

AN EXAMINATION OF THE CONTRIBUTION OF CAREER AND TECHNICAL EDUCATION TO STEM EDUCATION, STUDENT LEADERSHIP, AND CAREER READINESS

Allen Kitchel

Abstract

Problem: Principals influence the support provided to career and technical education (CTE) programs, their inclusion in school wide initiatives, and ultimately, their viability within the school setting. Limited research exists about principals' perceptions of CTE programs and how they contribute to overall school goals. **Research Questions:** What are junior/senior high school principals' perceptions of the contribution that CTE programs make to school goals, specifically as they relate to STEM education, student leadership development, and career readiness. **Research Method:** The study methodology involved a cross-sectional descriptive design using a census survey. **Data Collection Procedures and Analysis:** The target population was junior/senior high school principals in Idaho for the 2011 spring semester, and approximately 42% (n = 128) participated. Descriptive statistics and frequency tables were analyzed and interpreted. **Findings:** The STEM initiative, leadership development, and career readiness were important aspects of schools' curriculum and learning goals. Principals encouraged CTE teachers to integrate STEM learning objectives and better collaborate with STEM academic teachers. Leadership development through CTE student organizations was perceived as valued and effective. Business education was the highest rated elective program for its contribution to meeting school goals. **Conclusions/Recommendations:** Principals' valued curriculum integration and school-wide systems of support for emphasizing knowledge and skills associated with CTE programs. A barrier to better implementation may exist in the accountability measures for schools. To improve these integral areas of CTE programs, policy makers should assess existing incentive structures. CTE educators may use the findings from this study to inform decisions concerning program development or refinement.

Introduction

DiMattina and Ferris (2013) examined the needs of business and the types of employees they require for the emerging economy. They indicated that workers must be more capable than ever before, yet businesses are less likely to provide the resources to train them with the skills and knowledge needed. With a rich history in preparing individuals with the skills and knowledge needed for the workforce and economic citizenship, career and technical education (CTE) can contribute to

Dr. Allen Kitchel, Associate Professor of Business and Marketing Education, College of Education, University of Idaho, Moscow, Idaho 83844-3082, akitchel@uidaho.edu.

filling this training gap. CTE programs exist at many levels of education. At the junior/senior high school level, school principals influence teacher effectiveness and student achievement, and make critical decisions about which programs to offer and who to hire to teach and manage them (Branch, Hanushek, & Rivkin, 2013). Elective programs, which CTE programs tend to be, must validate their value and contribution to school goals and culture if they are to be supported by school leadership (Railsback & Hite, 2008). Through an understanding of the perceptions of school principals, CTE programs, including business education, can better position themselves as an important and critical component of the school curriculum that seeks to prepare people for success within, outside, during, and after academic experiences.

The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 defined career and technical education, referred to as *vocational education*, to be preparation for occupations that do not require a baccalaureate or advanced degree. Since that time, there has been an increasing need for workers to have some college experience in order to be prepared for the occupational challenges of the 21st century (Gordon, 2008). With changing and increasing demands concerning occupational preparation (Kesten & Lambrecht, 2013; National Education Foundation, 2006; Stone & Lewis, 2012), the definition of CTE changed with the 2006 Carl D. Perkins Act, which allowed for preparation of students in careers that eventually require a baccalaureate degree (National Education Foundation, 2006). Stone and Lewis (2012) indicated that career readiness requires (a) academic knowledge in subjects such as reading, writing and mathematics; (b) employability skills; and (c) technical skills.

School districts, and therefore school leaders such as principals, are responsive to the accountability measures to which they are subjected. The No Child Left Behind Act of 2001 (NCLB) required school accountability for student learning of reading and mathematics (U.S. Department of Education-Office of Elementary and Secondary Education, 2002). The NCLB mandate prompted CTE programs to better articulate their contribution to academics, which helped them to be recognized as contributors to school goals and accountability measures. The Carl D. Perkins Career and Technical Education Improvement Act of 2006 also increased focus on academic achievement and linking of secondary programs with postsecondary education. The Perkins Act sought to promote technical knowledge and teaching in an integrated setting. Section 2 of the Act stated that CTE programs should be “promoting the development of services and activities that integrate rigorous and challenging academic and career and technical instruction, and that link secondary education and postsecondary education for participating career and technical education students” (2006, para. 2).

The Common Core State Standards (CCSS) were published in 2010. As of 2014, 43 states had adopted the CCSS and were in various stages of implementing them (*Common core state standards initiative*, 2014). Like other educational initiatives, principals are expected to implement and support programs that lead

to students meeting standards. The standards place an emphasis on the need for schools to prepare students to be college and career ready. Although the CCSS standards focus on mathematics and language arts, their emphasis on career readiness and application of academic subjects to real world problem solving is congruent with the mission of CTE. To be college and career ready requires more than mathematics and language arts knowledge alone. It also requires the capacity to think, solve complex problems, be creative and inventive, and apply technical and academic knowledge to and in the workplace. Career and technical education (CTE) programs are well positioned to serve an important role in meeting the goals of the CCSS (Meeder, Suddreth, Association for Career and Technical Education, & National Association of State Directors of Career Technical Education Consortium, 2012).

The STEM (science, technology, engineering, and math) initiative represents another area of academic emphasis that states and schools are working to address (STEM Education Coalition, 2012; U.S. Department of Education, 2009). Some consider STEM to be about science and mathematics, not CTE, while others view STEM as a set of skills and knowledge that are embedded within the occupations that CTE programs prepare people for (Stone & Lewis, 2012). Collaboration between STEM and CTE teachers, and a school culture that supports and puts value on such collaboration, have the potential to better prepare students to be college and career ready.

There is limited extant research literature investigating school administrators' perceptions regarding the value and contribution of CTE to school goals and objectives. Railsback and Hite (2008) investigated principals' perceptions of the value of high school business courses and the competencies taught within them. Principals were found to value business courses more than guidance counselors and boards of education. The highest rated courses were in the area of business technology, which is congruent with the theory that all subject areas within the school are enhanced when students have strong technical computer skills to support their study.

In a 2012 article, a school principal (Hill, 2012) described her school district's efforts over 10 years to revitalize the role of CTE within a high achieving academic environment. The district's educational leaders recognized the importance of career readiness and preparing students with the skills and knowledge needed for their postsecondary plans. They worked to integrate CTE programs into the core academic mission of the school to ensure these programs were not seen as "separate or inferior tracks of learning" (p. 78), but were instead important for connecting academic content with applied skills and real world preparation.

Rayfield and Wilson (2009) investigated high school principals' perceptions of supervised agricultural experiences. These experiences, although specific to agriculture, have similar counterparts in other CTE content areas such as business and marketing, and are sometimes referred to as school-to-work, internships, or job shadowing (Wilhelm & Commers, 2013). Principals who were generally

supportive of CTE were found to value supervised experiences, yet there was little formal recognition of the CTE teacher. The authors indicated focused professional development for principals might help them better understand the goals and objectives of CTE, which should lead to a higher value being placed upon the program's activities (Rayfield & Wilson, 2009). There are other studies that indicate principals to be supportive of agriculture education and CTE in general, but many of them predate the early 21st century's focus on accountability, traditional academic subjects, STEM, and college and career readiness.

Theoretical Framework

The theoretical framework for this study is based on educational leadership theory, and specifically Heck, Larsen, and Marcoulide's (1990) validation study of the model of principal instructional leadership. The model purports that principals' instructional leadership as it relates to school governance, instructional organization, and school climate affects student achievement (Heck et al., 1990). Career and technical education programs are part of this instructional organization and school climate; therefore, how principals' perceive them as contributing to the overall school goals and mission is of importance.

The integration and application of academic subjects is integral to the goals and objectives of career and technical education; however, it is not clear how well this message is conveyed, understood, and valued by educational leaders. School principals are in a unique position to facilitate a school culture that prepares students with the competencies needed for the 21st century workforce. They make intentional decisions about which programs to offer within their schools, and they take actions that can support professional development of teachers and improve instruction and student learning outcomes. Understanding principals' perceptions of the contribution that CTE programs make to the goals and culture of the school may contribute to these programs' abilities to respond effectively to a changing educational environment, and may help policy makers better understand important factors that create a successful comprehensive school experience for students. An opportunity to understand and therefore address and overcome misperceptions about the CTE curriculum, and ultimately to better position CTE programs as an integral aspect of schools' educational mission will also be provided.

Purpose and Objectives

The purpose of the study was to examine and describe junior/senior high school principals' perceptions of the contribution that CTE programs make to school goals, specifically as they relate to STEM education, student leadership development, and career readiness. The purpose was also to investigate how each CTE content area is perceived in relationship to each other, as well as other elective programs within the schools. Objectives of the study were as follows:

1. Describe school principals' perceptions of the extent to which CTE programs contribute to STEM education within their schools.
2. Describe school principals' perceptions of the extent to which CTE programs contribute to student leadership within their schools.
3. Describe school principals' perceptions of the extent to which CTE programs and school culture contributes to the workforce preparation of their students.
4. Describe school principals' perceptions of the extent to which each of the CTE content areas is important to their school's educational goals as defined by their school district and local community.

Methodology

The study methodology involved a cross-sectional descriptive research design using a census survey. The target population consisted of junior/senior high school principals in Idaho as identified for the 2011 spring semester (N = 304). All principals were contacted through their school email accounts. Because of the use of a census method, sampling methods were not used. Nonresponse bias was examined in order to determine the extent to which the data provided by the study participants may be representative of the population. Miller and Smith (1983) indicated that nonrespondents are similar to late respondents in responding to surveys. Lindner, Murphy, and Briers (2001) concluded that "both early/late comparison and follow-up with nonrespondents are defensible and generally accepted procedures for handling nonresponse error as a threat to external validity of research findings" (p. 51). After such analysis, it was concluded that the study participants were representative of the overall population.

The data were collected through a survey instrument developed by the researchers. The instrument allowed participants to respond to questions about CTE teachers' professional development needs as well as to questions about the extent CTE programs contributed to the overall goals of the school. This paper reports on data provided by junior/senior high school principals about the contributions that CTE programs in their schools contribute to general educational goals as defined by their school district and local community, and the extent to which these programs contribute to achieving school goals as they relate to STEM education, student leadership development, and student career readiness. Thirty-eight items from the survey addressed these constructs, two being open-ended questions, with the remaining items being rated on a four-point Likert-type scale with two anchor points (1 = Strongly Disagree and 4 = Strongly Agree).

The instrument was reviewed for content validity, clarity, and usability by a panel of experts composed of university faculty members involved with CTE teacher education and educational leadership and a CTE teacher. Survey procedures suggested by Dillman, Smyth, and Christian (2009) were followed. An email invitation for study participation was sent to all junior/senior high school principals

in Idaho. The invitation did not include the survey instrument, but addressed the purpose of the study, the study's timeline goals, confidentiality, voluntary participation, incentives for participation, researcher contact information, and notification that a subsequent contact would follow which would include the survey instrument. Prompts for participation occurred within one week of the initial invitation, followed at two and four week intervals. Customization of each email contact sought to "invoke new and more persuasive appeals. ... with later follow-ups presenting stronger attempts at persuasion" (Dillman, 2007, p. 178). Approximately 42% ($n = 128$) of the state's junior/senior high school principals participated.

Findings

The junior/senior high school principals participating in this study were public school administrators in Idaho ($n = 128$). Of the 128 participants, 9 were previously CTE teachers, of which 7 had teaching experience in business education. The majority (61%) were 45 years of age or older. About 74% of the principals had more than five years of school administrative experience; 39% of them had more than 10 years of experience. Twenty-seven percent ($n = 34$) were female and 73% were male ($n = 94$). Approximately 58% ($n = 74$) of the schools had student populations of under 500 ($M = 243$), 23% ($n = 29$) had populations between 500-1,000 ($M = 1241$), and approximately 13% ($n = 17$) had populations larger than 1,000 ($M = 746$).

Objective 1: Describe junior/senior high school principals' perceptions of the extent to which CTE programs contribute to STEM education within their schools.

Principals indicated the STEM initiative to be an important component of their schools' curriculum and learning goals ($M = 2.9$, $SD = 0.85$), and that CTE teachers should integrate STEM learning objectives ($M = 3.1$, $SD = 0.7$). On average, there was a modest tendency to indicate that the STEM initiative will reduce the number of CTE courses offered ($M = 2.6$, $SD = 1.06$). Principals indicated room for improvement in terms of CTE teachers and STEM teachers working collaboratively to integrate curriculum ($M = 2.2$, $SD = 0.94$), and there was only modest agreement that CTE teachers effectively integrate STEM learning ($M = 2.4$, $SD = 0.84$). Five questions addressed the construct of actual STEM integration within their schools; the aggregate score of these items indicate a limited amount of success towards this goal ($M = 2.4$, $SD = 0.15$) (see Table 1).

Table 1***Principals' Perceptions of the Contribution of CTE to STEM Education Within Their Schools***

Question/Statement	<i>M</i>	<i>SD</i>	^a <i>SD %</i>	^b <i>D%</i>	^c <i>A%</i>	^d <i>SA%</i>
The STEM initiative is an important component of our school curriculum and learning goals.	2.9	0.85	15	11	41	33
Administrators are familiar with strategies to integrate STEM learning objectives within CTE curriculum.	2.4	0.83	13	50	28	10
It is important that CTE teachers integrate STEM learning objectives into CTE curriculum.	3.1	0.7	2	15	55	28
CTE teachers effectively integrate STEM learning objectives into the CTE curriculum.	2.4	0.84	16	40	36	8
Science standards are effectively integrated within CTE curriculum and programs.	2.5	0.85	14	33	44	10
Mathematics standards are effectively integrated within CTE curriculum and programs.	2.6	0.82	9	34	45	13
CTE teachers and STEM teachers work collaboratively to integrate subject matter.	2.2	0.94	25	39	26	10
Increased graduation requirements for math/science credit will reduce the number of CTE courses offered.	2.6	1.06	18	31	26	25

^a SD = Strongly Disagree, ^b D = Disagree, ^c A = Agree, ^d SA = Strongly Agree

Objective 2: Describe junior/senior high school principals' perceptions of the extent to which CTE programs contribute to student leadership within their schools.

Leadership development was considered an important educational goal ($M = 3.6$, $SD = 0.66$). CTE student organizations ($M = 3.2$, $SD = 1.04$) were on par with other well recognized and supported venues for leadership development, those being student government ($M = 3.3$, $SD = 0.87$) and athletics ($M = 3.0$, $SD = 1.01$). Three questions addressed the extent to which CTE programs and the school culture supported leadership development; the aggregate average indicated that principals perceived leadership development as effective within their schools ($M = 3.1$, $SD = 0.07$) (see Table 2).

Table 2***Principals' Perceptions of the Contribution of CTE to Student Leadership Development Within Their Schools***

Question/Statement	M	SD	^aSD %	^bD%	^cA %	^dSA %
It is important that students be provided leadership development opportunities.	3.6	0.66	3	1	24	72
Administrators regularly mentor teachers about leadership activities and programs.	3.0	0.81	6	15	54	24
Teachers regularly mentor students about leadership activities and programs.	3.2	0.75	3	12	51	34
Athletic programs are an important aspect of leadership development.	3.0	1.01	13	9	38	40
Student government is an important aspect of leadership development.	3.3	0.87	6	9	35	50
CTE student organizations are an important aspect of leadership development.	3.2	1.04	13	7	29	51
CTE programs in our school effectively develop quality leadership skills for our students.	3.1	0.89	8	11	46	35

^aSD = Strongly Disagree, ^bD = Disagree, ^cA = Agree, ^dSA = Strongly Agree

Objective 3: Describe junior/senior high school principals' perceptions of the extent to which CTE programs and school culture contributes to the workforce preparation of their students.

The common core state standards indicate that students are to be prepared for both college and careers. For schools to achieve this goal, CTE and academic teachers must work together and integrate content across program areas. Career readiness requires students to possess workplace skills which involve technical ability as well as soft skills and academic competence. Principals indicated that school administrators value CTE students attaining proficient levels of technical skills that meet industry standards ($M = 3.1$, $SD = 0.79$) just as much as CTE teachers do ($M = 3.1$, $SD = 0.83$). They also reported that non-CTE teachers support efforts to ensure students have an opportunity to develop these technical skills ($M = 2.9$, $SD = 0.80$). Overall, there was agreement that CTE students

will graduate ready for postsecondary education ($M = 3.0$, $SD = 0.92$) and ready to enter the workforce ($M = 2.8$, $SD = 0.93$). Although workforce preparation seemed to be a valued construct, principals indicated a lower level of involvement of school administrators with business and industry stakeholders of CTE ($M = 2.2$, $SD = 0.81$) (see Table 3).

Table 3
Principals' Perceptions of the Contribution of CTE and the School to Student Workforce and Career Readiness Within Their Schools

Question/Statement	<i>M</i>	<i>SD</i>	^a SD %	^b D%	^c A%	^d SA%
Administrators value CTE students attaining technical skills that meet industry standards.	3.1	0.79	6	8	53	34
Administrators regularly meet with business and industry CTE stakeholders.	2.2	0.81	18	49	27	6
Teachers of subjects other than CTE support CTE students attaining technical skills that meet industry standards.	2.9	0.8	6	21	54	19
CTE teachers value CTE students attaining technical skills that meet industry standards.	3.1	0.83	6	10	49	34
CTE teachers encourage CTE students to apply what they learn from academic courses.	3.1	0.81	4	15	46	34
Teachers of subjects other than CTE help students make connections to what they learn from CTE experiences.	2.7	0.84	10	27	49	14
CTE work experience placements allow students to apply their knowledge of core academic subjects.	2.5	0.96	18	30	37	15
CTE program completers will graduate ready to enter today's workforce.	2.8	0.93	12	18	47	23
CTE program completers will graduate ready for postsecondary education or training.	3.0	0.92	8	16	41	35

^a SD = Strongly Disagree, ^b D = Disagree, ^c A = Agree, ^d SA = Strongly Agree

Objective 4: Describe junior/senior high school principals' ratings of the extent to which each of the CTE content areas is important to their school's educational goals for students as defined by the school district and local community.

Principals responded on a four-point Likert-type response scale to statements concerning each CTE content area as well as other elective programs. The statements indicated, "<program name> is important to the school's educational goals as defined by the district and local community." Across all CTE content areas the average rating was a 3.2 ($SD = 0.09$), which was the same rating that all other elective programs combined received ($M = 3.2, SD = 0.08$). The highest rated program contributing to the goals of the school was the CTE content area of business education ($M = 3.41, SD = 0.80$), followed by music ($M = 3.33, SD = 0.80$), and then agriculture, another CTE content area ($M = 3.31, SD = 1.09$).

Table 4

Principals' Ratings of the Contribution of CTE Content Areas and Other Elective Programs to Their School's Educational Goals

CTE/Elective Content	<i>M</i>	<i>SD</i>	^a SD %	^b D%	^c A%	^d SA%
Business Education	3.41	0.80	4	7	32	57
Music Education	3.33	0.80	4	9	37	50
Agriculture Education	3.31	1.09	15	4	17	64
Skilled & Technical Sciences (Trade & Industry)	3.29	0.81	3	10	40	47
Engineering & Technology Education	3.29	0.81	4	8	43	45
Health Education	3.27	0.82	4	11	40	45
Physical Education.	3.26	0.75	3	10	46	41
Family and Consumer Science Education	3.25	0.89	6	11	33	49
Art Education	3.11	0.86	4	20	37	39
Foreign Languages Education	2.99	0.97	10	17	37	36
Cooperative Work Experience Education	2.97	0.90	8	16	47	29
Marketing Education	2.79	0.92	10	22	47	21

^a SD = Strongly Disagree, ^b D = Disagree, ^c A = Agree, ^d SA = Strongly Agree

The relationship between size of school and value of CTE programs were also examined. The value principals placed on these programs does not appear to be influenced by school size. However, interestingly, the value of one elective area, music, was found to have a significant positive relationship with the size of the school.

Conclusions and Recommendations

A review of literature found few empirical studies that address the perspectives of junior/senior high school principals regarding the extent of collaboration between CTE teachers and traditional academic teachers, and the value of the skills and knowledge supported through CTE programs. This study's objectives were to examine and describe principals' perceptions of the contribution that CTE programs make to school goals, specifically as they relate to STEM education, student leadership development, and career readiness. The study was conducted in a rural state and that may limit generalizability to urban settings; however, researchers from various settings can use the study as a foundation to build upon.

The findings of this study indicate that principals consider STEM, leadership, and career readiness to be important for students. Although there was some evidence that CTE teachers and STEM academic teachers are collaborating, this is an area that principals indicated would benefit from further development and better execution. It is also an indication of the important role that principals can play to ensure this collaboration occurs. Because the STEM areas are often required for students, STEM teachers may be less motivated than CTE teachers to engage in this work. The principal is in a position to influence the culture and extent to which teachers collaborate across disciplines. It is therefore important for policy makers to provide incentives for school administrators to work towards this goal.

CTE programs and their associated career and technical student organizations (CTSOs) were considered to be important and effective for developing student leadership. In fact, they were considered just as effective as other well recognized forms of leadership development such as student government or athletics. The major advantage that CTSOs might have over other programs is that they are available to all students, and not just a few. They are not only tools for developing leadership, but that they serve a dual purpose and can enhance the learning of both technical and academic subjects that are part of being college and career ready.

This study contributes to an emerging body of literature that suggests school leaders do value curriculum integration and school-wide systems of support for emphasizing knowledge and skills associated with CTE programs. The findings point to a discrepancy between the perceived value and the accountability

measures that schools must address. Perhaps these findings may be helpful for stakeholders of CTE programs as they articulate the role and achievements of CTE within the school environment and culture, and advocate for more support of these programs. Through advocacy there is the potential to influence decisions concerning allocation of resources and accountability measures. In addition, the findings also serve as evidence that may inform legislatures, superintendents, and other policymakers about the important factors that create a successful comprehensive educational experience for students and that prepares them to be college and career ready.

Future studies are needed to further examine the role that CTE programs may have in preparing students as 21st century citizens and workers, and how school leaders may create a culture in which educators collaborate to ensure students have the skills and knowledge required to be successful in the modern world. Although findings from this study in a rural state may not be generalizable to populations in an urban setting, researchers can use the framework from this study as a foundation for future research. Duplication of this study and similar research over time can serve to identify national trends and inform the commitment of resources to programs that effectively prepare students for postsecondary experiences.

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