Review

Why we cannot afford to lose CTE in schools

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Career and Technical Education (CTE) is a vital part of our nation's education system. Despite a myriad of positive outcomes related to CTE, such as creativity, problem solving, manual dexterity, and spatial perception, CTE participation, funding, and emphasis have declined in recent years. This paper discusses the history of CTE as well as the current status of CTE in education. Positive outcomes linked with CTE are highlighted and arguments are presented for an actual presence of CTE in education. Challenges facing CTE are addressed and recommendations are provided.

Key words: CTE, Career and Technical Education, Vocational Education, Technology Education

INTRODUCTION

Career and Technical Education: a brief history

While the history of Career and Technical Education, or CTE (also called: vocational education, industrial education, manual arts, industrial arts, or technology education) is not the purpose of this paper, a brief history will prove informative and supplemental to the arguments included. The roots of Career and Technical Education lie in the apprenticeships that existed throughout Europe and the infantile America. Artisan and industrial trades were passed from master artisans to eager apprentices. As schooling became mandated (Tozer, 2013) for students the inclusion of "trades" as a subject in the general education curriculum was a hotly contested topic (Tozer, 2013). As many voices argued that vocational knowledge should be separate from public school, and reserved for future industry workers, others asserted that trades and crafts be included in general education. The debate between Career and Technical Education as a "track" for future industrial workers versus a "component" of general education continues unabated today (ACTE, 2013; ITEA, 2007).

In the 1870s, John D. Runkle, president of Michigan Institute of Technology (MIT), came to the forefront of the topic, claiming that manual and intellectual education should be melded into the school experience (Tozer, 2013) to form a complete education. Another influential educational thinker, Calvin Woodward, also insisted that students not be separated into "thinkers" and "workers." All students should experience the world (Tozer, 2013) through an inclusion of Career and Technical Education as an integral component of general education.

In 1917 the Smith-Hughes Act was adopted (U.S., 1917), paving the way for the funding of Career and Technical Education in the United States. Later the Carl Perkins Act replaced the Smith-Hughes act (originally passed in 1984, reauthorized in 1988, and continuously through 2006 [U.S., 2006]). The Perkins Act perpetuates

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the federal government support of CTE classes in public school classrooms today.

Current status of Career and Technical Education

Despite the historical value of CTE, significant challenges aim to weaken and disrupt the current inclusion of CTE in our public schools. Recent federal government funding cuts (Baxter, 2011) have dealt a significant blow to CTE classroom inclusion. This decline in funding has occurred simultaneously with an overall decline in support from national and state level governments for CTE classes (U.S., 2006). Perhaps the most shocking trend has been the rapid and substantial closings of shop classes in public schools (Theriault, 2007). For example, in the LA United School District alone, as many as 90% of all shops have been eliminated in the past few years (Brown, 2012). These changes have not been confined to California, as shops, labs, and programs have closed at alarming rates across the country in the past few years (Benavot, 1983; Camp, 2007; Foster, 2007; Moye, 2009). In addition (and perhaps in response) to decreased funding, lack of federal and state government and school district support, recent trends demonstrate a marked decrease in CTE teacher graduates (Foster, 2007; Moye, 2009; Volk, 1997). This decline in the number of graduates from Technology Teacher Programs (Foster, 2007; Moye, 2009; Volk, 1997, Wilkin, 2011) has contributed to significant shortages of qualified technology teachers (Benavot, 1983; Camp, 2007; Wilkin, 2011) for CTE classes across America. As current CTE teachers retire, districts are struggling to replace them (Wilkin, 2011); often the result is the discontinuance of a school CTE program altogether (Brown, 2012).

In conjunction with these findings, recent studies also give evidence of a reduction in the number of Career and Technical Education classes offered nationally (Moye, 2009). Administrators, policy makers, and school boards are choosing to discontinue or "phase out" CTE classes at alarming rates. In addition to fewer classes offered, the National Center for Educational Statistics (USDOE, 2000) reported a substantial decline in student participation in the remaining CTE classes over the last two decades (from 41% in 1990 to 19.1% in 2009). Clearly students are not choosing, or perhaps not being allowed to participate in CTE classes as frequently as in years past.

Why we cannot afford to lose Career and Technical Education

Many observers will argue that students are simply "choosing" different classes. What are the major concerns if students do not take CTE classes? What are the repercussions if we lose Career and Technical Education? In reality is this a pressing problem – something we need to immediately address?   The author of this paper believes it is: the recent decline in CTE educators, CTE classes offered, district and state-level support, funding, and CTE class participation are all combining to form a national crisis (Moye, 2009; Wilkin, 2011). A loss or even a noticeable decline of CTE will generate a host of other negative side-effects.

Industry will suffer

In the past Career and Technical Education has been a major source of future industry workers (Theriault, 2007). With the recent legislation of *No Child Left Behind* and *Race to the Top* (U.S., 2002), there has been and increasing focus on college for all students (Camp and Camp, 2007; NCLB, 2002; H.R. 2011). However, for many students, college may not be a desired pathway (Noddings, 2011).   These students traditionally seek employment in the workforce after graduation. Those so inclined can expect higher wages if they enter the workforce with a CTE background in school (Carnevale, 2011) than those students who become part of the workforce without a CTE background in school. The emphasis in CTE on hands-on skills, project-based learning, and vocational competencies can be especially useful for students interested in vocational training. The cutbacks suffered in CTE have resulted in fewer students prepared to enter industry upon leaving high school, and in industry shortage of skilled labor (Theriault, 2007).

Realizing the potential for CTE classes to prepare students for participation in industry, political leaders have highlighted the necessity for technology education in recent public addresses. President Obama, in his most recent *State of the Union* address (Obama, 2013), specifically mentioned technology education as a requisite factor to our nation's success. Additionally, Marco Rubio, the Republican Senator who provided the official party reply to the President's address, also mentioned technology education and the need for increased incentives for schools to include technology education as part of their curriculum (Rubio, 2013). Finally, New York Mayor, Michael Bloomberg, while announcing a new initiative focused on vocational education in high schools, asserted: "Traditionally, career and technical education has been seen as an educational dead end. We're going to change that" (NYC, 2008).

CTE is education for life

Career and Technical education serves as a major catalyst for teaching not only foundational CTE concepts, but also life skills such as problem solving, creativity,

manual dexterity, and spatial perception (Crawford, 2006; Eisenberg, 1998). Technology is uniquely situated to teach students specialized skills and concepts taught in no other classrooms (Crawford, 2006; Eichhorst, 2012; Strauss, 2009). CTE classrooms contain equipment, materials, and processes unique to CTE content areas. The opportunity for students to interact with a variety of materials, processes, problems, and solutions has positive effects on student abilities (Crawford, 2006; Eichhorst, 2012; Strauss, 2009) and encourages students to learn in a variety of settings.

Problem-Solving. The ability to solve problems is a fundamental key to success in school, but even more importantly, in life. Most of the problems, which confront individuals on a day-to-day basis, are not well-structured problems with a clearly defined answer located at the back of the book. Due to CTE being largely taught through hands-on activities and problem-based learning (ITEA, 2007), it has been shown to improve student's problem-solving abilities (Crawford, 2006), especially ill-defined problems (Crawford, 2006, 2009). As a result of their CTE experiences, students are better suited to solve the day-to-day problems encountered in life than students without CTE classes.

Creativity. A recent International Business Machines (IBM) poll of 1,500 CEOs identified creativity as the No. 1 "leadership competency" of the future (IBM, 2010). Despite the positive image associated with "creativity," the nation is currently suffering from a "creativity crisis" (Merryman and Bronson, 2010). Creativity scores for children have steadily decreased since 1990 (Kim, 2011) and Adobe (2012) recently conducted an international survey that ascertained that only 1 in 4 people believe they are living up to their creative potential. Adobe (2012) also cited a widespread belief that "unlocking the creative potential of individuals is the key to economic and societal growth" (Adobe, 2012). Technology education is uniquely situated to help reverse the creativity problems addressed in current research. Creative tools and technology were perceived as some of the largest impact factors for "overcom[ing] creative limitations," "provid[ing] inspiration," and "increas[ing] creativity" (Adobe, 2012). Student creativity is often apparent in CTE classes as students are given a greater variety of opportunities to be successful than those inherent in other "academic" classes (Crawford, 2006, 2009; Strauss, 2009).

Spatial and manual dexterity skills. CTE classes frequently afford students opportunities to "build things." Learners with a kinesthetic learning style (Kolb, 1984) are especially matched to thrive in these hands-on settings. Studies have demonstrated that CTE class experiences result in improved spatial abilities, motor skills, and general understanding of processes and properties (Eisenberg, 1998). These improved spatial and motor abilities may contribute to academic and career success. Unlike most academic courses where students acquire concepts from books, teacher lessons, PowerPoints, or other forms of visual and auditory stimuli, CTE touts itself as a "hands-on," "experiential learning experience" (ACTE, 2013; ITEA, 2007; Kolb, 1984). Crawford (2009) argues that these experiences prepare students specifically for careers by mixing factual and experiential knowledge. Most careers require domain-specific knowledge coupled with manual dexterity and performance (think of letting a dentist perform a root canal who has done nothing more than read about root canals from a book). Crawford cites examples of surgeons whose work is both "technical and deliberative." Surgeons report that although useful, academic theories often "break down in practice," requiring surgeons to combine factual knowledge with practical manual dexterity skills in order to be successful.   An illustration of this point was made by Aristotle, 1958:

Lack of experience diminishes our power of taking a comprehensive view of the admitted facts. Hence those who dwell in intimate association with nature and its phenomena are more able to lay down principles such as to admit of a wide and coherent development; while those whom devotion to abstract discussions has rendered unobservant of facts are too ready to dogmatize on the basis of a few observations (p.316a 5-12).

Academic success results from participation in CTE

Many observers arguing for the removal of CTE classes from schools claim that CTE classes only benefit students with vocational career ambitions. Emphasis on more "academic" classes is portrayed as essentially "more beneficial for college and employment prep" than CTE classes. Contrary to these opinions, CTE classes have been shown to increase student skills, specifically in math, science, and engineering (Moye, 2009). Students with CTE experience in school have higher employment rates and high average wages than those without CTE backgrounds (USDOE, 2011). In addition to these benefits, CTE has contributed to an effective college preparation for students (Brown, 2012; Gumbrecht, 2013) desiring post-high school education.

Studies emphasizing the difference in learning styles (Noddings, 2011; Steinberg, 2009) and the need to deliver learning opportunities which accommodate these learning styles point out that appealing to a variety of learning styles is conducive to facilitating student learning. Society is becoming increasingly aware that tests and factual knowledge are not the only assessments of intelligence (Steinberg, 2009). Students should be provided with a

variety of modes of expressing what they "know" (Noddings, 2011; Ravitch, 2011; Steinberg, 2009). By allowing students to experience learning in a different manner and setting than classrooms, CTE stands out as a vital part of our schools (Crawford, 2009; Noddings, 2011). Several studies have highlighted the positive *academic* effects of CTE on students (Eisenberg, 1998; Moye, 2009).

CTE classes promote equality in society

Tracking and "Academic" vs. "Non-academic": One of the primary arguments for the removal or "phasing out" of CTE classes is that CTE classes promote or continue social stratification (Tozer, 2013). Proponents of this idea maintain that CTE classes encourage "tracking" students into vocational classes which lead to lower-paying vocational careers and less interest in a college education. Although quite popular at one time (Tozer, 2013), the notion of "tracking" has become increasingly less accepted in recent years (Noddings, 2011; Tozer, 2013). CTE is often the "poster-child" of tracking and blamed with the adverse effects of tracking (Noddings, 2011). CTE classes, which often focus on skills demonstrated in blue-collar workplaces, are blamed with perpetuating the differences (Crawford, 2009) between the "haves" (business owners, executives, etc.) and the "have-nots" (vocational workers, factory workers, etc.). Those who ascribe to this argument label CTE "non-academic" and set CTE up opposite to other "academic" discipline as Math, English, or History (Crawford, 2009; Noddings, 2011).

CTE works against social stratification: Analyzing the issues of social stratification and CTE inclusion in schools within a critical framework provides some interesting insights. Crawford (2009) uses these ideas to tenet the idea that CTE actually *promotes* equality by "levelling the playing field" as seen in today's industrial environments. Today's social stratification of "haves" and "have-nots" has various roots, but many of today's problems stem from the timeframe of the early 1900's. In 1910 Frederick Taylor, a mechanical engineer, began a revolution in the management of factories. Prior to Taylor's movement, industrial trades were recognized as an "art," with workers acquiring skills and understanding of entire processes over a lifetime in order to master complex tasks (Tozer, 2013). Taylor sought to improve industrial efficiency through the introduction of scientific observation and management principles. Workers jobs were systematically divided into smaller and smaller tasks, making the job of managers and trainers easier. Managers and trainers understood all facets of the process, however when they trained workers they only trained them on one specific task (i.e. insert one rivet at this location each time a new

product comes by). Positive effects of Taylorism include: jobs could be completed more quickly, workers were more efficient, and workers could be managed more easily due to the simplicity of their tasks. Despite these and other positive side effects, Taylorism produced many negative effects and sparked widespread outrage among employees (Tozer, 2013). For example, workers were less knowledgeable about more of the processes and products – they were only required to master one task. As a result, they were less capable of arguing for higher wages and their ability to "fight the system" or "move up" was largely crippled. Due to management beginning to envision and treat workers as "dispensable products;" it was as easy to hire and train a new employee, as it was to fire a long-time worker. Employees were not expected to grasp how things function or how the processes of change occurred - workers were expected to learn by listening to those who already knew these operations and follow explicit orders (Crawford, 2009; Tozer, 2013).

CTE classes empower future employees through a hands-on education. By returning an understanding and knowledge of processes, patterns, and "how things work" back in the hands of the employees, CTE classes help fight social stratification. CTE classes help "level the playing field" by providing future workers with a breadth of understanding and knowledge. In contrast, a loss of CTE classes and CTE influence in schools will lead directly towards a substantial increase in the knowledge dichotomy and impact on the "haves" and the "have nots."

CTE facilitates higher wages for non-college attenders. While college is viewed as an important and beneficial experience, the fact remains that many students will not attend college immediately following high school (Noddings, 2011; USDOE, 2011). For those that do attend, unfortunately, attendance does not guarantee graduation. What of life's preparation for these students? Without CTE courses they can be assured to receive lower wages and fewer opportunities (Carnevale, 2011; USDOE, 2011). In light of the recent statistics from the US. Department of Education regarding the number high school graduates not attending college (USDOE, 2011), CTE classes should be encouraged as a mode of life preparation for these students. With increased abilities and higher wages as a result of CTE classes, these individuals will be better suited to contribute in meaningful ways to society (Carnevale, 2011, 2009).

While some observers will cede that CTE is beneficial to non-college attenders, others continue to claim that those attending college should not be required to take CTE classes, but rather focus instead on "academic" courses. This argument not only collaborates with "tracking" approaches to education (thus promoting social stratification), it fails to incorporate with the reality that hundreds of thousands of students simply will not

continue their education following high school (USDOE, 2011). While college education should not be discouraged, efforts should be made to facilitate those that don't choose a college education by providing skills which results in higher wages and better work experiences.

The future of CTE

The time for CTE reform is now. If immediate action is not initiated the future of CTE will remain uncertain - recent trends suggest that CTE may continue to decline until it has been completely eliminated from our schools. However, with the combined efforts of legislators, administrators, teachers, and parents CTE can regain its strategic foothold in public education. Several possible suggestions for action are included here.

Stop closing CTE classrooms

The recent closure rates of CTE classrooms are alarming and need to be halted. Efforts need to focus on the long-lasting adverse effects of removing CTE programs from classrooms. Policy makers, administrators, and education representatives need to be educated to the benefits contained in CTE classroom experiences. National and state legislation should ensure that CTE funding is perpetuated and accessible to district and school administrators. Without funding CTE classrooms will continue to close and school administrators will be forced to choose between continuing CTE classrooms or reallocating funding.

Encourage CTE for students as academic and life preparation

Counselors, parents, and teachers need to be informed of the benefits contained in CTE educational opportunities. Student advisors should make efforts to rebrand CTE as a beneficial class for college preparation. Purposeful efforts should be encouraged to inform and invite all students to participate in CTE classes, regardless of their future career and academic goals. National organizations need to work in tandem and campaign for an increased positive image of CTE participation.

   Tasks, projects, and hands-on education need to be reinvigorated in schools. All forms of "knowing" (Noddings, 2011) and expressing knowledge need to be invited into the classroom. The benefits of CTE classes outside of academics need to be clearly identified and taught. School administrators should pursue opportunities for students to experience success and recognition for all types of skills and knowledge.

   Eisenberg offers a completing argument celebrating the unique benefits found in the CTE classroom: "Craft activities demand patience, a long attention span, and above all, ample free time of their practitioners; they are thus ill-suited to users who expect the pacing of a video game. Craft activities celebrate mess and material constraints, even as they offer a burgeoning range of new materials; they are thus ill-suited to "virtual laboratories" in which objects are resolutely untouchable and imaginary. Craft activities produce objects whose value derives from long-term personal memory; they are thus ill-suited to worlds in which value primarily derives from expense and novelty. And craft activities, particularly as practiced by children, are capable of investing real objects with the designer's personality; they thus run counter to a culture of Web-based education that, in our view, threatens to lead its charges into adulthood without a single souvenir."

Incentivize increased enrollment in CTE Teacher Education programs

Unfortunately, many schools are closing CTE programs due to the difficulty of replacing CTE teachers when current teachers retire or transfer (Brown, 2012; Theriault, 2007). The dramatic decline of qualified CTE teaching programs graduates must be reversed. Studies should be conducted in an effort to identify ramifications from the dramatic decrease in CTE teacher education program graduates. Incentives for CTE teacher education programs should be drafted at the national and state level. National and international CTE organizations should focus concerted efforts on strengthening current CTE teachers and recruiting future candidates. The topics of teacher recruitment and retention should take center-stage in conferences, publications, and goals.

Conclusion

The future of CTE remains uncertain as recent shortages in teachers, losses in funding, and emphasis on "academic classes" have threatened to undermine and eventually remove CTE from schools. Trends have consistently reflected a decline in CTE during the past two decades. Such circumstances call for urgent actions at the policy level of states and the programmatic levels of educational institutions to reverse this trend. CTE stands uniquely situated to teach, foster, and encourage a wide range of academic and life-skills: creativity, problem-solving, manual dexterity, and spatial perception are all skills specifically nurtured in CTE classrooms. Legislators and administrators should initiate steps to ensure that CTE classrooms, laboratories, and shops remain an integral part of schools. Counselors, teachers, and parents need to be informed of the benefits of CTE class participation, and in-turn, inform those students

they work with of the promising benefits. CTE teacher preparation programs at the university and college level should be strengthened. Ideas for incentivizing, marketing, and increasing enrollment in these programs need to be discussed, presented, and explored at state and national levels. Advocates for CTE need to unite in advocacy for a strong CTE-filled future in schools.

Conflict of Interests

The author has not declared any conflict of interests.

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