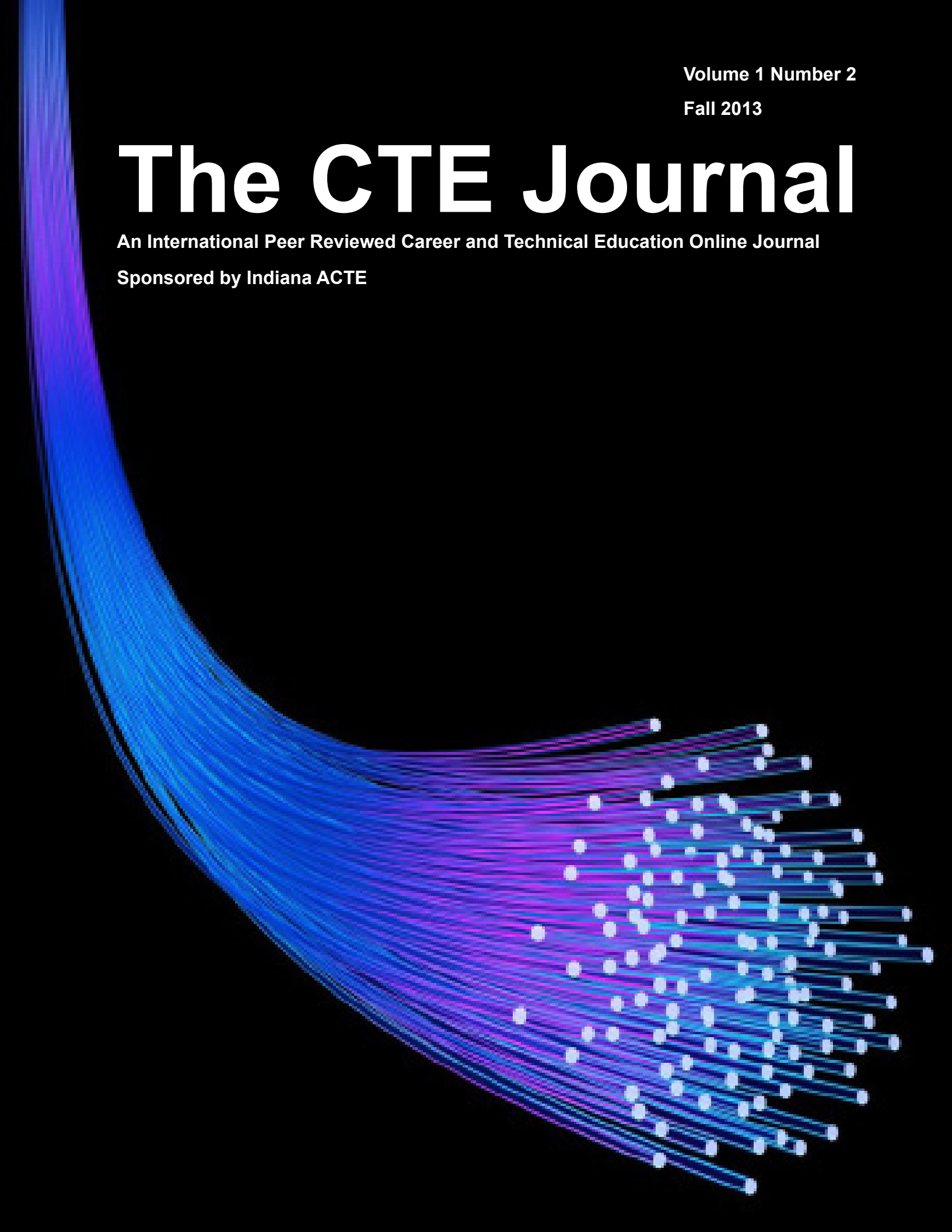# The CTE Journal

An International Peer Reviewed Career and Technical Education Online Journal

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Interactive Whiteboards in STEM

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Abstract
With the rising need for those trained in the fields of Science, Technology, Engineering, and Mathematics (STEM), measures are being made to increase student motivation in these areas. Hands-on activities and collaborative exercises through the use of interactive whiteboards can help spark interest and increase student success in the STEM segments. In addition to improving student motivation, interactive whiteboards can help instructors improve lessons by allowing the implementation of various tools, such as videos, sound clips, and internet resources in real time within the classroom.

Introduction
In the technology-oriented society of today, there is a growing need for people trained in segments of STEM (DeJarnette, 2012). One device that can be used to teach the different aspects of STEM education is the interactive whiteboard, also known as an interactive whiteboard or a smart board. Interactive whiteboards are a substitute for traditional chalkboards or dry erase boards; they have the added benefit of allowing users to incorporate and control multimedia resources (Liang, Huang & Tsai, 2012). Two different options that are available consist of stationary interactive whiteboards, which can be controlled by touching the screen on the classroom wall, and mobile interactive whiteboards, then can be controlled with a tablet (Robertson & Green, 2012). Both options allow students and instructors to interact with each other as well as the content being presented on the interactive whiteboard. The flexibility that interactive whiteboards provide offers a number of possibilities for STEM education, such as the integration of technology, the addition of various multimedia resources, and the incorporation of hands-on activities. This manuscript provides information about, and strategies in regards to, using interactive whiteboards.

How Interactive Whiteboards can be Utilized
Interactive whiteboards can bridge the gap between students' experiences both inside and outside of the classroom by providing a similar transfer of information in the form of digital technologies (Murcia, 2010). Instructors have the ability to use and manipulate in real time a wide range of resources, such as audio files, video clips, photos, and other materials (Betcher & Lee, 2009). These real time examples are especially important for students in STEM courses because equations and calculations are inherent in these fields. The presentation can be manipulated right in front of the students' eyes. An example of where this would be important for STEM would be formulas and calculations. These calculations can be implemented and manipulated in ways previously not possible. In addition, students can interact with these materials, whether it is for participation in lectures or during their own presentations. Interactive whiteboards allow for students to relocate material, complete tasks, and take notes on the existing presentation as well

as save files to a database (Hwang, Su, Huang, & Dong, 2009; Liang et al., 2012). There is also interactive whiteboard software that can assist instructors in incorporating all of the various aspects of the technology, specifically student interaction, into the pedagogy (Digregorio & Sobel-Lojeski, 2010). Interactive whiteboards provide a level of flexibility and interactivity that would otherwise be unavailable during lessons. This flexibility is important for any class, but it is seemingly indispensable for STEM courses. The instructor is able to observe the classroom and determine if students are confused by any of the concepts presented to them, and he/she can return to any that were not met with student comprehension.

The Importance of Interactive Activities in STEM Education
Problem-based activities enhance the interest of students and promote critical thinking (DeJarnette, 2012). The use of interactive activities with interactive whiteboards can be very beneficial to STEM education. Specifically, allowing some manipulations of three dimensional objects that, until now, would have been done within two dimensions. This increases the hands-on nature in STEM education (McQuillan, Northcote, & Beamish, 2012). Previous "two dimensional" examples would have required substantial erasing, where the interactive whiteboard can have the shapes and equations preloaded, so they can be recalled at any time (Hwang et al., 2009). This allows the concepts of geometry to be presented less with formulas explaining shapes and more with the observation of shapes and equations to match them. This is a more "naturalistic" learning style to how learning occurs in the real world. The new visibility in geometry and early geometric understanding can provide the basis for higher level concepts in STEM (Hwang et al., 2009). When Hwang et al., (2009) conducted their analysis of math faculty and the use of interactive whiteboards; they found that 90% felt the use had a positive impact on learning. The use and integration of interactive whiteboards in STEM courses should help to increase the amount of time available for teaching, instructor no longer is required to draw diagrams, molecules, shapes, or formulas (Liang et al., 2012; Turel & Johnson, 2012). This then allows the instructor increased time to teach facing the class. A difficulty however, is that it may not be used to let the students participate with the interactive whiteboard technology (Turel & Johnson, 2012).

The implementation of real-world examples and hand-on activities helps motivate students to excel in their chosen field (Murcia, 2010). Classes with hands-on activities, such as laboratory exercises, help students better visualize information presented in lectures and can help bridge the gap between theory and practicality of more complex experiments within STEM (Mackechnie & Buchanan, 2012). Laboratory education is a necessary tool to improve learning outcomes, but large class sizes and high costs can be daunting (Mackechnie & Buchanan, 2012). One solution is to utilize computer technology, such as interactive whiteboards (Mackechnie & Buchanan, 2012). This could help reduce the amount of money spent on a long-term scale in addition to avoiding the issue with the rise of strict health and safety rules (Mackechnie & Buchanan, 2012).

Positive Effects of Using Interactive Whiteboards
Interactive whiteboards allow instructors who struggle with the limited space of chalkboards and dry erase boards to maintain information from lessons and annotations made by students in a database that they can review later (Robertson & Green, 2012). This also allows instructors to refer to previous lessons so that they can tailor new presentations to suit the needs of students. In

addition to storing information provided by students, instructors can display the thoughts and ideas of different individuals on the interactive whiteboard in real time, providing a sense of interactivity and collaboration (Robertson & Green, 2012). By using the tools provided by the interactive whiteboard, it is possible to increase the collaboration of students and assist instructors to retain the attention of larger groups (Hennessy, 2011). To improve collaboration, digital technologies are compiled and presented through one source where everyone can work together to create a better understanding through interactive activities rather than only observing lectures provided by the instructor (Murcia, 2010). Student collaboration and communication is successful, in part, due to the large visual workspace provided by the interactive whiteboard. Also, students are better able to convince peers of their understanding by using the interactive whiteboard to exhibit their ideas through pictures, diagrams, and web pages (Bruce, McPherson, Sabeti, & Flynn, 2011). An interesting aspect reported by Murcia (2010) was that in STEM (science, specifically but applicable none the less) different ideas took multi-modal forms (verbal, experimental, mathematical, figurative, and kinesthetic) and the use of interactive whiteboards enhanced the ability to apply these. McQuillan, Northcote, and Beamish (2012) found that when instructors switch between forms of instruction student engagement levels are higher, and this can be accomplished with interactive whiteboards. In fact, many students felt that they learned more, and the information was easier to understand when there was use of interactive whiteboards (McQuillan et al., 2012). It was also noted that interactive whiteboards help speed up student thinking and allow students to investigate a number of different solutions in a shorter period of time (Bruce et al, 2011).

Interactive whiteboards also simplify the expression of ideas by allowing instructors to add justifications, explanations, and evaluations all in one location, as well as allowing them to directly link information through the internet (Hennessy, 2011). Instructors can display various works by different students to compare and contrast different thought processes used to solve problems (Bruce et al., 2011). Consider further, Liang et al. (2012) found that even novice users of interactive whiteboards integrate abundant multimedia and interactive designs in learning activities.   This integration allowed the instructor to be more confident and poignant, which allows more time to guide the learning of the students. Murcia (2010) succinctly stated, "what a teacher does with interactive whiteboard technology is far more important than the technology itself (p. 27)." This is important to keep in mind when implementing the use of interactive whiteboards.

Another interesting effect is that the use of technology in courses can minimize gender differences when compared to the usual teaching methods. An equal development of the memory structures of both genders has been analyzed due to the wider variety of deliverables that the interactive whiteboard provides. In addition, some instructors may favor a certain gender, but the collaboration between mixed groups that interactive whiteboards prompt can help limit such favoritism (Dhindsa & Shahrizal-Emran, 2011).

Some Negative Aspects of Using or Implementing Interactive Whiteboards
Upon examination, there are some aspects of interactive whiteboards that can be problematic. First, instructors may need to change some of the pedagogic strategy that they have been accustomed to, because some strategies that worked previously need to be replaced with

strategies that are more beneficial with this emerging technology (Liang et al., 2012; Murcia, 2010; Turel & Johnson, 2012). Implementation without change in lessons is an under-usage of this technology that opens the doors to many meaningful possibilities (Turel & Johnson, 2012). Technology led initiatives in education fundamentally are not based in understanding, but more so on a theoretical positive aspect; pedagogy is often over-sighted (Murcia, 2010). This reformatting could include loading modules, notes, and concepts onto the interactive whiteboard and anything that would bring the teaching style in line with the digital practice; this may take more time than some faculty may foresee (McQuillan et al., 2012; Murcia, 2010). However, the misapplication of interactive whiteboard technology may be just as detrimental. STEM faculty run the risk of "spoon feeding" or "overwhelming" the students (Liang et al., 2012; McQuillan et al., 2012). Instructors may fail to perceive the importance of interactivity; they may fill the lesson with multimedia and lectures. They could lead the lesson without involving the students, eliminating some of the positive effects that the interactive whiteboard could provide (DiGregorio & Sobel-Lojeski, 2010). Contrary to other cited research in this manual, Liang et al., (2012) found that there was a lack of interactive learning with interactive whiteboards. This statement will need to be further addressed because it has been proposed as one of the most beneficial aspects of interactive whiteboards.

An aspect that must first be observed before any implementation of interactive whiteboards is the instructor's acceptance and attitudes about the technology. Turel and Johnson (2012) found that the use of the technology is strongly correlated with attitudes and acceptance by the instructor. More positive attitudes and acceptance of the technology comes with the usage of the technology by the instructors (Turel & Johnson, 2012). Accordingly, the more that the instructors use the technology, the better their attitudes and acceptance will be toward interactive whiteboards. The danger happens when they have positive perceptions and attitudes about the technology, but they are unfamiliar with its implementation or changes that should be made in pedagogy (Turel & Johnson, 2012).

Other problems that have been noted are technology glitches and reproductive instances in which traditional technology could have presented the same information. However, Bruce et al. (2011) observed that only 71 technological issues and 15 reproductive cases emerged from the 296 instances in which interactive whiteboards were used in the study.

Conclusion
Interactive whiteboards connect directly to the internet and can be manipulated either by touching the board or by using an independent tablet. These devices can be utilized in STEM education to assist students excel; therefore, supporting the increasing need for science, technology, engineering, and mathematics professionals. Interactive whiteboards can enhance the success rates of students by assisting instructors, inspiring collaboration, and increasing student engagement. They allow instructors to manipulate information in real time and store information from lessons to better understand and fulfill the needs of students. Interactive whiteboards allow students to interact with the lesson presented on the board, instructor, and other students by manipulating the information. Also, students can participate in lessons and activities through the interactive whiteboard, increasing the levels of interest and engagement. In summation, interactive whiteboards represent a useful tool for a wide array of instruction.

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Labeling: An Alternative View of the Underlying Problems for CTE

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Abstract
The labeling of special populations students is a widely studied phenomenon, but much of the past and current research has been limited to the change in behavior of the labeled students, and not the change in behavior of those interacting with the student. This work explores the possibility that the student change in behavior may be strongly influenced by how the label changes those around the student, and less relative to the student's initial perception of a label. Understanding this possible impact on student self-esteem and motivation may assist teachers, parents, and others regarding how they perceive and interact with students who have been labeled within the category of special populations. The issue is not limited to a single or small group of special populations categories, but may be more significant for some than for others. This work explores a number of possible intervention strategies to reduce the negative influences of labeling students within special populations. Because Perkins legislation provides support for special populations in career and technical educational programs, this concern becomes significant for CTE teachers (Carl D. Perkins Career and Technical Education Act of 2006, 2008).

Introduction
The purpose of the study is to explore some of the existing evidence to consolidate and interpret trends to better understand the true nature of the issue of labeling, and what some less overt impacts may be related to this well documented phenomenon. There has been considerable effort dedicated to understanding and addressing the issue of labeling students considered special populations. It is suggested that there is very limited research and discussion regarding how labeling impacts those interacting with labeled students or their impact on learner behaviors. This study proposes that one of the likely strong influences on reduced motivation and ability may be the change in behavior of those around the student once a label is assigned. Career and technical teachers have an increased potential of benefit from understanding these issues since many Career and Technical Education (CTE) programs have significant numbers of students from special populations, some classes as high as one-hundred percent. This concern can be exaggerated for those teachers who have been hired based on work experience and who have limited formal education in pedagogy (Cotton, 2000; Cotton, Koch, & Harvey 2010; Harvey, Cotton, & Koch 2007; Harvey, Cotton, & Koch 2005; Koch, Cotton, & Harvey 2009). This work is provided to offer some new insights and strategic approaches into this ongoing concern.

Literature Review
There has been substantial discussion over the past few decades about concerns regarding the negative impacts of labeling students within special populations that can result in exclusion or other social disadvantaging scenarios, as well as destabilizing a student's self-confidence causing

an identity crisis. (Sutcliffe and Simons, 1993; Crocker, Major, & Steele, 1998; Crocker & Quinn, 2000; Gillman, Heyman and Swain, 2000; Olney, Brockelman, Kennedy & Newsome, 2004; Olney & Brockelman, 2005; Levin & Laar, 2006; Lauchlan & Boyle, 2007; Trammell, 2008). There has been some evidence that labeling often results in negative impacts on the success potential of students who have been labeled, especially those labeled with learning or emotional disorders (Cotton, 2000; Cotton, Koch, & Harvey 2010; Harvey, Cotton, & Koch 2007; Harvey, Cotton, & Koch 2005; Koch, Cotton, & Harvey 2009). These studies often concentrate on the negative impacts, but have limited measures or discussion exploring the many potential underlying reasons for these impacts. This discussion will suggest and discuss some of these potentially significant impacting circumstances. When recognized and more fully understood, these could suggest a number of strategies to help reduce the sometimes serious changes in behavior that many studies report are a result of identifying students within special populations with specific labels. Care should be taken when labeling a person, because the label may affect his or her self- perceptions, perceptions by others, and major events and choices in life (Gates, 2010).

Many CTE programs, especially in trade and industrial program areas, have an enhanced concern regarding students from special populations because of limited professional development in pedagogy, and more specific labels within special populations. Many CTE teachers have had little to no training with special populations, though many work with large numbers of students within these categories (Cotton, 2000). This indicates a significant need for CTE teachers to be offered more specialized training regarding student attributes and instructional strategies applied to special populations.

"Indeed in the United States even the mere perception of disability is enough to disable as evidenced in the Americans with Disabilities Act (ADA) of 1990 giving federal protection to those not actually disabled according to societal norms but who are only regarded as such. Thus, one can be free of impairment and still be disabled" (Denhart, 2008, p. 484). This suggests that people are being protected from negative treatment based on visually apparent conditions, whether true disadvantages or not. This is caused by misunderstandings regarding the impairments and reduced "respect" for those with impairments. In a study by Moore & Keefe, it was stated, "The participants in this study expressed that even the word 'disability' frequently conjured antagonistic or disparaging images from their typical peers" (2004, p. 12). Some impairments can be devastatingly disabling for one person and barely a challenge for others. This could be largely relative to how others react to the condition and how well the impaired individual can overcome the negative attention from others, especially those with some authority or control over their conduct. Some researchers have noted that the phrases "disability," and "handicap," which could also imply disadvantage, have become stigmatized with many debating the usefulness of the terms (McWhorter, 2005; Trammell, 2009). Lock and Layton (2001) reported that often individuals thought to be lazy or not motivated enough were believed by their professors to be using their disabilities as an excuse to get out of work.

Greenbaum, Graham, and Scales (1996) found fear of discrimination was a critical barrier for success among those labeled with LD. "Fearing stigma and misunderstanding, college students labeled with LD often avoid using their legally mandated accommodations that could ease their

workload, fearing they would be misunderstood as cheating" (p. 485). Some perceive that many with needs for some form of accommodation to enhance successful learning will refuse the accommodation because of the negative attention it brings to the learner. This can negatively impact the student's learning potential, but it may be that with the accommodation their learning may also be reduced because of the negative impact of peer pressure. Some who do demonstrate a disadvantage attract an increased level of negative attention from their peers; sometimes this will also be associated with either verbal or physical abuse. "As a dyslexic with a visual perceptual disability I was misunderstood by those around me as being 'slow,' yet today I hold a doctorate in educational policy" (p. 487).

"An example of *institutionally* held master status was found on an advertisement for a 'therapeutic support group' at one university in the Pacific Northwest. A flyer posted across campus by the psychological services office depicted a large heading 'A.D.H.D.' with a subheading asking, 'Do these describe you?' followed by a list of 18 negative attributes including 'social misfit,' 'under- achiever,' and 'undisciplined.' Only one positive attribute, 'creative,' appeared near the bottom of the list. Here, the university's chief medical authority on attention- deficit/hyperactivity disorder (ADHD) publicly announced that students with an ADHD label necessarily belong to a stereotype invalidating their overall competence and capacity" (Denhart, 2008, p. 484). It is a concern when even recognized professionals in the field of special populations reinforce stereotyping people in a negative light. This can expand the mistreatment, misunderstanding, and disservice of those appropriately or inappropriately assigned to a particular category under special populations. Of most concern is the tendency of many in a position of influence over a labeled person, such as a teacher or parent/guardian, to either reduce the level of attention, ignore the person, or reduce the expectations to levels much lower than is appropriate. "Since the early 1990s an expanding stream of qualitative research has invited the voice of those labeled with LD to illuminate the barriers facing them in higher education. That voice speaks to being silenced, misunderstood, and misrepresented by others" (Denhart, 2008, p. 483). This suggests that disadvantaged and labeled students may stop trying because these inappropriate barriers are presented to those interacting with the students on a frequent basis.

Discussion
This article proposes that the label does not directly cause the learner so identified to exclude themselves from others or lower motivation, but that the label more often causes a change in the perception of others, who in turn modify their behavior in the presence of the labeled student. It is suggested that the reactions of others to the labels may have a more pronounced impact on reduced motivation or even ability of labeled students than the student's initial understanding of the label. Labels, though helpful for instructors and others regarding understanding specific special populations scenarios, may cause additional disadvantages to the students involved because of the changes in behavior of others through their social and instructional interactions.

Career and technical education teachers need to be very aware of limitations and abilities of many scenarios under special populations. Many environments and laboratories in CTE programs have heightened risks because of equipment and limitations regarding monitoring students. Enhancing this concern is the belief often held by many that students challenged

academically should be placed in programs that are typically or historically primarily manual trades. One issue with this is that many trades that have been historically manual trades requiring limited academic skills have become highly skilled trades requiring advanced academic skills, such as automotive technician trades. This raises the importance of proper placements and higher teacher awareness and skill related to special populations learners.

Sometimes the interventions of others may actually interfere with a labeled student discovering useful strategies to overcome barriers. It is suggested that many disadvantaged learners can perform at much higher levels than those around them believe possible if only one or a few others will demonstrate high confidence and encouragement. Is this really from being lazy as many, if not the majority, believe? Educators often reduce or extinguish expectations for a labeled student and treat the student as if they have no confidence in them and as if they have no real expectations of success. When this occurs, the students are only living up to or in this case, down to, the expectations demonstrated to them by others. Many students, especially those already disadvantaged, draw much of their motivation from those around them and not from internal motivation. Those who are disadvantaged get worn down by negative input and from the low expectations of those around them, falling prey to self-fulfilling prophesy.

Some with disabilities may not be recognized as having the disadvantaging condition without the label. One of the authors of this article is familiar with an undocumented case of one person who was diagnosed with dyslexia, but only after the second year in college. The student successfully worked through a college preparation program in elementary through high school with no indications for others that there was a disadvantaging condition involved. Many students identified as special populations learn through trial and error how to overcome their situation and often to the point of performing at levels above those of their peers. Combining student experimentation for resolving personal barriers with teacher or other authoritative individuals support and positive advice, may have a dramatic impact on improving student self-esteem, motivation, and success.

This change in behavior of friends and authority figures over time may convince a student identified as special populations that their situation is more limiting than it may actually be, and they react by losing motivation to achieve what they have been convinced are tasks that are insurmountable. The key to resolving this issue may be improved education and assistance for teachers, administrators, parents and others with influence over students so that they are more aware of the true limitations and do not expect and accept inappropriately low standards for the students. It is possible that, like students identified as special populations using the label to avoid a challenge, that teachers and others also use the label as an excuse to put less effort into teaching and assisting the labeled students in order to save time and effort. It is suggested that many well intentioned teachers or parents prematurely give up in these efforts, not realizing the level of patience and encouragement that may be required to improve the motivation, self-confidence, and ability of the students in question.

A good example of this concept in action is the many successes of Los Angeles teacher Jamie Escalante, who repeatedly encouraged and supported students who other teachers and family had long ago decided were incapable of success or motivation. Though others shared that there was

not a chance of success in calculus for his students, a significant number of his students passed advanced placement calculus test after a second year in his mathematics class. The students were accused of cheating because of general level of scores from a normally low performing population and because many mistakes that did occur were consistent among many of the students, which was ultimately proven as an incorrect conclusion. Escalante's first group of students repeated their impressive success under high security measures during a second administration of the test. Students in his later classes continued demonstrating high success on the advanced placement test (Matthews, 1988).

This reflects a significant concern, the lack of understanding of others. Often people assume limitations that are not applicable for those with a disadvantage. This can be evidenced by those who hold doors or help in other ways when they would not do the same for those who are not perceived as incapable of the task or who would find the task challenging. Individuals such as this often do not understand why a person with a disadvantaging condition would resist or be offended by help offered. The phenomenon here may occur because the labeled person has been "trained" through experiences with those who influence their learning that they can't or won't be allowed to confront certain challenges or tasks. Some appear to "take advantage of" a label such as LD, but the more likely scenario is that they use this strategy because others with influence have convinced them they can't achieve, so they ultimately resist trying. This is maybe because they perceive that others expect them to fail, and since they don't want to be in the "I told you so" scenario, they won't even attempt a "risky" task. It is proposed that in situations where the learner is exposed to a teacher or other person of influence who is sincerely and highly encouraging and confident in the potential of the learner, the labeled student will take on challenging tasks with a greatly increased chance of success, often well beyond personal expectations or the expectations of others. One person, like a teacher, can make a major difference in the success of a disadvantaged learner even when others won't offer the confidence and support.

A disadvantaged individual often will seek out strengths that may not be apparent to others which can lead to success and respect of others while reducing their concentrations on tasks that the limiting condition may impede. Those with disadvantaging conditions often overcome challenges in ways that non-disadvantaged individuals would not consider as legitimate strategies. The following are a number of examples of disadvantaged individuals achieving significant success either through their own experimentation, or with the support and assistance of others. Some assume physical limitations for students with physical disabilities though the students may overcome many of these limitations using alternative strategies that those not disadvantaged may not conceive of. There are many well-documented cases of individuals succeeding in overcoming limitations that others know can't be overcome.

Blaise Winter is an example of a learner forced into a class dedicated to special populations, over the protests of the student and his mother because of a speech impediment. He later succeeded in football, becoming a popular player in high school. After graduation he was admitted to college with continued success. He later was drafted into professional football, being recognized as rookie of the year. He currently works as a motivational speaker, a field that few would have allowed him to attempt (Winter, 1998). The following are comments retrieved from the Blaise Winter website April 15, 2013.

Blaise Winter Homepage (Four Seasons Speakers, Ed., 2008):
http://www.4speaks.com/blaise.winter.asp

"Blaise had two saving graces in his life, his mother and his great grandmother. They helped him get through difficult times as a kid. Both showed him unconditional love, devotion, and encouragement" (Carew, 2010).
http://www.theinsightfulplayer.com/2010/03/10/blaise-winter/

"Today, Blaise is a motivational speaker and author of *A Reason to Believe.* Blaise teaches people how to believe in themselves, obliterate obstacles, and become unstoppable in pursuit of their dreams. He believes the dreams we have in our hearts are God given and it is our responsibility to go after them with all our might. Blaise's inspiring and content rich live programs are in big demand. He is a genuinely powerful speaker who has a deep rooted passion for his audience. He naturally connects with his audience and elevates their spirits no matter what age, creed, race, or position they have in life" (Carew, 2010).
http://www.theinsightfulplayer.com/2010/03/10/blaise-winter/

The following are additional examples of individuals who have successfully adapted to significant physical handicaps or other disadvantaging conditions. These help demonstrate that many can discover strategies to overcome disadvantages either with or without help or recommendations from others. Each example is summarized and hyperlink addresses are provided for expanded content site or video case study.

- Discussed at more length below, George Patton has been recognized as a dyslexic, a condition not understood during his lifetime. Not only did he complete training at West Point, he also competed at the Stockholm Olympics in 1912, and came in fifth place. Today, he's considered "one of the most successful field commanders in U.S. History" (A+E Television Networks LLC., Ed., *George patton biography*, (1996-2013).
  http://www.biography.com/people/george-patton-9434904

- Barb Guerra is a thirty-seven year old woman who has been an amputee since the age of two. She no longer has her arms, but has managed to use primarily her feet in order to play sports as a child, drive a car, fold laundry, and care for her own children (Humi171421, 2009). http://www.youtube.com/watch?v=AKA_hNszdn0

- Another woman who has proved she can overcome her disadvantage, goes by the nickname "Tisha Unarmed." Tisha was born without arms and like Barb, uses her feet to perform daily activities such as drawing, painting, driving, cooking, and even using chopsticks (Whitelocks, 2012).
  http://www.dailymail.co.uk/femail/article-2202755/My-life-arms-Womans-extraordinary-video-blog-reveals-eats-chopsticks-puts-bra-drives-car--using-just-feet.html

- Unlike the other women mentioned previously, teenager Joanne O'Riordan was born without her arms, and without her legs due to a rare condition called "Total Amelia." Despite Joanne's condition, she excels when it comes to using a laptop, writing, and like most teenagers, texting (O'Reilly, 2011).
  http://www.dailymail.co.uk/health/article-2072662/Joanne-ORiordan-born-arms-legs--heart-lion.html

- Business mogul, Richard Branson had difficulty in school because of his dyslexia. Because of his disability, he decided to drop out of Stowe School when he was 16 years old. After dropping out, Branson went on to start his own record labels, a radio station, a travel company, an airline, a mobile phone company, and many more entrepreneurial endeavors. His increasing success, helped him become recognized in the distinguished business magazine, Forbes, for being one of the top "World Billionaires" (A+E Television Networks LLC., Ed., *Richard branson biography*, 1996-2013).
  http://www.biography.com/people/richard-branson-9224520?page=1

- Nick Ackerman became an amputee when he was just eighteen months old due to a deadly case of meningitis. Even though Nick grew up without his legs, he fulfilled his dream of becoming a wrestler and made it all the way to the NCAA championships. Nick became the first athlete without legs to win the championship and was given the title of "Outstanding College Player in the Country" in the NCAA's centennial (Dotson, 2011).
  http://www.today.com/id/42590729/ns/today-good_news/t/amputee-champion-gives-others-legs-stand/

- Stephen Hawking may be one of the more easily recognized individuals who lives with a handicap. Stephen was diagnosed with Amyotrophic lateral sclerosis (ALS or Lou Gehrig's Disease) while in college, but has become one of the most influential scientists today, earning multiple awards for his research and continuing to make history (A+E Television Networks LLC., *Steven hawking biography*, 1996-2013).
  http://www.biography.com/people/stephen-hawking-9331710?page=1

Denhart found significant concerns of study subjects regarding how others perceived them as students with Learning Disability (LD). Also reported were concerns that faculty would recommend not taking a course because of a learning disability. "Ten of eleven informants spoke of being misunderstood by faculty. For example, Lea noted those labeled with LD were seen as 'weird,' 'wacky,' 'not quite on the ball,' and 'not getting it together like they could if they really pushed the pedal to the metal' (L, f, p. 20, line 16-18). Bering noted the LD label was seen as 'having connotations with stupid or not intelligent' (B, f, p. 7, line 1-2). When Sarah sought testing for dyslexia, one professor commented to her, 'I think people just do it nowadays to get medicine for it' (S, f, p. 15, line 6). Beth's professor told her 'Well, I don't know if you need to be taking this class if you have a learning disability' (ZB, f, p. 9, line 28-35). Adequate studies

now demonstrate those labeled with LD in higher education do fear discrimination" (2008, p. 491).

This phenomenon of perceiving being misunderstood by faculty is not uncommon and may actually be accurate in many cases. Instructors not trained or experienced in working with special populations may fall back on inaccurate stereotypes regarding the limitation or label involved. When the instructor assumes a disadvantage or limitation that may apply, the teacher will tend to treat the student in a way that makes that low or incorrect expectation apparent to the student. For those with an external locus of control, this will have a major impact on what the student believes of themselves, whether negative or positive.

There are many categories within special populations that are not well understood or have a wide range of symptoms. One of these conditions that may be generally misunderstood by many teachers and general public is dyslexia. General George Patton is a good example of this circumstance. As noted by Blumenson in his biographic work "The Patton Papers…" one common feature of dyslexia that many are not aware of is that those with dyslexia often are overachievers or put much more effort into a challenge than many others. He had great difficulty reading and spelling, but was still able to successfully complete training at West Point, a school at the time that would not allow many accommodations, especially for a condition like dyslexia that was at the time not known or understood. He actually was a voracious reader of history (Blumenson, 1972).

Conclusion
There has been a long-running, strong concern and effort among researchers to understand and resolve barriers and issues related to students within special populations. There has been significant research verifying the negative effects of specific labels for students within special populations, but there has been limited success in fully understanding why labeling creates negative impacts on students. This issue is of enhanced concern in the area of CTE because of policies that purposefully target students classified as special populations into many of these programs. The issue is further complicated by limited formal preparations of CTE teachers regarding special populations. By better understanding some of the possible underlying and less recognized factors creating this situation, teachers may benefit in ways that will positively impact any students they work with who have been labeled as special populations. Training and additional preparations, especially for CTE teachers, may serve to improve the successes of students with special needs in the American educational system.

Recommendations
For instructors in CTE programs, it is proposed to be essential to dramatically expand and improve the professional development and other educational opportunities and experiences that target a variety of topics related to students labeled as special populations. This should include instructional strategies, accommodation techniques and tools, and information regarding the nature of a wide variety of labels that fall under special populations.

When labeling, avoid limiting ideas for strategies or limitations to the suggestions or perceptions of non-afflicted individuals. Parents and teachers often over protect children from disabling

conditions, further handicapping them by not allowing them to overcome their condition. Teachers often have difficulty understanding or identifying useful alternative strategies because of their understanding of standard practices. It is also helpful to consult with others with similar limitations for strategies already tested. The Internet can also be a valuable resource when seeking new or unusual ideas or strategies. See the examples shared earlier, which were drawn from the Internet.

Students categorized as special populations can benefit significantly from external input that will help boost self-esteem and also motivation to achieve. The problem with others helping achieve this requires sincerity. Often teachers will encourage or compliment students within special populations to help motivate them, but if the teacher doesn't fully understand or believe the student can achieve, students will perceive that the encouragement and confidence may not be sincere. This defeats the efforts of a teacher or other authority personality when trying to boost self-esteem or confidence, and by association the ability to confront a challenge or to succeed.

Based on this exploration, it is suggested that teachers must first convince themselves and understand that many students who qualify as special populations can perform at significantly higher levels than many others perceive or expect. Once a teacher or parent understands that their perceptions of what a learner can do or achieve has a significant impact on their ability and motivation to attempt challenging task, then encouragement may become more sincere. This can have a major impact toward improving motivation and success in those who perceive they are disadvantaged or who are labeled as such.

It is critical to experiment with a number of strategies for many students. Even for students with similar issues, different strategies may be required for success. When experimenting with alternate strategies, it is critical to include the student when formulating ideas. They are often more familiar with the limitations and may have already discovered some strategies that others may not consider. It is also important to include parents or others close to the student for strategies they have successfully administered away from school.

It may be valuable to conduct additional studies that target changes in perception or behavior of parents, teachers, administrators, and friends following a student being labeled. The difficulty for this form of study is that measures prior to labeling would be of great value, but once the awareness of the limitation occurs or is suspect, the time to study the preconceptions and actions of those exposed to the disadvantaged student is lost.

Encouragement and demonstrated sincere confidence in a disadvantaged student may be one of the most powerful tools for improving success of a labeled student. The challenge is in helping those who have influence over the student actually believe that the student can succeed when most believe the student cannot. It is suggested that as few as one authoritative and respected individual can overcome the negative attention impacts of many.

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