this study, member checking took place in two distinct ways. First, narrative accuracy checks occurred after the first interview as the participant was provided a transcribed copy of the interview to verify that his sentiments were accurately portrayed in the transcript. Narrative accuracy member checking occurred at the time of the follow up interview. After the second-round interviews, member checking occurred again as the researcher shared her themes and categories with the participants and elicited feedback to insure that her interpretation of the data was in line with the intended meaning by each participant. The member checking process occurred online individually with each participant via videoconferencing. The purpose of member checking is to increase both the credibility and the validity of a qualitative study. Lincoln and Guba (1985) state that member checking is “the most crucial technique for establishing credibility” (p. 314).

Reflective Memos
The researcher made copious memos throughout the data collection and analysis process. After each interview, the researcher spent approximately twenty to thirty minutes writing down her observations with regard to the participant’s body language, verbiage, and tone. As the interviews were transcribed and before sending to each participant for verification of accuracy, the researcher reviewed her initial impressions from the interviews in their textual format. As they were returned from each participant, the researcher once again reviewed the transcripts for the sole purpose of recording her thoughts and impressions as well as jotting down potential follow up or clarification questions.

As the researcher examined documents provided by the participants, she recorded her thoughts and impressions. Keeping the research questions of the study in mind, particular attention was given to data that appeared connected to student engagement, assessment of learning, social integration and classroom democratization.

As the researcher recorded her thoughts through memos, she was mindful of Glaser’s (1978) guidelines for effective memos:

1. Keep memos separate from data, 2. Stop coding when an idea for a memo occurs, so as not to lose the thoughts, 3. A memo can be brought to you by literally forcing it, by beginning to write about the code, 4. When a lot of memos on different codes appear similar, compare the codes for any differences that may have been missed. If the codes still seem the same, collapse the codes into one code, and 5. When you have two ideas, add two separate memos to avoid confusion (Polit-O’Hara & Beck, 2003, p. 582).

**Document Analysis**

It is the recommendation of Saldaña (2016) that descriptive coding be used as a first-cycle coding for documents. The documents analyzed in this study included unit lesson plans,
student handouts, student readings, laboratory guides, classroom teaching materials such as reference guides to be used during activities, writing prompts, and exemplars of student work. After first-round coding of teacher-provided documents, thirty-one codes were assigned. Second-round coding used pattern coding, recommended by Saldaña (2016), as logistical way of grouping data summaries into themes.

**Research Questions**

The research questions that guide this case study are:

1. What are the perceptions of career and technical education teachers and academic integration teachers regarding student motivation, engagement, and learning with the use of transdisciplinary, thematic, academically-integrated units in the CTE classroom?

2. How do career and technical education and academic integration teachers perceive transdisciplinary, academically-integrated, thematic units facilitate student learning, social integration, and classroom democratization in the CTE classroom?

**Thematic Analysis**

Several super-ordinate themes emerged from the data analysis including student motivation, student engagement, social integration, and classroom democratization

**Student motivation.** All six of the participants responded that student motivation was an important element in the success of the TAIT units. Mrs. E ascribed this to “I think the fact that every day was different” as a key contributor to student motivation within a TAIT unit. Mr. M added that the excitement factor of the activities involved in the TAIT unit contributed to the students’ motivation, stating “students who would normally want to just sit and just do their work and be done were now offering to go collect the sap because…it was just an excitement of,
I need to go out and be a part of that”. He also added, “I mean you’ve got some city kids that are not out in the middle of trees having fun, realizing that they’re going to produce something that is quite a good experience for them.” Mrs. P. cited the use of hands-on experiments as part of the Animal Feeds unit and students’ participation in the calorie lab as a motivating factor, “during the calorie lab we used fire, so that’s really exciting for them”. She stated that the use of elements such as fire and hands-on messy activities in the TAIT unit added to the students’ motivation to participate in the lessons:

When we had done previous activities [in prior years on the same curricular objectives], it wasn’t as in depth and it wasn’t necessarily as messy. Students like to see messy and then see the end results after they’ve made the mess. They like to set things on fire. 

**Student engagement.** Student engagement occurs when students are actively participating and demonstrate on-task behavior in the classroom (Cawthorn et al., 2001). All six of the teachers interviewed perceive that the use of TAIT units in the classroom increased student engagement. The reasons for this cited by the participants include the hands-on experiences embedded in the units, differentiation of instruction to accommodate for different learning styles within and between activities, and the ability for students to make social connections between the individual lessons within the unit and their chosen trade or personal experiences. Each of these reasons is discussed in further detail below. 

**Hands-on experiences.** Rayneri, Gerber, and Wiley (2006) found that students are more motivated and engaged when the instruction includes hands-on activities that have real-life application. When asked directly about student engagement within a TAIT unit, Mrs. E responded:
I think they’re more engaged in these types of units because they know there are hands-on components. They’re learning something new but they don’t take that negative approach to traditional learning or lecture style that may occur for certain pieces.

Mrs. E elaborated that the deliberate planning of hands-on components within the units helped students to be more engaged and focused, “there was always, for every bit of what we would consider traditional classroom learning, there was a hands-on aspect, [resulting in students being] extremely engaged and focused”. Mrs. P added her impressions when discussing the Animal Nutrition TAIT unit,

I think they were more engaged than in past [traditional] units because we were doing fun stuff. They definitely thought the activities were more fun. They were not stationary sitting at their desks. They found that this unit itself was more entertaining than for them in the past.

**Differentiated learning.** Student engagement is increased when differentiated instruction is provided that meets the needs of all students’ learning styles and intelligence (Douglas et al., 2008). In conjunction with the hands-on component, Lister (2005) states that kinesthetic learning activities provide students with differentiated learning that results in increased student engagement. Mr. M discussed the “outside the box” thinking that occurs in the development of the TAIT units, providing experiences for students who traditionally may “not necessarily want to get involved” but now “can’t help it [getting involved]” and embrace the opportunity to participate. The transdisciplinary approach to the TAIT units allows students to experience a theme through a variety of academic contexts. Mr. L spoke about his perceptions

I think they were more engaged [with the TAIT unit] because it hit different learning styles, and for the students who really want to get into the criminal investigations part of
it and the forensics part of it, I think it really opened their eyes up to the reality of when people pass due to foul play or a criminal element, how we try to investigate that and then how we try to report it, our findings by doing visual investigation and following up with reports. I think it really engaged them throughout the process.

**Social connections.** When discussing student engagement within the context of a TAIT unit, Mr. S. talked about the different topics related within the unit and stated, ‘they were different topics, but they were still things that they considered relevant and that is the key thing”. Mr. S. added, “You gain something that is lost when you have individual classrooms. When you have to get up and you walk over to English, and then you get up and walk over to math, and then you get up and you walk over to science…you lose a real relevance that is important for student engagement…” Mr. M also talked about the curricular interconnectedness within a theme as a reason for increased student engagement, “they were more connected with how the English connected with the science connected with the math”. In the Maple Syrup TAIT unit, where the collection process ran over several weeks’ duration, students were able to make predictions as to what they would find in the buckets using the weather conditions over the previous 24 hours. Mr. M stated that the ability to make these daily predictions within the unit increased student anticipation and student engagement, “we predicted whether last night was a good night for the sap to run or not a good night…that was engaging for the student”.

**Student learning.** Reviewing the data in regard to student learning, again, all six of the teachers indicate that the use of TAIT units in the classroom provide students with more connections to their learning as well as a greater breadth and depth to their learning. Mrs. T shared reactions from her students after the completion of a TAIT unit, “boy, that was great; they don’t teach us like this at our home school”. Mr. M expressed his ideas about student learning
within a TAIT unit as, “There’s more ownership from the student because we, as professionals, give them some basic guidelines and then sort of let the learning occur. We step back and allow students to develop and build their own learning and knowledge”.

Connections to learning occur in three ways: Students can make connections between the unit theme and individual subjects, both academic and technical; the interconnection of the lessons within the unit to one another; and the differentiated instruction methods used throughout the unit address a number of learning styles within the student audience. This encompasses not only the first research question but also the second research question which queries how student learning is facilitated through the use of a TAIT unit.

**Thematic connections.** The brain research of Strahan et al. (2012) showed that learning best occurs when connections between a concept and a hands-on concrete application. Mr. S. relayed a story about teaching in a traditional high school science classroom. He spoke about the length of time that he spent on a specific concept midway through the school year that he spent at least two weeks covering and the students’ inability to recall this at the end of the year prior to the final examination. When asked as to why he believed this occurred, he stated, “I really do think that it is the lack of connection as the reason they weren’t able to remember this”.

The use of a single theme that provides relevance to the students’ learning allowed students to see how different academic and technical disciplines interconnect. Mr. M discussed how in the Maple Syrup TAIT unit, the lessons within the unit spread across multiple academic disciplines, “We went everywhere from the science of it, to the math of it, and then the English of describing how it worked out”. He further elaborated that from the students’ perspective, “They were more connected with how the English connected with the science connected with the math” with regard to the overall theme.
When asked about the use of TAIT units within the CTE classroom, Mr. S. spoke about the academic content connections within a TAIT unit versus the presentation of academic subjects in isolation, “You gain something that is lost when you have individual classrooms [for academic subjects]”. Mr. L also spoke about how the use of multiple academic contents within a single unit helped to facilitate student learning, “I think it was good because it had several different disciplines involved and I think it helped with a lot of their different learning styles”.

**Lesson interconnectedness.** Pinkus (2015) speaks about the need for interconnectedness within thematic teaching, “Education should reflect the interconnectedness with which the world developed and changed through time so that students are better prepared for the world around them” (p. 1). Student knowledge and learning built between the lessons within a TAIT unit in that information from one lesson was then revisited within additional lessons in the unit. When speaking about lesson interconnectedness, Mrs. T. said, “They [the lessons] all tied together, and I think it helped them to really make sense out of [the unit]”. Mrs. P. reflected on this thought when discussing the lessons within the Animal Feeds TAIT unit, “…using the information from the different lessons on nutrition to bring it all together”. She also related that lesson interconnectedness is not limited within a single TAIT unit but rather the concepts learned from one unit also contains an interconnectedness to future units, where the new knowledge from one unit provides the platform for prior knowledge acquisition later in the academic year, “we will go back to these lessons to approach new learning that we are doing”. Scarapani (1998) promotes the use of interconnected lessons within thematic teaching stating that they are “excellent ways of engaging students in higher-order thinking” and that such lessons “provide opportunities for students to see how knowledge in one discipline folds into knowledge in other disciplines” (p. 275).
Differentiated instruction. Differentiated instruction within a TAIT unit occurs via two distinct pathways. First, there is differentiation of the material presented within the unit, in that the students are provided multiple learning activities, individual and group work, and learning activities addressing both the needs of auditory and visual learners. The use of intentionally-planned differentiated learning activities within the unit provides students with various options to demonstrate what they have learned. When discussing the ice cream lab within the Typhoid Mary TAIT unit, Mrs. E described, “One of the culminating experiences of this unit, students actually get to use a variety of techniques to make homemade ice cream, to see how Mary Mallon could have potentially contaminated other people by making ice cream”. She also went on to describe other activities contained within the unit to include a WebQuest about microbiology, the analysis of a handwritten letter by Mallon, a communicable diseases project, a handwashing lab, and a lecture-format lesson on communicable diseases.

Within the Mechanism of Death TAIT unit, Mr. L discussed the variety of lesson formats and activities that addressed multiple intelligences and individual student strengths such as “presenting information from a textual input about a case and converting that information into a crime scene sketch of not only the scene but also the injuries of the victim”. Students also were required to perform an autopsy on their victim to determine the cause of death, estimate the time of death based upon physical factors and mathematical formulas, create a written autopsy report of their findings, and also prepare and present a press conference as a forensic investigative team to inform the public of the status of the crime. Utilizing Gardner’s (2011) Theory of Multiple Intelligences as a guide for instructional differentiation, the Mechanism of Death unit hit upon seven of the nine intelligences outlined as illustrated in Table 3.
<table>
<thead>
<tr>
<th>Intelligence</th>
<th>Learning Activities</th>
<th>Activities Covered within MOD Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal-Linguistic</td>
<td>Learning through spoken and written words; reading, listening, speaking, and writing</td>
<td>- Body of Work Chapter 2 Reading&lt;br&gt;- Autopsy vocabulary jigsaw activity&lt;br&gt;- Written Autopsy Report&lt;br&gt;- Autopsy Report Analysis Exercise&lt;br&gt;- Press Conference Oral Presentation</td>
</tr>
<tr>
<td>Mathematical-Logical</td>
<td>Learning through reasoning and problem-solving; numbers</td>
<td>- Calculating time of death of the decedent using physical factors and mathematical formulas</td>
</tr>
<tr>
<td>Visual-Spatial</td>
<td>Learning visually and organizing ideas spatially; think in images and pictures, and “see” things in one’s mind</td>
<td>- Autopsy lab graphic organizer&lt;br&gt;- Creating photographs of the autopsy procedure&lt;br&gt;- Watching a video of a human autopsy&lt;br&gt;- Creation of Crime Scene and Victim sketches</td>
</tr>
<tr>
<td>Bodily/Kinesthetic</td>
<td>Learning through interaction with one’s environment; concrete experiences</td>
<td>- Hands-on activities such as Chicken Autopsy Lab, Crime Scene Reenactment, Crime Scene and Victim Sketches</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Learning through feelings, values, and attitudes; understand other people</td>
<td>- Pre-reading questions addressing feelings, fears, and attitudes about autopsies&lt;br&gt;- Post-reading discussion of changes, if any, of the above</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Learning through interactions with others; working collaboratively and cooperatively</td>
<td>- Group work and pair work activities embedded throughout the unit</td>
</tr>
<tr>
<td>Existential</td>
<td>Learning by seeing the “big picture”. Connects real-world understandings and application to new learning</td>
<td>- Use of fictional crime case to integrate core academic and technical concepts throughout the unit</td>
</tr>
</tbody>
</table>

The second method of differentiation within a TAIT unit includes the use of multiple instructors within the unit, each of whom have their own teaching styles and ways of presenting
material. The use of multiple instructors within a TAIT unit allows for students to experience material presented within different contexts by teachers who demonstrate different teaching styles. The intensive collaboration during the creation of the units allows for all instructional members to be intimately familiar with the lessons their colleagues are presenting and allows for instructors to field questions on subsequent days regarding a lesson they may not have directly taught. Mrs. T reflected on the differences of teaching styles and its impact on the students in her classroom when talking about the collaboration of teaching amongst TAIT unit teachers, “They’ll get the information across to you in one particular way, where another person’s going to get it across in another way”. This model of teaching supports both the shared planning on the part of the TAIT unit team as well as clarification of material by two separate experts about a topic, allowing students to receive differing explanations using the same information.

**Breadth and depth.** Both academic and technical teachers expressed their perceptions that student learning occurred at a broader and deeper level when academic and technical concepts were introduced to students through a TAIT unit versus previous teaching methods utilized. When Mrs. T was asked about student learning, she replied, “This is broader. Yeah, this is much broader, I think. It’s not just, okay, this is what it is, this is how you do it, and this is why you do it, which is probably what I did ten years ago. It probably made sense to the people I was teaching then because they had to wash their hands all of the time”. She further elaborated that the Foundations of Education program had an on-site daycare facility, which has since closed, where the students underwent work-based learning. Due to the closure of this facility, the relevance of the handwashing/spread of disease lesson objectives needed to be relayed in a different capacity. To this end, she stated, “I really wanted it broadened because we don’t have that piece anymore”. With regard to working with a team to create and produce TAIT units, she
stated, “We have more time and more collaboration, and more of a sense of, ‘okay, how can we make this hands-on, how can we make it interesting, and how can we look at the broader experience?’”. As a result of the TAIT unit format, she claims that “they [the students] have learned how to ask their own questions that I may not have come up with, and then we can investigate that”.

Mr. M discussed how working together in a team to create TAIT units promoted some “outside the box” thinking on behalf of his colleagues, “she [one of the academic integration teachers] goes that extra mile to really come through with some extra learning, some extra things that you go, that’s out of the box but inside the realm of learning that really anticipates a student trying to…not necessarily want to get involved but then can’t help it”. Mr. S also stated that due to the theme being used as a context for teaching, from a science perspective, “I am looking at the science standards and many of them have applicabilities to practical science, and those are the ones that we’re taking and we’re applying to, whether or not it has to do with students making observations, taking measurements, making predictions, understanding and interpreting the world around them, and just building that broader science concept behind it”.

In terms of the depth of student learning, Mr. S stated that within the planning process of the Maple Syrup TAIT unit, “our team, together, under the leadership of [academic integration teacher], really came together to make a unit that had to do with really going deeper into the idea of harvesting the sap from the maple trees, when is that done, how is that done, and then what the significance of that would be”. With regard to teaching science within a TAIT unit he claimed, “I think that maybe you do get into even more complicated themes because I feel like within a transdisciplinary unit we actually can get into more complicated themes than you would otherwise because there’s a reason to”. He stated that the Maple Syrup TAIT unit allowed him
to teach students about “…the concepts of solubility, the concepts of chemical change due to heat, and just the various other transformations that go along with that so that they would also understand the processes that are behind that, they could be applicable to other areas as well, so not only for the creation of maple syrup, but in general also for caramelizing actions that they may perform were they to be working in part of the food service side of the hospitality career”.

Specific to the depth of the caramelization process during the boil off of the sap, he stated:

it contained a complexity that I normally would not have ever wanted to pull in and would have had trouble justifying to students. We would have talked about something else entirely, something that had a more simple chemical pathway [than sugar]. This pushed me into doing something that was more difficult. I think the students are richer for it.

From a technical teacher perspective, all of the technical teachers expressed that the TAIT unit allowed them to go into more complex concepts with students. Mrs. T, who has both first-year and second-year students within the same classroom, stated “what I usually do is try to figure out what I could use that would help the students who are just coming in to learn some things, and then also help the second-year students to really look at things at a deeper level, like thinking about that unit from last year”. Mr. L discussed the Mechanism of Death TAIT unit and said, “I think the way that we did it here [using the TAIT unit] was more involved and gave them a lot”.

When comparing how students learned within the TAIT unit versus how the material was presented in previous years, he stated “…this one gave them more hands-on learning, put them in the shoes of what a medical examiner would do. Previously, we didn’t do that. We kind of told them and showed them, but here they actually got to do it”. Mrs. P relayed similar sentiments
when talking about the Animal Feeds and Nutrition TAIT unit, “when we had done previous activities [covering these learning objectives], it wasn’t as in depth”.

**Social integration.** Beane (1993) describes social integration as a “problem-centered curriculum that involves collaborative work on common social issues” (p. 6). Teacher observations of how the TAIT units facilitated social integration fell predominantly within four subcategories: (1) student-to-student(s), (2) student-to-society, (3) student-to-nature, and (4) student-to-family. This is illustrated in Figure 5.

![Diagram of Types of Social Integration within TAIT Units](image)

*Figure 5. Social Integration within TAIT Units*

**Student-to-student integration.** Social integration between students is facilitated through intentional design within the TAIT units. Students are often required to work together in partners or small group settings, participate in pair-and-share activities, laboratory activities that include a small group, and other hands-on group activities. Mrs. E spoke about the instructors’
intention to insure that students work together, “we try very hard to make sure that students don’t work one-on-one, and most of our classes don’t necessarily use traditional lecture, so students have several opportunities to work in small pairs and to work as teams”. For example, in the Mechanism of Death TAIT unit, students worked in teams of four as a forensic pathology team. They were responsible for several group projects within the unit including a case study analysis of their victim, performing a physical autopsy of their victim, creating crime and victim sketches, and culminating in a mock press conference presentation where all of the findings of their case were presented to “the public” in their classroom. Students worked collaboratively through Google Drive applications for the completion of data sheets, autopsy drawings, press conference scripts, and autopsy reports.

When asked about social integration within the TAIT units, Mr. S added, “Socially, within the classroom, under the direction of the teachers, they [the students] were interacting with one another and accomplishing some of the tasks that we had for them to meet their learning goals”. When asked for clarification, he added that “students were working in groups” and specifically referred to the Maple Syrup unit where students, in small lab groups, worked together to create different sugar solutions to illustrate the different concentrations one may observe during the boil down process in the formation of maple syrup from maple sap. When asked about how social integration occurred within the Mechanism of Death TAIT unit, Mr. L replied, “They had to work in groups and basically digress in how to do an autopsy and then try to see if they can figure out what might have caused the person to, on in their case, a chicken, to die”. Students further worked together in that unit in 4-person teams to create crime scene sketches and later present a mock press conference where each student represented one member
of the forensic investigative team to inform the public of the discoveries and status of their assigned case.

During one activity in the Typhoid Mary TAIT unit, students from two separate classrooms worked together in a bacteria collection lab, allowing students to interact with others outside their normal classroom in an investigation. Mrs. T cited this as an example of social integration, “Here, they worked together in groups. They didn’t keep the same groups the whole time. For the most part, they worked with the students they sat next to, but that wasn’t the same every single time”. When asked for examples of how student-to-student social integration occurred during this lesson, she replied,

They all talked to each other about things. I think it was a little more difficult maybe when we did it with the other class, because they didn’t know them, but they still did it.

They were still collaborative and worked with the other people without a problem.

Mr. M also spoke about student-to-student integration and his observations and perceptions of how students received the group tasks and said, “They like the fact that everyone is doing it together”. Mr. M also cited an example during the Flint Water Crisis TAIT unit done with the Foundations of Education class, “I know that with each other they were very interactive and were talkative about what was happening…”.

**Student-to-society integration.** Student-to-society integration occurs through one of two pathways. The first pathway is the awareness of a societal issue through the TAIT unit, often relayed through a storytelling technique that becomes the central focus of the unit. For example, the unit on communicable diseases was facilitated through the story of Mary Mallon, more commonly known as Typhoid Mary. Students examined disease transmission, transmission prevention, health policy, microbiology, exponential growth, and English language arts elements
through the use of handwritten letters by Mallon to a health official, George Soper, at the time. Other examples include the use of current and news events as a central theme for the unit. The Flint water crisis was used as a medium to discuss the physiological, emotional, and societal effects of lead contamination in a drinking water system. In the Mechanisms of Death unit, students were introduced to actual criminal cases to provide a reference for the various stages of rigor and how forensic pathology plays a role in determining the cause of death and the criminal investigation process.

Student-to-society integration also occurs in how students respond to the information and knowledge gained by the unit of study. For example, social advocacy was demonstrated by students who then took proper handwashing techniques to educate others in public. Mrs. T spoke about how the handwashing and spread of disease lesson within the Typhoid Mary TAIT unit allowed her students to become handwashing advocates not only for themselves but for others as well, “…that lesson makes them very aware of bacteria, and how taking care of hygiene affects you as a person and keeps you safe, but then also how important it is to help keep other people safe too” and “One of the things, they get very aware of who doesn’t wash their hands, and what we should do to help people to remember to do this.” The students’ takeaway of this information, she believes, “I think that they can help somebody else to learn how to do this and then also as a result, people in general are going to be healthier from them doing it and other people doing it.”

Mrs. T talked about the importance of using social advocacy and the knowledge brought forth by the issues covered within the TAIT units to bring about awareness as young adults to their elected officials about the impact of social issues, “Maybe you can’t do the whole thing [solving the issue individually], but try to get with some people who can look at this, or the right
people”. To this degree, students wrote letters to politicians to express concern and ask for support for social causes related to the victims of lead contamination. Mrs. T also spoke about the relevance of this issue within a Foundations of Education career track for her students, “It is to really try to get to know your community and what’s happening in your community, and to really pay attention to those children when they walk through the door, which is something in childcare you do”.

Mrs. E spoke about her role in facilitating student-to-society integration within the Typhoid Mary TAIT unit, “My specific role was to talk a little bit about the history of Mary Mallon, who was one of the most famous individuals who was ostracized from society for having a communicable disease that could have potentially been treated had we had more advanced scientific knowledge at the time”. In this unit, students were introduced to bacteriology, communicable diseases, and prevention of transmission through the story of Mary Mallon. Students were required to later make applications to their own lives and to their chosen career track. Mrs. E gave a further description of both her role within this unit and how student-to-society integration occurred within the Typhoid Mary TAIT unit:

It was a good way to show students how not washing out hands leads to other problems, so I did several lessons: one specifically about the history of Typhoid Mary, one that introduced them to a different perspective and specifically how she felt being ostracized, and actually removed from society, and then I led the final project where students had to research a different communicable disease and create either a brochure that could be given out to other students, or a poster that could be displayed in class, to remind us why it’s important to take some of the safety precautions that we do.
Mrs. E spoke how the Typhoid Mary TAIT unit had connections to students’ chosen career path when presented to a hospitality careers class,

In the case of food preparation, if we don’t practice certain safety and cleanliness rules, it is very easy for us to pass on those diseases to other individuals, whether we intended to or not. In this case, I think, for students, something as simple as the peach ice cream that Mary Mallon was known to make and famous for making, literally turned an entire household and their friends ill from consuming it. I think it makes them more aware within their career choice.

Mr. S added how the Maple Syrup TAIT unit connected students to an industry and social events that occur in the local region, “Maple syrup production is an industry, and it is an industry in this area and other places as well, so it has a practical focus in that way, and so far as that it is something that is going on around them”. He cited a Maple Fest event that occurs every spring approximately 40 miles north of the study site and said, “This is something that people in this area are participating in, and it’s worth understanding how it is that this is happening, and at the same time it also meets educational goals that we have for them”.

Finally, Mrs. P discussed how the students’ work and projects facilitated a connection between the students in her Animal Science program and stakeholders in the community who were able to examine the students’ final projects that were displayed during the spring open house at the site, “There were people from the community that could see what the animal science students had done”. She also elaborated that as a result of the Animal Feeds TAIT unit, the students “…in the future when they are in college or working in the industry, they will be able to use that knowledge to help out other people, whether it’s customers, clients in a vet’s office or a pet store, to help them make the correct decisions for pet nutrition”.
**Student-to-nature integration.** Student-to-nature integration was cited primarily in the discussion of the maple sugaring unit. In this unit, many of the hands-on activities involved outside work in the woods where students were responsible for identifying and tapping maple trees followed by sap collection over several weeks. Mr. M spoke of the initial outdoor experience students had with the Maple Syrup TAIT unit when he described that students would “leave their classroom under the guidance of [science teacher] in order to identify the trees”. He also spoke about how this was a new experience for some of the students who had grown up in New York City or another urban area and for whom being in the woods was new, “I mean you’ve got some city kids that are now out in the middle of trees having fun, realizing that they’re going to produce something that is quite a good experience for them …and really have that interaction with nature, interaction with the sciences”. Mr. S expressed similar sentiments when describing his recollection of the unit, “I know that [science teacher] was working with them in order to get the sap collected, so going out behind the Animal Science building and selecting the correct trees, tapping the trees, checking the buckets daily, and collecting the sap”. This was followed by using the collected sap, filtering it, and subsequently boiling it down to create a syrup which students later enjoyed during a pancake breakfast.

Student-to-nature integration also occurred as a result of the Flint Water Crisis TAIT unit in that students became aware of local instances of lead contamination involving both soil and water contamination. Within the Flint Water Crisis TAIT unit, students were introduced to the concept of how the change in the water source for Flint affected extraction of lead within the old pipes to contaminate the water delivered to homes. Mrs. T then took the lessons of the unit to incorporate an additional lesson about a local incident:
I have an article over there that I cut out of the paper, and it is about upstate New York, and it is about getting the soil that was kept hidden for years, and years, and years. Now looking at it, it is like, ‘oh if they know about this, they’ll never, ever be uninformed’, I think about that particular topic, because we covered so many aspects of it [in the Flint Water Crisis TAIT unit].

**Student-to-family integration.** A pleasantly unanticipated example of social integration that was present in the data was the presence of student-to-family integration as the result of the TAIT units. Teachers cited examples of student responses that the information learned from the classroom was then discussed and/or implemented at home. For example, students who participated in the Typhoid Mary unit took the proper handwashing techniques used in a laboratory exercise to instruct younger siblings at home on the same. Mrs. T described this, “Even they’ll go home and they’ll come back, and the next day they’ll say, ‘I taught my younger sister, or my younger brother or whatever, how to wash their hands’ and we’ll all get talking about it. Mr. M talked about his impressions of students taking information home from the Maple Syrup TAIT unit, “…were very talkative about what was happening and I think they took it home to their parents. I think that’s the social aspect that connects people together is that social interaction of, my other classmates from other schools and then all of a sudden I am talking to my parents. I get to take samples with me”.

**Classroom democratization.** Apple and Beane (2007) have defined characteristics that categorize a democratic classroom as (1) the open flow of ideas, (2) faith in the individual and collective capacity of people to create possibilities for resolving problems, (3) the use of critical reflection and analysis to evaluate ideas, problems, and policies, (4) concern for the welfare of others and the common good, (5) concern for the dignity and rights of individuals and minorities,
(6) an understanding that democracy is not so much an ideal to be pursued as an idealized set of values that we must live and that must guide our life as a people, and (7) the organization of social institutions to promote and extend the democratic way of life. A list of these characteristics were provided to the teachers and they were asked how the TAIT units used and those currently under development are meeting the goals of democracy in the classroom.

Mr. M responded to this inquiry, “I saw the free flow of information as the students were comparing notes and discussing their outcomes with each other. Ideas and proposed outcomes were discussed and reasons for refuting were constructive and allowed for a democratic debate rebuttal time approach. The end result was a collaboration of the ideas and reasoning of the group”.

Mrs. E described classroom democratization within three of the TAIT units: Typhoid Mary, Maple Syrup, and Mechanism of Death:

The democratic classroom was employed in a variety of ways in this unit. Students were taught about the history of communicable diseases, our class study was Mary Mallon also labeled as Typhoid Mary. Students discussed and problem solved a variety of issues with her situation, treatment, and attempted to come up with solutions that could enact policy change in regard to who we quarantine as individuals. Current day examples, such as the nurse from Maine who was in contact with Ebola, were cited as well as local whooping cough outbreaks. The final project required students to research a specific disease, define how we contract it, how to treat it, as well as strategies for public health and awareness. They then presented their findings to classmates and received feedback from peers and teachers.
The unit as a whole lends itself to the democratic classroom by allowing students to exchange ideas about tapping, collection, and processing as well as other products that use maple syrup. They had to work in teams in many aspects to ensure the maple syrup was always tended to. They problem solved issues with taps, collection, weather patterns etc..

Students worked in teams to investigate and report on the death of a character. While taking various professional roles on a team where they had an open exchange of ideas, faith in each other and teams possibilities to build reports. Critical reflection and analysis of each aspect of investigation and report out. Students developed a better understanding of investigating polices and social institutions.

Apple and Beane (1995) discussed what a democratic school looks like and posited that “the idea of democratic schools has fallen in hard times, … we must keep the long tradition of democratic schools reform that has played a valuable role in making many schools lively and powerful places for those who go to them” (p. 3). The classroom democratization that occurs within a TAIT unit provided students the opportunity for students to look at historical and real-world issues and apply them to not only their proposed career choice but also to present-day societal issues.

Findings

After all of the data was analyzed, this researcher reflected back to the research questions of the study. Looking at the questions individually, this researcher looked through the teacher responses once again to determine if enough data had been collected to answer each question posed adequately. It was determined that the data collected do, in fact, provide sufficient evidence to support the conclusions made by this researcher. The connection of the final
findings to the research questions is outlined in Table 4. The findings as interpreted by this researcher answer the research questions that were used to guide this study.

Table 4. Research questions and connection to study findings

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Study Findings</th>
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| What are the perceptions of career and technical education teachers and academic integration teachers regarding student motivation, engagement, and learning with the use of transdisciplinary, thematic, academically-integrated units in the CTE classroom? | 1. Student motivation is perceived to be increased when taught via a TAIT unit. This was attributed to what one participant referred to as the *excitement factor* in that every day within the TAIT unit was different and the incorporation of many hands-on activities in the TAIT unit.  
2. Student engagement is perceived to be increased during instruction via a TAIT unit. This was attributed to the hands-on activities embedded within the units, differentiation of instruction to accommodate for learning styles within and between activities, and the ability for students to make social connections within the unit and their chosen trade or personal experiences.  
3. The use of TAIT units in the classroom provides students with greater connections to their learning and results in a greater breadth and depth of learning of core concepts compared to more traditional teaching methods. It is perceived that students are able to make connections between the unit theme and individual subjects, whether academic or technical (*thematic connections*); connections between individual lessons within the TAIT unit (*lesson interconnectedness*); and the differentiated instructional methods utilized throughout the unit addresses various learning styles within the student population. |
| How do career and technical education and academic integration teachers perceive transdisciplinary, academically-integrated, thematic units facilitate student learning, social integration, and classroom democratization in the CTE classroom? | 1. TAIT units facilitate student learning through the use of differentiated instruction and providing opportunities for the use of multiple intelligences, thematic connections between the students’ career track and/or personal experiences, and interconnectedness between the lessons within the unit.  
2. Social integration within the TAIT units was found to fall within one or more categories: student-to-student integration, student-to-society integration, student-to-nature integration, and |
student-to-family integration. This was due to the deliberate planning of social integration opportunities during the planning and creation of the TAIT unit.

3. Classroom democratization within a TAIT unit is facilitated through the use of real world problems/situations as a thematic focus for the unit. The relevance of these problems/situations to the students’ day-to-day lives or their chosen career track provides a relevance for the students. Students are then able to engage in greater discussions and debates about the topic due to their previous experiences and new-found knowledge.

Summary of Findings

The purpose of this qualitative study was two-fold. The first reason was to examine the perceptions of academic and career and technical education teachers on student motivation, student engagement, and student learning when instruction is provided via a transdisciplinary, academically-integrated, thematic (TAIT) unit versus when the same concepts were taught previously using the teacher’s traditional methods. Additionally, the study served to examine how student learning, social integration, and classroom democratization is facilitated through the use of TAIT unit as a teaching tool. The findings revealed that both academic and technical teachers perceived that student motivation, student engagement, and student learning were all increased when material is presented via a TAIT unit. The teachers who participated in this study perceived that student learning within a TAIT unit was facilitated through deliberately planned differentiated instructional methods within the unit, thematic connections, and lesson interconnectedness. Social integration was perceived to take place via one of four ways: student-to-student integration, student-to-society integration, student-to-nature integration, and student-to-family integration. Lastly, classroom democratization opportunities occurred during the TAIT
unit facilitated by the connections students were able to make between the content of the unit and its relevance to either their personal experiences and/or their chosen career track.

In Chapter V, this researcher will provide an overall summary of the findings, the literature review, implications for current practice, and recommendations for future research.
Chapter V: Discussion of Research Findings

Introduction

The purpose of this case study analysis was to examine the perceptions of both academic integration teachers and career and technical teachers on student motivation, student engagement, and student learning when content is presented within a transdisciplinary, academically-integrated, thematic (TAIT) unit in a career and technical education (CTE) classroom. The study also examined how the use of a TAIT unit in a CTE classroom facilitates student learning, social integration, and classroom democratization. The study was guided by two research questions: 1. What are the perceptions of career and technical education teachers and academic integration teachers regarding student motivation, engagement, and learning with the use of transdisciplinary, thematic, academically-integrated units in the CTE classroom?, and 2. How do career and technical education and academic integration teachers perceive transdisciplinary, academically-integrated, thematic units facilitate student learning, social integration, and classroom democratization in the CTE classroom?

The goal of this study was to examine the use of TAIT units as a proficient teaching tool at one New York state career and technical education high school.

The final chapter of this dissertation will focus on the discussion of the research findings, the themes of the findings in relation to the scientific literature, its relation to the theoretical framework, implications for practice, recommendations for further study, as well as limitations to the current study.

Research Questions and Themes

As noted throughout this study, this researcher examined TAIT units in the career and technical education classroom using two distinct research questions to guide the study. The first
research question examined the perceptions of teachers regarding student motivation, engagement, and learning. All six of the teachers involved in the study agreed that the use of the TAIT unit(s) in their classrooms resulted in increased student motivation due to the deliberate format of the units which allowed each day to be a different experience with the use of many hands-on activities. The use of hands-on activities was also felt to increase student engagement throughout the unit. This, combined with the intentional planning for multiple intelligences and differentiated instruction along with the ability for students to make social connections with the material and their personal experiences and/or chosen career track were felt to be factors responsible for the increased student engagement. Finally, the ability for students to make connections between the material and their experiences and/or career track, thematic connections, and connections between the lessons within the unit were all felt to be factors that promoted an increased breadth and depth of learning opportunities within the unit. This was facilitated by the theme of the unit which required teachers to use more complex examples to fit within the topics within the unit, and the desire for teachers to provide a broader experience for students through the use of the overall theme.

The second research question examined how learning, social integration, and classroom democratization are facilitated via the TAIT units. The participants in this study related that the deliberate planning for connections between the content material and the theme with the chosen career track helped to facilitate learning of the content material. The teachers used both social issues and topics of local and high interest to provide a relevant focus for the students. This allowed students to make connections to their past, present, or future lives. The planning for activities that addressed multiple intelligences throughout the unit was also felt to facilitate student learning, as demonstrated in the Mechanism of Death unit. The collaboration of teachers
within the creation of the unit provided multiple individuals to brainstorm and create learning activities beyond what a single teacher may have been able to do by himself.

Deliberate planning was cited as a factor for the promotion of social integration within the TAIT units. Many of the activities within the units required group and/or pair work, requiring students to work with one or more classmates for specific activities. One of the units, Maple Syrup, required students not only to work in collaborative groups but also integrate with nature in that they needed to be able to identify appropriate trees for tapping, regularly collect sap from the tree taps, and then work in the kitchen to boil down the sap into a syrup. The topic of social issues, such as the Flint water crisis, facilitated students to experience social integration through not only awareness of issues outside of their community but also through planned social advocacy activities. The study also revealed a type of social integration that was not intentionally planned for, student-to-family integration, which came about when students reported back to their teachers that they had shared information from the previous day’s lesson with family members.

The use of real-world problems, issues, and topics facilitated classroom democratization during execution of the TAIT unit. The themes selected as the focus of the units were felt to provide students with a relevance to their personal or potential career lives, promoting greater discussion and debate about the topics. Students focused on societal issues such as communicable disease and the quarantine of patients, criminal investigation, and local industry as democratic ideas within the units discussed.

**Major Findings and Themes in Relation to the Literature**

The academic literature examined in chapter II incorporated a wide berth of authors over an almost century-long timespan. As a result, this examination looks at curriculum integration
through a variety of perspectives during quite contrasting times of both war and peace in society, where the role of technical education changes drastically to meet the demand of the country.

**Education-career connection.** Dewey (1916) suggested that education and occupation are directly linked. The use of TAIT units within the career and technical education classroom facilitates the connection between academic knowledge and practical application by providing a medium to embed academic concepts within a high-interest and relatable topic for students. This study’s finding that student connections between academic material embedded in the TAIT unit and increased student interest supports Dewey’s century-old supposition. Hargreaves & Moore (2000) supported Dewey’s position in their study, stating “relevance to the world of work is and should be an important component of teaching and learning and curriculum integration for young people who are beginning to think seriously about future jobs and careers for the first time” (p. 100). Within their study, Hargreaves and Moore (2000) found that teachers cited curriculum integration, as challenging as it is, required deep connections as to how the content is relevant to the students’ lives, including career prospects and social awareness. The collaboration that occurs between academic integration and career and technical education teachers in the planning, design, and development of TAIT units helps to ensure that these connections are solidified within the context of the unit.

Palmer (2009) ascertained that student learning is increased when students are able to make a connection with the material in the form of big concepts or big ideas, specifically citing thematic curriculum units as an opportunity for increased learning growth. The data in this study supports that the use of TAIT units within the career and technical classroom is congruent to Palmer’s claims. TAIT units within the career and education classroom make connections not only with larger societal concepts that are often the overarching themes of the units but also tap
into cross-sectioning career concepts. In the Mechanism of Death TAIT unit, the physiological process that occurs ante- and postmortem was the overarching theme; however, career-based skills such as report writing and documentation, crime scene sketching, criminal investigation, and press conference presentations were embedded into the student experiences to create the education-to-career connection within the unit.

**Connections to prior knowledge.** The constructivist view of learning where students construct their knowledge from prior-held knowledge and then scaffold that knowledge with the new information presented within a thematic unit is documented by Etim (2005). The deliberate construction of the units progress from an introduction and salient vocabulary on day 1 of the unit and continue to build upon prior-learned knowledge each day, incorporating various academic content areas within the technical content area. The activation of this prior knowledge scaffolded to new knowledge allows for students to experience internal regulation, deeper process, and knowledge building (Jong, Wierstra, & Hermanussen, 2006). This results in a much more holistic learning experience for students.

**Student Learning.** Castellano et al. (2003) stated that CTE programs were responsible for the provision of “rigorous academic development” deemed beneficial to students (p. 245). The finding within the study context that the academic material covered within a TAIT unit compared to previous teachings of the same material showed that the TAIT unit was found to be of both a greater breadth and depth. The TAIT unit provided a platform where teachers and students were able to explore academic concepts at a more complex level. The overarching theme/topic of the TAIT unit provides the why factor for the importance of knowledge of this material to the students.
Beane (1995) discussed the use of real-life themes to increase the breadth of knowledge within a topic as well as increasing its accessibility to young people. This research study supports Beane’s claims in that the teachers interviewed perceived that student learning within a TAIT unit context was both broadened as well as more in depth. Rooks and Winkler (2012) added that knowledge within a broader context such as is found in a TAIT unit helps students to realize that the academic concepts taught within the TAIT unit are not static, and rather are transferrable to other real-life and career applications.

**Differentiated learning styles.** A universal praise about TAIT units from the career and technical education teachers who participated in this study was the way they were intentionally designed to address a variety of student learning styles. While the units included the core academics of English, mathematics, and science, many of these concepts were iterated and then reinforced through more than one teaching modality. For example, all of the units included several hands-on activities or labs in which the students participated. In the case of the Mechanism of Death TAIT unit, the introductory vocabulary lesson included a hands-on jigsaw-type puzzle activity where small groups of students competed against one another to properly fit textual vocabulary with pictorial vocabulary. The hands-on approach continued throughout the unit as students created crime scene sketches and performed an autopsy lab. Additional lessons in this unit also addressed the learning styles for auditory learners, visual learners, kinesthetic learners, verbal-linguistic learners, logical-mathematical learners, interpersonal and intrapersonal learners.

**Critical thinking.** In today’s rapidly changing and advancing technology society, the careers that secondary institutions of learning are preparing students may not be viable careers in ten years. Therefore, it is imperative that educators provide students with the opportunities to
hone their skills to become proficient problem solvers and critical thinkers. The embedding of problem-based lessons and projects within the TAIT units helps to facilitate these skills in students. In the Mechanism of Death TAIT unit, students were presented with a case of a decedent victim. They were provided some demographic information about their victim and limited information about the circumstances of the victim’s death to include where the body was found, approximate time of death, and details known about the circumstances of death. Using the skills taught within the unit, students performed a forensic autopsy on their victim (a chicken) and used deductive reasoning techniques with evidence found during autopsy to draw conclusions as to the probable cause of death.

As part of their critical thinking and deductive reasoning process, students in the Foundations of Education classroom learned to create essential questions during their investigation of the Flint water crisis. Students then used these questions to conduct research on lead contamination from a number of perspectives including health-related issues, child development issues, other geographical areas of reported contamination, etc. Based on the results of their research, they had in-depth classroom discussions to solicit information their classmates may have obtained as well as elicit the experiences of their peers.

Student engagement. In the academic literature, Springer (2003) cited that students who are taught via curriculum integration are “actively involved in their learning” (p. 15; Etim, 2005). The experiences of teachers in this study illustrated that students were much more engaged and involved in their learning with the use of TAIT units. Two teachers in the study specifically cited that the design of TAIT units promoted greater independence among learners, even in cases of previously-reluctant learners.
**Social integration.** Beane (1995) cited that the “central focus of curriculum integration is the search for self and social meanings” (p. 616). In this study, the data showed that social integration on the part of the students occurred at four levels: student-to-student integration, student-to-society integration, student-to-nature integration, and student-to-family integration. While student-to-student and student-to-society integration was intentionally planned for in several of the units assessed, both of these forms of social integration were then expanded by the students. Student-to-nature and student-to-family integration was an extension that was, at some level, instigated by the students. In the case of the Typhoid Mary TAIT unit, students took their initiative to teach others the proper handwashing techniques when others demonstrated the improper technique within the school. They also shared their newly found knowledge with family members at home, especially younger siblings. Neither of these tasks was assigned to students as part of the unit but rather transpired as a natural extension of social learning, reaching the highest level of Bloom’s taxonomy of the learner taking the role of teacher to instruct others on the skill. In the Maple Syrup TAIT unit, students actively volunteered to collect sap and boil syrup beyond the conclusion of the unit, often inquiring if they could do these tasks on their own or invite others who were not involved in the original unit. In this context, this researcher asserts that the central focus of curriculum integration, as defined by Beane (1997), was not only met but exceeded through the facilitation of TAIT units.

**Classroom democratization.** Classroom democratization was demonstrated in the units discussed through the use of student-centered discussions and debates about issues not only within the unit but with connections to present-day related problems. For example, although Mary Mallon’s issue was a century old, students made analogies to present-day issues of whooping cough outbreaks that affect communities today as well as a case of a nurse who had
been exposed to the Ebola virus a couple of years ago. The free flow of information and communication in these situations, combined with further discussion of how to enact policies or come up with reasonable solutions provided the opportunity for democracy within the classroom to take place.

**Summary.** The findings in this study correspond with what other researchers have found using similar themed or academically-integrated units in the classroom. This study expanded on the types of social integration that can be involved as the result of a themed unit. Previous studies have demonstrated increased student learning and engagement in the presence of themed-unit instruction. This study confirmed those claims and also found when themed units are used in the career and technical education classroom, student motivation was also increased. Opportunities for social integration were deliberately planned within the units; however, the presence of student-to-family integration was an unanticipated extension. The use of the TAIT units also facilitated classroom democratization through group discussions, policy writing, and the proposal of solutions to real-life events.

**Major Findings in Relation to the Theoretical Framework**

Beane’s (1997) Curriculum Integration Theory is a comprehensive approach that encompasses more than multidisciplinary teaching and learning. In Beane’s definition of Curriculum Integration Theory, the organizing centers allow students to expand their knowledge of self and the world. The four central tenets of Beane’s Curriculum Integration Theory include (1) the integration of experiences, (2) social integration, (3) integration of knowledge, and (4) integration as a curricular design. Each of these tenets and their relationship to this study will be examined in greater depth below.
**Integration of experiences.** Every TAIT unit is intentionally designed to incorporate a number of experiences purposed to blend both academic concepts and the overarching social concept/theme of the unit. By Beane’s (1997) definition, curriculum integration “transcends subject-area and disciplinary identifications with an eye toward integrative activities that use knowledge without regard for subject or discipline areas” (p. 44). The integration of experiences allows a medium for differentiated instructional strategies to be employed during the unit while immersing the student in experiences by which he grows not only academically but as a citizen of the world. Within the planning process of the TAIT units, focused attention was placed on ensuring that experiences were embedded within the unit to facilitate learning and engagement. Table 5 illustrates the experiences that were integrated within the TAIT units discussed in this study.

Table 5. Examples of Experiences Integrated within Selected TAIT Units

<table>
<thead>
<tr>
<th>TAIT Unit</th>
<th>Integrated Experiences</th>
</tr>
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<tbody>
<tr>
<td>Mechanism of Death</td>
<td>- Autopsy Report Review Activity</td>
</tr>
<tr>
<td></td>
<td>- <em>Body of Work</em> Chapter 2 Group Reading and Discussion</td>
</tr>
<tr>
<td></td>
<td>- Autopsy Video Viewing</td>
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<tr>
<td></td>
<td>- Chicken Autopsy Lab</td>
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<td></td>
<td>- Autopsy Reporting</td>
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<tr>
<td></td>
<td>- Crime Scene / Victim Art Sketching</td>
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<td></td>
<td>- Press Conference Presentations</td>
</tr>
<tr>
<td>Flint Water Crisis</td>
<td>- Brain Anatomy and Physiology Discussion</td>
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<td></td>
<td>- Water Testing Laboratory</td>
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<td></td>
<td>- Article Analyses and Group Discussions</td>
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<tr>
<td></td>
<td>- Cost Analysis Group Discussions</td>
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<tr>
<td></td>
<td>- Research of Local Area Contamination Due to IBM and Other Industries – Soil Contamination</td>
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<tr>
<td>Typhoid Mary</td>
<td>- Communicable Diseases Introduction and Discussion</td>
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<tr>
<td></td>
<td>- Meet the Microbes WebQuest Activity</td>
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<td></td>
<td>- Typhoid Mary Movie Screening</td>
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<td></td>
<td>- Handwritten Letter Analysis</td>
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<td></td>
<td>- Handwashing Lab</td>
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<td></td>
<td>- Exponential Growth Discussion</td>
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</tbody>
</table>
Social integration. As discussed in Chapter 4, the TAIT units are intentionally designed to promote social integration. Both student-to-student and student-to-society integration activities are planned within every unit, and student-to-nature activities are planned when appropriate. An extension of social integration that was observed in this study was student-to-family integration where many students reported to their teacher that they had taken their lessons and experiences home to share with family members. Student-to-student integration is deliberate and facilitated both formally through specific classroom-based activities such as pair-and-share, small group work, laboratory groups, and group presentations, but also informally through the spontaneous generation of deeper discussions that take place on both an individual and collective level. Student-to-society integration occurs initially through the overarching theme of the TAIT unit which addresses a society or community-based issue or event. This integration expands during the execution of the unit and will encompass activities to encourage social advocacy and social awareness.
**Integration of knowledge.** As the planning process of a TAIT units occurs, the desired learning objectives of the unit take precedence over all other elements. The academic team, together with the technical teacher, look at the expected outcomes and the learning standards to be addressed within the unit. As Beane (1997) tells us, “knowledge from the disciplines is repositioned into the context of the theme, questions, and activities at hand”. In the case of the Mechanism of Death TAIT unit, the new knowledge of anatomy and the processes of death, verbal communication (public speaking), and English language writing skills was integrated within the activities in the unit. Students used the process of performing the chicken autopsy, documenting their findings in the subsequent autopsy reports, sketching the body, and ultimately delivering the information via a press conference to utilize and reinforce the anatomical vocabulary and stages of rigor in both written and practical forms. This included presenting information in the context of a law enforcement official to the public.

**Integration as curriculum design.** The theoretical framework, Curriculum Integration Theory, lends itself to integration as a curriculum design. As classrooms are transformed into areas of organizing centers and high pedagogy, students become empowered to be educational self-advocates, as predicted by Beane (1997). Students become aware of their responsibility in the world as a global citizen and their ability to be a change agent from a social advocacy point of view. The curriculum in the integrative context is designed around world problems or issues, providing students relevance from a personal or social perspective. Students within the Foundations of Education classroom were posited to become change agents by writing letters to elected officials involved in the Flint water crisis.

**Implications for Practice**
As career and technical education programs continue to seek for methods of best instructional practices, the use of TAIT units as a primary method for integrating required academic content with technical-specific content is a viable option. The implementation of TAIT units in the career and technical education classroom represents a paradigm shift in teaching methodology, one which is received favorably by students as evidenced by increased student engagement and direct comments made to teachers from students. Teachers’ perception of greater learning in the presence of these units suggests that their use in the CTE classroom is justified. In July 2016, the U.S. House of Representatives passed a bill reauthorizing the Perkins Act by a vote of 37-0. Its proposed reauthorization, the Strengthening Career and Technical Education for the 21st Century Act, impacts over 11 million students annually across the United States. At the time of this writing, the bill has been received in the U.S. Senate effective September 14, 2016, and is awaiting a vote (H.R. 5587 – 114th Congress (2015-2016): Strengthening Career and Technical Education for the 21st Century Act | Congress.gov | Library of Congress, n.d.). Within this Act, academic curricular integration remains a required expectation within the CTE classroom. The teaching methodologies described in this study not only provide an avenue for that to occur, but do so in a way that motivates and engages students, and provides opportunities for greater breadth and depth of academic learning.

Opportunities for experiential and thematic learning, however, are not limited to the career and education classroom. Traditional K-12 schools can implement such instructional strategies utilizing Beane’s framework across grade levels. For example, a middle school grade could choose a theme that connects the bombing of Hiroshima during World War II from a historical perspective, atomic structure and energy from a science perspective, calculations of radius, diameter, and circumference from a mathematical perspective, and reporting either in
written or oral formats from an English perspective on the use of nuclear weaponry. Challenges associated with creating and implementing this type of instructions tends to be primarily logistical in nature. The need for common planning times and professional development time for teaching teams to create these units becomes essential. The scheduling of students within teaching teams is also necessary so that students are able to be assigned to each teaching within the teaching team. For many districts, this task represents a significant paradigm shift in the way students are scheduled for classes in middle and upper grades, as well as the necessary team teaching and collaboration approach that needs to be embraced by the faculty.

Experiential and hands-on education additionally requires funding in order to take place. With many districts facing financial cut backs, a strong argument to the district administration needs to be made for the value of TAIT-based teaching. Social integration within the learning environment assists in preparing students for work-based life after the completion of formal education. Classroom democratization, especially in terms of creating globally-cognizant citizens, is essential for creating skills that students will require both as adolescents and adults in a democratic society.

**Recommendations for Further Study**

The research on transdisciplinary, academically-integrated, themed units within the career and technical education classroom should not end with this study. Additional research should be conducted on a broader scale to include studies that examine students’ perceptions of their learning through TAIT units, a quantitative study examining two groups of students enrolled in the same class – one taught through TAIT units and the other through more traditional methods to examine performance differences on both unit and annual summative
assessments, and a larger study looking at teachers’ perceptions once more classrooms at the research site begin to use these units as a teaching platform.

Additionally, future research studies outside of the CTE world is recommended to justify a TAIT-based curriculum in a more traditional K-12 setting. Decontextualization of curriculum from small subject-based topics to broader themes is successfully occurring in Finland through Phenomenon-Based Learning (PhenoBL), using real-world situations as the starting point for learning (“Phenomenon Based Learning”, 2015). In Iowa, an initiative-based high school provides students with experiential-based opportunities for learning utilizing partnerships between curriculum and business (“IowaBig”, 2008). Studying both of these methodologies in a broader sense is warranted for potential common place teaching strategies in schools across the United States.

**Limitations to the Study**

This case study was limited to a group of six teachers at a single location. Due to this small sample size, this study cannot be generalized to CTE classrooms either at the study site or off site. This study examined initial perceptions after the pilot year of the implementation of several TAIT units and should not be mistaken for TAIT units encompassing the majority of the teaching in these classrooms. The study is limited in that students’ perceptions were not examined at this time due to a lack of response to recruitment efforts for parental consent, disallowing this researcher to incorporate student voice within the study. Future studies of a mixed qualitative and quantitative methodology may be helpful to elicit further data regarding student achievement.

This researcher is aware that her employment at the research site may have affected participant responses despite best efforts to eliminate bias within the interview process. This
researcher also acknowledges that she has a vested interest in the success of TAIT units as an instructional model and, once again, precautions were taken to eliminate bias from the data analysis in the study. Study participants were able to choose the time and location of their interview, and the interview was held at an isolated location with the use of pseudonyms in order to facilitate honest communication between the researcher and participants. The use of leading questions was avoided to minimize additional bias during the data collection process.

Conclusion

This case study examined teachers’ perceptions of student motivation, engagement, and learning through the use of TAIT units in the career and technical education classroom at one CTE high school located in the northeastern United States. Six teachers participated in this study: three academic integration teachers and three technical education teachers. In each case, the teacher interviewed related that the use of the TAIT unit in the classroom did appear to facilitate student motivation, engagement, and learning. The data also pointed to a greater breadth and depth of material covered due to the relativity and high interest of the presented material. The education-to-occupation setting within a CTE classroom permitted students to see and experience the connections of the academic material to the technical material which had direct application to their career goals.

Students were presented with real-life situations and problems and asked to use multiple strategies to reach solutions or a deeper understanding. The embedment of social integration within the teaching units resulted in students interfacing not only with one another but also with society, nature, and family. The facilitation of all of these skills should create better, more productive employees and citizens upon graduation as the ability to dissect and tackle problems
outside of textbook scenarios provides them much-needed skills to analyze issues and propose appropriate solutions.
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Celestino, T., & Marchetti, F. (2015). The chemistry of cat litter: Activities for high school students to evaluate a commercial product's properties and claims using the tools of chemistry. *Journal of Chemical Education, 92*(8), 1359-1363.


http://www.phenomenaleducation.info/phenomenon-based-learning.html


NOTIFICATION OF IRB ACTION

Date: November 16, 2016  IRB #: CPS16-10-10
Principal Investigator(s): Kelly Conn
Jennifer Leip
Department: Doctor of Education Program
College of Professional Studies
Address: 20 Belvidere
Northeastern University
Title of Project: Transdisciplinary, Academically-Integrated, Themed Units in the Career and Technical Education Classroom
Participating Sites: Broom-Tioga permission in file
DHHS Review Category: Expedited #6, #7
Informed Consents: One (1) signed parent/guardian consent and child assent form
One (1) signed consent for teachers

This project is approved under 45CFR46.404 which applies to children as research subjects and involves research not involving greater than minimal risk. Adequate provisions are made to solicit the assent of the children and the permission of their parents or guardians, as set forth in 45CFR46.408.

Monitoring Interval: 12 months

APPROVAL EXPIRATION DATE: NOVEMBER 15, 2017

Investigator’s Responsibilities:
1. The informed consent form bearing the IRB approval stamp must be used when recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #4630
October 1, 2016

Mr. Allen Buyck, District Superintendent  
Broome-Tioga BOCES  
435 Glenwood Road  
Binghamton, NY 13905

Re: Permission to Conduct Research Study

Dear Mr. Buyck:

I am writing to request permission to conduct a research study at your institution. I am currently enrolled in the Doctorate of Education program at Northeastern University in Boston, MA, and I am in the process of writing my doctoral dissertation. The study is entitled, “Transdisciplinary, Academically-Integrated, Thematic Units in the Career and Technical Education Classroom”. It is my hope that you will permit me to recruit six teachers from the school to conduct one-on-one interviews, provide teaching materials, and observe teaching. Due to the nature of the study, I hope to recruit three academic integration teachers and three technical education teachers. Interested teachers, who volunteer to participate, will be given a consent form to be signed and returned to the primary researcher at the beginning of the research process.

If approval is granted, teacher participants will conduct the interviews at a time and location of their choosing. The interview process should take no longer than one hour for the initial interview and approximately thirty minutes for followup interviews. Should this study be published, no names of participants will be documented and the use of pseudonyms utilized. No costs will be incurred by either your district or the individual participants.

Your approval to conduct this study will be greatly appreciated. Should you have any questions about the study, I may be contacted via my email address at leip.j@husky.neu.edu.

If you agree, kindly sign below and returned the signed form via scanned document to my email address. Alternatively, kindly submit a signed letter of permission on your institution’s letterhead acknowledging your consent and permission to conduct this study at your institution.

Sincerely,

Jennifer Leip
Doctoral Student, Northeastern University

Approved by:

[Signature]

[Print your name and title here]
Appendix C

Teacher Recruitment Letter

November 9, 2016

Re: Transdisciplinary, Academically-Integrated, Themed Units in the CTE Classroom

Dear Colleague:

I am writing to let you know about an opportunity to participate in a research study about transdisciplinary, academically-integrated, themed units in the career and technical education classroom. This study is being investigated by myself, Jennifer Leip, at Northeastern University as part of my doctoral dissertation. This study will investigate students’ learning and engagement as a result of the use of these units in the classroom. This is important for teachers and administrators to understand in order to support best teaching practices within the CTE classroom.

As a teacher at Broome-Tioga BOCES who has been involved in the creation and/or facilitation of at least one of these units, I am inviting you to participate in this research study. Your participation is completely voluntary and will involve a one-on-one interview for approximately 45 minutes about your experiences. I will take notes during the interview and digitally record the interview for later analysis. You will be given the opportunity to review the transcript of the interview to ensure that your point of view is accurately captured.

If you are interested in participating in this study, please contact me through my Northeastern email at leip.j@husky.neu.edu to express your interest. If you begin the study, you may choose to leave the study at any point without consequence. If you do not choose to participate, you do not need to do anything further, and you will not be contacted again about this research study.

Thank you in advance for your consideration in participating in this important study.

Sincerely,
Jennifer L. Leip
Doctoral Student
Northeastern University
Department of Education
Appendix D

Informed Consent Document

Northeastern University, Department of Education, College of Professional Studies

Name of Investigator(s): Kelly Conn, Ph.D.; Jennifer Leip, M.Ed., M.S.

Title of Project: Transdisciplinary, Academically-Integrated, Themed Units in the Career and Technical Education Classroom

Informed Consent to Participate in a Research Study

We are inviting you to take part in a research study. This form will tell you about the study, but the researcher will explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the researcher if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?
We are asking you to participate because you are/were involved in the implementation of one of the teaching units over the past year.

Why is this research study being done?
The purpose of this research is to examine the use of transdisciplinary, academically-integrated, thematic units on student learning and engagement in the CTE classroom.

What will I be asked to do?
If you decide to take part in this study, we will ask you to answer some questions about your experiences working with these units in the CTE classroom. You may be asked to provide lesson plans and/or other teaching materials related to the unit. Additionally, you may be asked to allow a researcher to observe you teach a lesson using one of the units.

Where will this take place and how much of my time will it take?
You will be interviewed at a time and location of your convenience. The interview will take about one hour. Within a few days of the interview, you will be provided a typed transcript of the interview to check for accuracy. Based on the information obtained in the first interview, you may be asked to participate in a followup interview, again at a time and place of your convenience, lasting approximately thirty minutes. Once again, you will be provided with a typed transcript of this interview to check for accuracy.

You may be asked to provide either paper or electronic copies of all teaching materials relative to the unit(s) that you were involved. Additionally, if you are involved in the teaching of one of these units during the time of data collection, you may be asked if the researcher can observe you during the teaching of the lesson.
Will there be any risk or discomfort to me?
Your risk for participating in this study is negligible. Your identity will be protected through the use of a pseudonym during the study. No information gained during the data collection process of this study will be directly shared with the testing site.

Will I benefit by being in this research?
There will be no direct benefit to you for participating in this study. However, the information learned from this study may help other CTE professionals to provide more effective teaching modalities to their students.

Who will see the information about me?
Your part in this study will be confidential. Only the researchers on this study will see the information about you. No reports or publications will use information that can identify you in any way or any individual as being of this project.

The audio recording of your interview(s) will be labeled using a pseudonym. Any questions about your identity should be answered using your pseudonym during the interview process.

In rare instances, authorized people may request to see research information about you and other people in this study. This is done only to be sure that the research is done properly. We would only permit people who are authorized by organizations such as the Northeastern University Institutional Review Board to see this information.

Can I stop my participation in this study?
Your participation in this research is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the study, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services that you would otherwise have [as a student, employee, etc].

Who can I contact if I have questions or problems?
If you have any questions about this study, please feel free to contact Jennifer Leip at leip.j@husky.neu.edu, the person mainly responsible for the research. You can also contact Dr. Kelly Conn at k.conn@northeastern.edu, the Principal Investigator.

Who can I contact about my rights as a participant?
If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, 490 Renaissance Park, Northeastern University, Boston, MA 02115. Tel: 617.373.4588, Email: n.regina@neu.edu. You may call anonymously if you wish.
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Appendix E

Interview Questions for Technical Teachers

Please state your name and your current position with the institution.

How many years have you been in the field of education?

How many years have you been in your current position?

If you have held other positions within the educational field, please state what those positions were and your length of time at those positions.

How do you typically structure your learning units within your curriculum?

How do you assess students’ learning of key objectives within a curricular unit?

Briefly describe how a multidisciplinary themed unit was used in your classroom in the past school year.

   a. Over how many days did the lesson take place?
   b. How many academic disciplines were involved in the lesson?
   c. What new knowledge was addressed in the unit?
   d. What was the student response to the unit?
   e. How was student learning assessed during and after the unit?
   f. What experiences were integrated into the unit?
   g. How was the unit socially integrated?
   h. How was the design of this particular unit different from how the unit was presented in the past?
   i. What was your role in the planning and design of this particular unit?
   j. Were any obstacles encountered in either the design or implantation of this unit? If so, what were they?

Based on your experience with the above-mentioned unit, do you feel that students were less engaged, engaged at the same level, or more engaged in their learning during the themed unit than during a previous integrated lesson covering similar objectives?
Based on your experience with the themed academic unit over the past year, how likely are you to use other multidisciplinary, integrated, themed units in your curriculum?

Do you have anything else you would like to share with me at this time?
Appendix F

Interview Questions for Academic Teachers

Please state your name and your current position with the institution.

How many years have you been in the field of education?

How many years have you been in your current position?

If you have held other positions within the educational field, please state what those positions were and your length of time at those positions.

Briefly describe a multidisciplinary themed unit with which you were involved in the past school year.

a. What was your role in the planning and design of this particular unit?

b. Were any obstacles encountered in either the design or implantation of this unit? If so, what were they?

c. Over how many days did the lesson take place?

d. How many academic disciplines were involved in the lesson?

e. What new knowledge was addressed in the unit?

f. What was the student response to the unit?

g. How was student learning assessed during and after the unit?

h. What experiences were integrated into the unit?

i. How was the unit socially integrated?

j. How do you ensure that the units are linked to standards? Which standards do you link it to?

Based on your experience with the above-mentioned unit, do you feel that students were less engaged, engaged at the same level, or more engaged in their learning during the themed unit than during a previous integrated lesson covering similar objectives?

Based on your experience with the themed academic unit over the past year, how likely are you to participate in the creation and implementation of other multidisciplinary, integrated, themed units?
Do you have any other information you would like to share with me at this time?