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## FROM THE EDITOR

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Welcome, Readers, to Volume 45, Number 3, Winter 2009 of the Journal of Industrial Teacher Education (JITE), and the final issue of my term as editor. The editorship is now in the capable hands of Robert Howell whose term begins with Volume 46, Number 1, Spring 2009. I wish to extend a sincere thank you to the members of the editorial board, the reviewers, the style editor, and the manuscript contributors who have made this experience an enjoyable one.

The authors of the first article in this issue ask us to consider the evolving requirements of the 21<sup>st</sup> Century workforce combined with a projected shortage of skilled workers and the implications for our education programs. Stone, Kaminski, and Gloeckner state,

*The purpose of this research was to identify if a knowledge gap existed between the manufacturing industry and the educational institutions charged with education of the production workforce throughout the Front Range of Colorado. One of the areas explored was perception of needed hard skills and soft skills.*  
(p.7)

Similarly, Sturko and Gregson chose to focus on factors that play a role in successful professional development for Career and Technical Teachers designed to address changes in classroom practices stemming from workforce requirements and mandates included within Perkins IV. The authors state,

*The purpose of this multi-case study research was to better understand and describe the types of learning and collaboration that CTE teachers experience by participating in two different types of professional development opportunities: a formal course on integration strategies delivered by a CTE master teacher (defined in this study as a secondary school career and technical educator with a master's degree and several years of teaching experience), and a study group of six CTE teachers who met regularly to discuss issues related to teaching and student learning.* (pp. 39-40)

Adiguzel and Cardak contribute to this overall consideration of relevance of curriculum and effectiveness of instruction with their evaluation of the current computer technology and programming

curriculum taught within the higher education system in Turkey. Document analysis and student interviews resulted in the authors' conclusions,

*The results of the research reveal that the curriculum of "Computer Technology and Programming" was influenced by the structural problems of vocational colleges. In addition to this, some problems related to content and the teaching-learning process of the curriculum including, quality of teaching, managements of internship, and limitations of the specialization choices provided by the curriculum were identified. (pp. 80-81)*

Fazarro, Pannkuk, Pavelock, and Hubbard take the discussion to the next level with their consideration of the interactions between student learning style preferences and instructional methods.

*The purpose of this study was to determine the learning style preferences of undergraduate Agriculture students in a Soil Science course (treatment group) using the Productivity Environmental Preference Survey (PEPS) and to determine, when using the students' learning style preferences, if their course grade average (CGA) is higher versus the control group of the Soil Science course. In turn, modifying instruction will better fit the students' learning style preferences for the course. The study also sought to determine the students' preferred learning styles from the treatment group. (p. 89)*

Finally, Bazile and Walter provide a follow up to the discussion of postsecondary career and technical instruction certification initiated by Olson and Spidell in Volume 44, Issue 2 of the JITE. The authors state,

*...the following is organized to assist stakeholders of career and technical education in developing a clearer understanding of the issues that make it difficult to reach consensus on the implementation of required certification for all CTE instructors at the postsecondary level. (p. 106)*

Enjoy!

## **Closing the Gap: Education Requirements of the 21<sup>st</sup> Century Production Workforce**

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### **Abstract**

*Due to the large number of individuals retiring over the next ten years a critical shortage of people available to work within the manufacturing industry is looming (Dychtwald, Erickson, & Morison, 2006). This shortage is exacerbated by the lack of a properly educated workforce that meets the demands of the 21st century manufacturer (Judy & D'Amico, 1997). Combine these two issues and the result is a steady reduction in qualified candidates for the millions of jobs available in the manufacturing industry. The purpose of this research was to identify if a knowledge gap exists between the manufacturing industry and the educational institutions charged with education of the production workforce. Although the majority of manufacturers and educators indicated there was a gap between the educational institutions and the manufacturer's needs, this research did not uncover a significant gap between the educational institutions and the manufacturers specific to their understanding of the attributes, skills and adult basic education level of a highly skilled production employee.*

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### **Introduction**

Working in the manufacturing sector since 1990 the first author has watched the industry change, in a relatively short time, from primarily being dominated by North American manufacturers to a global market that is driven by innovation, cost, quality, and the ability to change rapidly. Manufacturers in the United States are competing against low cost foreign suppliers with government subsidized materials that are driving retail prices of products far below most domestic manufacturer's cost. In addition, the rising cost of energy and health care in the U.S. are compounding the struggle to remain profitable (The Manufacturing Institute [TMI], 2006). Despite all of these challenges and contrary to many American's perceptions that manufacturing in the U.S. is a declining industry, more goods are produced in the United States now than at any other time in U.S. history with close to \$1.5 trillion contributing to the Gross Domestic Product (GDP) in 2005. The manufacturing workforce employs 14.3 million people with another 6 million in related industries that support manufacturing. This translates to approximately 10% of the entire workforce generating 15% of the GDP from 2001 through 2005 (TMI, 2006).

The significance of understanding the economic impact that manufacturing has on our overall health as a nation can be directly related to our greatest strengths, which are to remain competitive through a diverse and flexible workforce that reacts quickly to changes in the market and competition (Judy & D'Amico, 1997). The skills required to be successful in manufacturing today have changed not only for the professional but for the production workforce too. Change is a part of our culture in manufacturing and the current rate at which the educational and training systems change is far too slow to meet the demand. Postsecondary vocational schools continue to produce students with inadequate employability skills and universities continue to have low enrollment for engineers and scientists while the local community colleges struggle for proper funding (National Association of Manufacturers [NAM], 2005).

Due to the large number of individuals retiring over the next ten years a critical shortage of people available to work within the

manufacturing industry is looming (Dychtwald, Erickson, & Morison, 2006). This shortage is exacerbated by the lack of a properly educated workforce that meets the demands of the 21st century manufacturer (Judy & D'Amico, 1997). Combine these two issues and the result is a steady reduction in qualified candidates for the millions of jobs available in the manufacturing industry. A coordinated effort between the manufacturing industry, educational institutions, and the government is our only hope in developing a workforce that is able to meet the demand of manufacturing in the 21st century.

The purpose of this research was to identify if a knowledge gap existed between the manufacturing industry and the educational institutions charged with education of the production workforce throughout the Front Range of Colorado. One of the areas explored was perception of needed hard skills and soft skills. The term *hard skill* was used to describe the skills typically associated with accomplishing specific tasks related to machining, welding, painting, mechanical assembly, electrical assembly, inspection and testing. These skills are often simple to observe, measure, and quantify. The term *soft skill* (also described as “employability skills”) was used to describe the skills typically associated with interpersonal communication, problem solving, initiative, attendance, attitude, and character. These skills are often difficult to observe, measure, and quantify.

### **Research Questions**

1. Are there differences between manufacturers and educators perceptions related to soft skills, hard skills, and adult basic education requirements of the 21st Century production workforce?
2. How can the attitudes of participants from the educational and manufacturing settings be described?
3. Is there a different perception of the future of manufacturing between educators and manufacturers?

### **Workforce Availability**

The United States annual average unemployment rate in 2007 was 4.6%, with a labor force of 154 million people. This translates to 7 million people out of work and currently looking for jobs (U.S. Department of Labor, 2008). Without an understanding of the statistics, one could assume that there are too many people looking for jobs and not enough jobs to fill the need. While this assumption may have been true in recent history, it does not accurately address the underlying issue of our nation's future labor shortage, which is compounded by inadequate workforce skills specific to the manufacturing industry. Of the 154 million people that are active participants in the labor force, many do not have appropriate skills nor do they understand how to obtain skills required to remain employed in 21st Century manufacturing jobs. A benchmark study completed by The Manufacturing Institute included over 800 manufacturers throughout the United States. Their results indicated "Ninety percent of respondents indicated a moderate to severe shortage of qualified skilled production employees" (NAM, 2005, p. 4). The importance of production and the support of manufacturing in the United States is an issue grossly misunderstood by many outside the manufacturing industry. The U.S. Department of Labor (2006) statistics reported that production is the fourth largest occupation out of 22 and in 2005 over 10.2 million jobs in the United States were directly related to production.

In the future, demographics will contribute to the issues of workforce development as opposed to our current economic conditions that drive today's unemployment rates (Employment Policy Foundation [EPF], 2001). Annual growth of the U.S. population continues to decrease and is currently at 1.1% (American Society for Training & Development [ASTD], 2003). The Bureau of Labor Statistics anticipates the total growth of the labor force from 2005 through 2014 will average less than 1% per year (U.S. Bureau of Labor Statistics [BLS], 2006). The result will be at least 58 million job openings available by 2010, potentially falling more than 4.8 million workers short of meeting this demand (ASTD, 2003). Daniel Eisenberg (2002) stated that "over the next 30 years, 76

million baby boomers will be retiring, with only 46 million “Gen Xers” entering the labor force” (p. 30).

The workforce continues to change not only in population growth but also in diversity. The U.S. Census Bureau reported within forty years the non-Hispanic white person will make up 54.5% of the population as opposed to 71.4% in 2000. The Hispanic population will grow from 11.5% to 23.1%, African Americans from 12.2% to 13.2%, Asian and Pacific Islanders from 3.9% to 8.4% (ASTD, 2003). As the diversity of our nation’s population continues to change, so must our education and training requirements for the 21st century workforce.

As we continued to research the nation’s dilemma with regard to workforce development, the magnitude of the availability issue was enlightening. Statistically, we are headed for a workforce shortage based on current population growth and immigration estimates regardless of the workforce skill level. Population growth can be influenced by public policy on immigration and a potential surge in newborns, however, it is likely that statistical trends are correct and the shortage of available workers will exist. A graphical summary of the workforce availability issue is shown in Figure 1.

The graph is clear, we are most likely heading for a major workforce shortage in many industries as the years progress regardless of the skill and education level of the labor force. In order to offset the reduction in individuals available to participate in the workforce, a strong focus is required to clearly identify the education and training needs of the existing and future workforce to be capable of meeting the demands of the 21st century. The development of workforce education and training programs need to ensure diversity, innovation, productivity, and flexibility are all addressed in order to fulfill the requirements of the “Human Capital Challenge” (EPF, 2003).

### **21st Century Manufacturing Workforce**

Earlier we stated production was the fourth largest occupation in the United States and employs over 10.2 million people in the

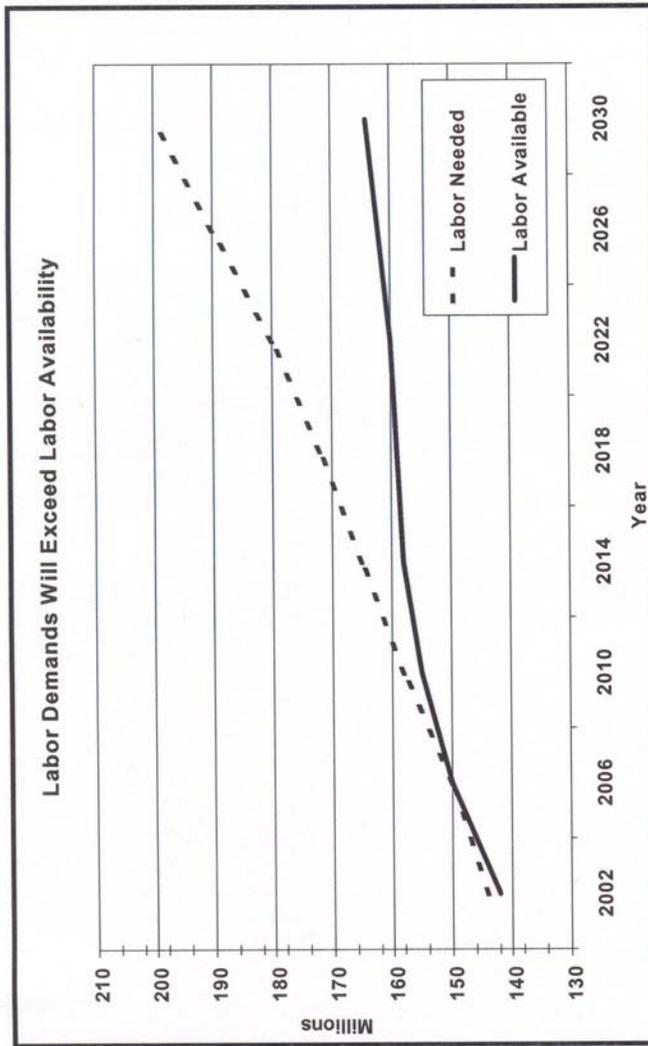


Figure 1. (Employment Policy Foundation [EPF], 2001, p. 5)

manufacturing industry contributing almost \$1.5 trillion to the Gross Domestic Product. With statistics like these, why is the image of manufacturing often negative or referred to as a dying industry? Presumably, because many have been impacted by manufacturing or have known someone whose life has been affected by changes in the industry. Jobs are shifting from the manufacture of products to the distribution of services. In the early 20th century, 63% of the workforce produced products and only 37% were in the service industry. The trend has been a continual shift from products to services with recent data indicating that 22% of the workforce is producing goods and 78% in services. By the year 2025, the numbers could be as great as 83% of the workforce in the service industry leaving only 17% making products (Judy & D'Amico, 1997). Manufacturing has endured many challenges over the past few decades and continues to change more rapidly due to intense cost pressure from consumers and an ever expanding global market. This expansion of the global market creates new opportunities but also presents its share of challenges (TMI, 2006). In 2005, U.S. exports totaled 900 billion dollars and manufactured products consisted of more than 60% of these goods. In 2001, a sharp drop in exports impacted the manufacturing industry contributing to a loss of approximately 3 million jobs between 2000 and 2003 and contributed to the recession at the start of the 21st Century (TMI, 2006).

Another challenge for the U.S. manufacturing industry is maintaining a balance between exports and imports commonly associated with the amount of outsourcing of jobs that occur between the U.S. and foreign countries. For example, in 2005, the U.S. exported \$806 billion dollars of manufactured goods and imported \$1,347 billion dollars of manufactured goods resulting in a \$541 billion dollar trade deficit. Although this deficit has started to drop slightly over the past few years this is a response to exchange rates rather than an increase in exports (TMI, 2006). Many of the jobs outsourced to low cost countries have been for production of products using unskilled labor in cost sensitive commodity markets. Judy and D'Amico (1997) discussed this shift in skilled versus unskilled labor reinforcing the issue surrounding outsourcing of low-

wage, unskilled labor jobs to low-cost countries. Their research suggested modifications of U.S. public policy that could reduce the gap created by the reduction of low-skilled workers for the newly created high-skilled jobs often found within the 21st Century manufacturer.

The manufacturing workforce of the 21st Century is comprised of productive, well paid, highly-skilled individuals. The measurement of productivity within the manufacturing industry is a common indicator of performance increasing over 94% between 1987 and 2005 (TMI, 2006). This data could be interpreted two ways. First, manufacturing was less productive in the preceding years leaving much room for improvement. Second, increased productivity could be a result of the increased competition (foreign and domestic) within the industry forcing manufacturers to employ better business practices to achieve improved results. Meckstroth (2003) stated “a main theme of the manufacturing outlook is that the sector will not generate many net additional jobs” (p. 56). He also reinforced that the productivity gain within the manufacturing industry is a direct result of “innovative products and production methods, outsourcing, and downsizing” (p. 56). The dichotomy for the manufacturing industry is they must continue to increase productivity but in doing so will indirectly reduce the number of available jobs. By reducing the number of available jobs, the labor market will remain very tight for highly-skilled workers in a high-wage industry. There will be little room for unskilled, under-educated individuals in the 21st Century manufacturing workforce.

### **Current Trends in Workforce Education**

The crisis regarding our nation’s workforce is not limited to the looming shortage of people. The lack of adult education and training programs that meet the requirements of the manufacturing industry and are readily available is part of the crisis too. The issues lie within our ability to adjust public policy on workforce education rapidly enough to meet the demands of the manufacturing industry and the needs of the workforce. *The Skill Gap 2001* published by the National Association of Manufacturers (2001) discussed both the

lack of support from federal programs and where training dollars are actually being allocated. The good news is that companies are spending more time and money on training. The bad news is companies are forced to meet the rising demand for training due to an inadequate workforce.

...52% of the companies surveyed reported that they are spending more on training than in the past four years. Sixty-one percent are spending one percent or more of payroll, 33% are spending two percent or more, and 17% are spending three percent or more. Most of the training was in-house (62%) while 43% of the training was outside the company and consisted of three major sources that included vocational and technical schools, business associations, and community colleges. (p. 16)

The report noted this was the first time since 1997 business associations were rated as one of the top providers of workforce development (NAM, 2001). This illustrates a trend in adult education that professional organizations are trying to close the gap left by outdated and underfunded workforce education programs. As the requirements for training change, those closest to the “front line” are going to be able to respond much more quickly than those disconnected from the manufacturing industry. If adult education and public policy would approach the issues with the same focus as businesses approach their customers, adult education may be able to adapt more quickly to changes in customer demand. The Employment Policy Foundation (2003) stated in their annual report that future prosperity is not guaranteed to the American workplace; a workplace policy framework that respects diversity, encourages innovation, rewards productivity, and maintains flexibility is necessary. These seem to be clearly defined objectives that could assist educators when developing adult education and training programs as these are the requirements of the 21st Century manufacturer.

### **Funding Workforce Education**

Workforce education has been central to our nation's development since the industrialization era of 1870s. Prior to the formalization of workforce education, the labor force consisted of tradesmen who passed their knowledge through apprenticeships and were often abused or miss-guided in their teachings (Gray & Herr, 1998). Upon review of funding workforce education over the past 100 years the Federal Government has increased contributions from zero in 1870 to \$1.2 billion in 2005. Throughout the past 100 years, numerous educational philosophies and "acts" have guided the allocation of funds. Common themes are apparent when one studies the history of workforce education and the economic benefits for our nation and the individual. Judy and D'Amico (1997) noted that as education increases earning potential increases. Trends for the past thirty years show the level of earnings continue to increase. Unemployment data demonstrates as education increases the likelihood of being unemployed decreases rapidly. Current data report of the seven million people unemployed, 6.9% have less than a high school education, a sharp contrast to 3.8% of the unemployed who have a high school degree and some college or an associates degree (U.S. Department of Labor, 2006). The data continues to support that as education increases it is good for the individual, the economy, and our nation.

In February 2006, the president published the 2007 budget for our country. To the casual observer it would appear that everything is on track. What more could one ask for when you hear comments like, "we are measuring success not by good intentions or by dollars spent, but rather by results achieved" (U.S. White House, 2006a). The 2007 budget held spending below the 2006 budget (non-military only) and eliminated or significantly reduced the size of hundreds of major programs. Unfortunately, for the Career and Technical Education group, it appeared that it was one of the 142 programs proposed to be cut. Upon review of the Department of Education Budget (Office of Management and Budget, 2006a) the amount spent for Vocational Education was \$1.2 billion in 2005, estimated \$1.1 billion in 2006 and zero in 2007. The program had been *eliminated*.

To understand why the program was eliminated one must understand how the program was measured. The government developed the Program Assessment Rating Tool (PART) as their method of analyzing the effectiveness of a program based on measurable results. The performance management system was not new to government as it was originally developed based on the Government Performance and Results Act of 1993 to evaluate performance of a program and its ability to meet the budget. New with the PART was the ability to directly measure the performance of a program based on results. The tool was first introduced in 2003 and consists of four sections that have multiple questions that measure 1) Purpose, relevance, and federal role; 2) Strategic planning; 3) Program management; 4) Program results (Office of Management and Budget, 2006c). There are five categories of possible ratings: Effective, Moderately Effective, Adequate, Ineffective, and Results Not Demonstrated. After reviewing PART for Vocational Education State Grants (Ineffective), Tech-prep Education State Grants (Results not demonstrated), and Adult Education State Grants (Results not demonstrated) it was clear why the money was removed from the budget. The PART questionnaire (Office of Management and Budget, 2006b) for the above programs identified obvious pitfalls of programs such as ‘clarity of purpose’, ‘inconsistent definitions of a vocational education student’, and ‘lack of consistent data collection’. Overall, 793 programs were assessed using the PART method and 72% were performing as opposed to 28% that were considered to be not performing (U.S. White House, 2006b). Specific to the Department of Education, 73 programs were assessed with 27 programs considered performing and 46 programs considered not performing.

The Association for Career and Technical Education website ([www.acteonline.org](http://www.acteonline.org)) reported, “June 7, 2006: House Subcommittee Restores Perkins”. The house subcommittee was successful in restoring the funding for the Perkins act which supports most of the CTE programs with \$1.2 billion and specifically \$10.8 billion dollars that supports Workforce Development programs (Association for Career and Technical Education [ACTE], 2006).

While the funding for Vocational Education was eventually restored for another year, the message was clear: funding will continue to be challenged if results are not produced. A clear interpretation of the PART system needs to be understood by all levels of leadership among the Career and Technical Education (CTE) community. Programs need to be held accountable for producing results that not only demonstrate the validity of workforce education but act as an example of continuous improvement for others to benchmark.

### **Literature Summary**

Currently there are over seven million people out of work but the data is clear that as soon as 2010 the number of people available in the workforce will decrease causing a shortage of qualified individuals. The literature does not suggest zero unemployment but it does establish that the workforce will need to be more productive and diverse than previous generations. The median age of the U.S. population is already 35 years and this will only continue to increase as the baby boom population ages (ASTD, 2003). A typical “qualified” candidate will change over the next decade. High school diplomas will be mandatory requirements for most jobs as will post secondary education. Supervisors and managers will need to be fluent in at least one, possibly two foreign languages and respect cultural diversity.

To gain insight on how we can work toward closing the gap, data was collected from manufacturers and educational institutions located throughout the Front Range area of Colorado. Surveys were designed with the intent to capture current trends, opinions, and requirements of both populations regarding workforce development issues for those working with the production workforce.

### **Survey Method**

Two surveys were developed using an on-line electronic questionnaire website called Question Pro ([www.QuestionPro.com](http://www.QuestionPro.com)), one for educators and one for manufacturers. The two survey sample

groups were chosen through a non-probability convenience sample. Both surveys were distributed via internet to a convenience sample of participants contacted December 18, 2006 through February 10, 2007.

For the purpose of this research the Manufacturing Industry population was defined as a company that produces a product from raw materials either chemically, mechanically, or physically and found within the North American Industrial Classification code 31 - 33: Manufacturing (NAICS, 2002a). The survey sample consisted of 10 separate manufacturing companies that met the following criteria:

- Employed 25 Production employees or more (direct hourly labor).
- Production Operations consisted of at least one: Mechanical assembly; electrical assembly; welding; machining; industrial painting.
- Located in the area of Colorado known as the Front Range which consists of the Denver Metro area, Colorado Springs, Pueblo, Boulder, Longmont, Loveland, Ft. Collins, and Greeley.

For the purpose of this research the Educational Institution population was defined as any establishment that provides instruction and training as stated in the North American Industrial Classification code 61: Educational Services (NAICS, 2002b). The survey sample consisted of educational institutions that met the following criteria:

- Their current curriculum supported manufacturer's needs either through academic degree programs, continuing education program, workforce development or certification program.
- Facilities physically located in the area of Colorado known as the Front Range which consist of the Denver Metro area, Colorado Springs, Pueblo, Boulder, Longmont, Loveland, Ft. Collins, and Greeley.

Communication with the survey sample was initially accomplished by a phone call or on-site visit during which the purpose of the research was discussed and a request for their participation was extended. A request for participation e-mail

message was then sent to the sample population with a brief description of the research project and a link to the on-line survey. Once the participants were routed to the survey website, they were informed of the risk associated with the survey (or lack thereof) and asked to continue, which provided informed consent. All participants' anonymity was maintained throughout the survey and data collection. The participants were asked to complete the survey within two weeks of their first notification. A follow-up e-mail was sent three weeks after their first notification reminding them to participate in the survey or thanking them for their participation if they had already completed the survey. Due to anonymity, we were not able to tell if each participant had actually completed the survey so the number of estimated participants to the number of surveys actually completed was monitored to determine the overall response rate. The results were analyzed using descriptive and inferential statistical methods and presented in a summarized format.

### **Survey Population**

Of the 68 people contacted, a total of 36 surveys were completed, 20 from educational institutions and 16 from manufacturing. The breakdown of positions held by the educational institution respondents were seven instructors, five program coordinators, five workforce development professionals, two consultants, and one continuing education professional. The educational institutions included 13 community colleges, four career and technical education institutes, two consulting companies, and a workforce development center. The breakdown of the positions held by the manufacturing industry respondents were seven from operations management, four from human resources, three owners or presidents, and two production supervisors.

## Findings

Workforce availability issues are predicted to rise as the demand for qualified workers increase due to the anticipated shortage of individuals that create the labor force. Many industries are currently affected by this shortage and manufacturing is not immune to the resource availability crisis. If manufacturing is to remain competitive and contribute to the economic heartbeat of our nation, it must overcome the skills gap that is currently impacting the performance of the production workforce (TMI, 2006). One of the issues facing manufacturing is the development of a highly skilled production workforce through the use of either educational institutions or manufacturer's internal training programs. Here we present the findings from the surveys.

***Research Question #1:** Are there differences between manufacturers and educators perceptions related to soft skills, hard skills, and adult basic education requirements of the 21st Century production workforce?*

The first theme to emerge from the surveys was specific to the attributes of a highly skilled production employee related to soft skills and adult basic education requirements. The only attribute that indicated a statistically significant difference ( $p=.009$ ) was quality focus (see Table 1). The manufacturers placed a higher level of importance on quality focus ranking it the most important attribute as opposed to the educators who ranked it as the fourth important attribute. In fact, educators ranked attitude as the most important attribute. Even with this finding, the overall close ranking of all the preferred attributes demonstrated that the manufacturing and educational respondents generally agree on the attributes that contribute to a highly skilled production employee.

(Note that the calculation of t-values and p-values used within this study are intended for exploratory purposes specific to the differences between the two survey groups that participated in this research and not meant for generalization.)

Table 1.

*Indicate the importance of each attribute of a highly skilled production employee.*

Attribute	Ranking		Mean		SD		t-value	P-value
	Edu	Mfg	Edu	Mfg	Edu	Mfg		
Attitude	1	3	4.700	4.438	.571	.743	1.214	.117
Productivity	2	4	4.650	4.438	.049	.727	1.045	.152
Attendance	3	2	4.600	4.688	.598	.479	-.475	.319
Quality Focus	4	1	4.450	4.875	.605	.342	-2.505	.009*
Character	5	5	4.300	4.312	.801	.793	-.047	.482
Problem-Solving Skills	6	7	4.250	4.125	.716	.885	.469	.321
Communication Skills	7	6	4.100	4.250	.718	.856	-.572	.286
Math Skills	8	9	3.450	3.375	.826	.957	.252	.401
Reading Skills	9	10	3.450	3.375	.605	.885	.302	.382
Writing Skills	10	11	3.200	2.875	.696	.957	1.179	.123
Computer Skills	11	8	3.100	3.500	.718	.097	-1.425	.082
Education Level	12	13	2.750	2.563	.639	.512	.953	.174
Work Experience	13	12	2.650	2.688	.671	.602	-.174	.431

Note: Mean, Median, and Mode are scored as 1 = Not Very, 2 = somewhat important, 3 = important, 4 = very important, 5 = Extremely Important : Edu – Educational institution participants, Mfg = Manufacturing industry participants  
 \* $p < .05$

The next theme to emerge from the survey was the current state of the production workforce based on the frequency of common attributes observed by the respondents (see Table 2). The first seven attributes were classified as 'soft skills' and in general, there was little gap between the education and manufacturing rankings. The significant gaps observed between attendance issues ( $p=.020$ ), good communication skills ( $p=.038$ ), and productivity issues ( $p=.027$ ) did not necessarily affect their ranking but indicated the manufacturers were observing these attributes less frequently than educators. The responses from both the educators and manufacturers indicated similar ranking of each attribute but with slightly less optimistic responses from the manufacturers.

The attributes related to adult basic education were adequate computer skills, adequate math skills, and adequate writing skills. Education and manufacturing ranked all of these attributes similarly. However, the educational respondents were more optimistic regarding their frequency of observation. Of the 13 attributes ranked, seven of the attributes were observed less frequently by manufacturers and indicated the first significant gap identified regarding their different perceptions specific to the skills gap. As discussed in the first theme, both groups understood what is expected of a highly skilled production employee, yet data indicated that the educational respondents are observing this behavior more frequently than manufacturing respondents. This could be an indication of disconnect between education and manufacturing or it could also be related to the amount of contact each respondent actually has with the production workforce. For example, educators may spend only two hours a week with the individual and manufacturers could spend forty hours a week with them.

The next theme regarding attributes of the production workforce was related to the hard skills requirements of the local manufacturing industry. We were encouraged by the continuity between the survey groups as each skill was ranked in the same order (see Table 3). Testing and inspection, mechanical assembly, and electronic assembly were ranked as 'very important' skills. Machining was ranked as 'somewhat important' by both groups. Welding and industrial painting were ranked by educators as 'somewhat'

Table 2.  
*Indicate the frequency of each attribute found in the current production workforce.*

Frequency of Attribute	Ranking		Mean			SD			t-value	p-value
	Edu	Mfg	Edu	Mfg	Edu	Mfg	Edu	Mfg		
Good Quality focus	1	1	3.550	3.563	.887	.727	.887	.727	-.045	.482
Positive Attitude	2	2	3.400	3.188	.821	.911	.821	.911	.735	.234
Problem-solving Ability	3	3	3.400	3.125	.754	.719	.754	.719	1.110	.137
Attendance Issues	4	5	3.350	2.813	.745	.750	.745	.750	2.144	.020*
Good Communication Skills	5	7	3.200	2.750	.834	.577	.834	.577	1.834	.038
Solid Character	6	4	3.200	3.000	.834	.730	.834	.730	.755	.228
Productivity Issues	7	8	2.850	2.313	.875	.704	.875	.704	1.993	.027*
Adequate Computer Skills	8	10	2.750	2.000	.910	1.033	.910	1.033	2.314	.013*
Prior Work Experience	9	6	2.650	2.813	.671	.750	.671	.750	-.685	.249
Adequate Reading Skills	10	9	2.450	2.063	.945	.854	.945	.854	1.276	.105
Adequate Math Skills	11	11	2.350	1.813	1.040	.834	1.040	.834	1.679	.051
Adequate Writing Skills	12	12	2.300	1.688	.979	.793	.979	.793	2.025	.025*
Post Secondary Education	13	13	2.200	1.375	.951	.619	.951	.619	2.994	.003*

Note: Mean, Median, and Mode are scored as 1= Not Very, 2 = sometimes, 3 = normal, 4 = most often, 5 = always  
 Edu – Educational institution participants. Mfg = Manufacturing industry participants  
 \*  $p < .05$

Table 3.

*Based on your understanding of the local manufacturers needs, please indicate the importance of each "hard" skill of the production workforce.*

Hard Skill	Ranking		Mean		SD		t-value	p-value
	Edu	Mfg	Edu	Mfg	Edu	Mfg		
Testing & inspection	1	1	4.000	4.313	.795	.946	-1.077	.144
Mechanical Assembly	2	2	3.900	3.938	.852	.854	-.131	.448
Electronic Assembly	3	3	3.650	3.313	.813	1.250	.978	.167
Machining	4	4	3.100	2.688	1.021	1.448	1.002	.162
Welding	5	5	2.800	1.813	1.005	1.109	2.798	.004*
Industrial Painting	6	6	2.200	1.625	.951	1.088	1.691	.050

Note: Mean, Median, and Mode are scored as 1= Not Very, 2 = somewhat important, 3 = important, 4 = very important, 5 = Extremely important. Edu = Educational institution participants. Mfg = Manufacturing industry participants  
\* $p < .05$

important while manufacturers ranked these as 'not very' important skills. There was a significant difference between the groups regarding the least important hard skills (welding;  $p = .004$  and industrial painting;  $p = .050$ ) that could be a result of the manufacturer's particular requirements and educator's general understanding of the requirements. A larger survey group could yield a clearer picture of the true needs amongst the manufacturing industry located in the Front Range while also shifting the order of ranking.

The final discussion on this topic directly relates to the perception of disconnect between the educational institutions and the manufacturers needs. When asked specifically, both groups indicated they believed there is a gap between the two groups with regard to understanding the manufacturer's educational requirements. However, this survey did not generate substantial evidence that the two groups have different perceptions regarding the attributes of a highly skilled production employee. There was a slight significant difference between the current observations of both groups with manufacturing reporting less frequent observation of the preferred attributes while maintaining a similar ranking as the educational respondents. The attributes specific to hard skills requirements supported continuity between the two groups resulting in a general understanding regarding all of the attributes and skill requirements between the manufacturers and educators.

***Research Question #2: How are the attitudes of participants from the educational and manufacturing settings described?***

A series of questions were presented to education participants to understand their current and preferred method of communication between manufacturers and educational institutions. Educational respondents indicated that advisory panels were the most common form and most preferred method of communication. Not surprisingly, the major limiting factor to improving communication between the two groups was time. We were encouraged by the high number of responses indicating that manufacturing consortiums and quarterly roundtable discussions with plant tours were viable options

to improved communication. A possible improvement to the current advisory panel structure would be to incorporate the use of regional manufacturing consortiums that host roundtable discussions in conjunction with plant tours on a regular schedule. The oversight of the advisory panel can still be maintained in addition to educators and manufacturers meeting face-to-face directly where education of the learner is applied; the manufacturing environment. In a perfect world, one goal is to have the classroom and the manufacturing environment one in the same.

The establishment of a conduit that facilitates the smooth flow of information between the educational institutions and manufacturers will not only improve the educators' understanding of the requirements and desired attributes but also provide an opportunity for manufacturers to improve their educational endeavors as well. This important issue was discussed in the literature review and indicated that manufacturers and business associations were rated as the top providers of workforce development (NAM, 2001). The manufacturing survey supported these findings with over 87% of the respondents indicating they have a dedicated workforce development and training budget. The manufacturing respondents indicated that a majority of the training is focused on hard skill development with a few respondents indicating soft skills training occurred and 78% responded that no training occurred for adult basic education skills. As an indicator of the struggle between hiring a productive employee that meets basic educational requirements and educating an unproductive employee, most manufacturing respondents indicated that a high school degree or GED is required for employment within their organization.

In our experience, training programs within the manufacturing industry are often discussed but seldom pursued, especially for the production workforce. The educational respondents reported that 'lack of time' was the major obstacle to improving communication and also indicated the learner's major obstacle as the 'availability of time'. Within manufacturing, time is also a premium but the most common obstacle is return on investment (ROI). When faced with the dilemma of training verse production, it can be challenging to clearly justify the advantages of the training based on typical ROI

calculations. To off-set this expense, qualified manufacturers can apply for state and federal funding dollars set aside specifically to assist with training and development of their workforce (Uhalde, Seltzer, Tate, & Klein-Collins, 2003). The manufacturing survey respondents implied that less than half are using state funding and only one reported using any federal funding. The manufacturers were also asked if they offered tuition reimbursement programs with 75% indicating 'yes'. Regardless of the obstacles surrounding time and funding, both groups need to work together in the efficient design and implementation of successful workforce development programs.

***Research Question #3: Is there a different perception of the future of manufacturing between educators and manufacturers?***

Another gap explored from this survey was one of perception regarding the expansion or reduction of the manufacturing industry along the Front Range of Colorado. The educational respondents report a decrease in the level of interest in manufacturing while the manufacturing industry reports a slight growth in the hiring of production employees over the next four years. However, this shift is not statistically significant as indicated by the p-value as shown in Table 4.

These limited results appear to mirror research discussed in the literature review from a benchmark study completed in 2005 by The Manufacturing Institute titled *2005 Skills Gap Report – A Survey of the American Manufacturing Workforce* that found “ninety percent of respondents indicated a moderate to severe shortage of qualified skilled production employees” (NAM, 2005, p 4). The reality of this dichotomy is that manufacturing is in need of a different type of skilled individual not necessarily more individuals. The use of ‘unskilled’ production workers within the United States may soon be an outdated term as many of the so-called ‘unskilled’ jobs have been outsourced to low cost countries where labor is abundant (Judy & D’Amico, 1997). In addition, the 21st Century manufacturer requires a workforce that is diverse, innovative, productive, and flexible, not one that is full of specialists capable of only a few different tasks (Judy & D’Amico, 1997).

Table 4.

*Indicate the estimated number of production employees at your facility by the end of:*

# of Production Employees	# of Respondents	
	December 2006	December 2010
Less than 10	2	0
10 – 19	1	1
20 – 49	8	6
50 – 99	3	6
100 – 199	0	1
More than 200	2	2
Mean	3.250	3.812
Median	3	4
Mode	3	3
SD	1.390	1.109
t-value	1.28	
p-value	.108	

Note: Mean, Median, and Mode scored as (1)= less than 10 production employees, (2) = 10 – 19 prod. emp., (3) = 20 – 49 prod. emp., (4) = 50 – 99 prod. emp., (5) = 100 – 199 prod emp., (6) = More than 200 production employees.

$p < .05$

The issues facing the educational institutions and the manufacturing industry are complex and have been the main theme discussed and researched throughout this study. The final question regarding gaps presented to both survey groups was based on six common issues (see Table 5). The educational respondents ranked available funding as the issue that will create the largest gap for workforce development followed by retirement of qualified workers. Hard skills and low unemployment rate tied for third. Interestingly, the manufacturing industry ranked hard skills as the largest issue followed by low unemployment rate and then available funding. The level of variance within the educational participants indicated they were in agreement with the ranking as there was only a .70 difference between the mean scores. The manufacturing participant's variability was greater with a mean difference of 1.1. This could indicate that educators viewed these issues more similarly than manufacturers did. This difference (or lack of) suggests the educational participants perceived these issues differently than the manufacturing participants and this could contribute to the disconnect between the educational institutions and manufacturing industry. If one were to attempt to interpret the most important issue from the educational responses they would list funding as the number one issue due to the competitiveness caused by the ever-shrinking education budgets. Manufacturing ranked funding as third possibly due to their feeling of more control over their own funding for education based on their revenue growth. The manufacturers' most pressing issue was hard skill training and could be interpreted as a result of the lack of vocational education training found in the current workforce (TMI, 2006).

### **Conclusion**

Although the majority of manufacturers and educators indicated they feel there is a gap between educational institutions and the manufacturer's needs, this research did not uncover a significant difference between the educational institutions and the manufacturers specific to their understanding of the attributes, skills, and adult basic

Table 5.

*Over the next four years, what do you feel will create the largest gap between what the manufacturers require and the available production workforce?*

Gap	Ranking		Mean			SD			t-value	p-value
	Edu	Mfg	Edu	Mfg	Edu	Mfg	Edu	Mfg		
Available Funding	1	3	3.800	3.250	.894	.931	1.801	.040*		
Retirement of Qualified Workers	2	4	3.600	2.938	.940	1.124	1.927	.031*		
Hard Skills	3	1	3.450	3.750	.826	.577	-1.231	.113		
Low Unemployment Rate	3	2	3.450	3.688	.826	.602	-.963	.171		
Soft Skills	5	6	3.100	2.688	.852	.704	1.556	.064		
Adult Basic Education	6	5	3.100	2.750	1.021	.856	1.096	.140		

Note: Mean, Median, and Mode are scored as 1= No Gap, 2= Slight Gap, 3 = Manageable Gap, 4 = Large Gap, 5 = Extreme Gap  
 Edu = Educational institution participants, Mfg = Manufacturing industry participants  
 \* $p < .05$

education level of a highly skilled production employee. A couple of areas suggest further investigation is necessary. These are measuring the attributes that contribute to a highly skilled production employee, improving communication avenues between manufacturers and educators, developing production workforce training programs, mapping the stakeholders of vocational education, and eliminating causes of inadequate funding. Further research is clearly needed to uncover where the differences and opportunities lie.

A review of literature revealed that vocational education and the manufacturing industry have changed dramatically and understanding workforce education remains a very important issue. Traditional vocational education programs of the 1960's and 1970's that focused on the development of specific skills like woodworking, metal working, and small engine repair were replaced by the school-to-work programs of the 1980's that combined skills with academics. The school-to-work programs started the move of vocational education out of the public school systems and directed it more towards industry training. In the 1990's, the term "vocational education" was changed to "career and technical education" and was supported by a model of career paths focused on soft skills and academics specific to a chosen industry combined with hands-on, job specific training. The fundamental difference between the production workforce of the 1970's and 2007 is the expectation from manufacturers that the individual is skilled in numerous areas, not one specific skill or trade. This requirement of a flexible workforce stems from the success of North American manufacturing's demonstrated ability to rapidly change to the demands of the customer. As the literature suggested, the vision of 21st Century career and technical education should be based on the ability to quickly develop flexible and functional programs that meet the needs of individuals and manufacturers for a given industry.

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**Learning and Collaboration in Professional Development  
for Career and Technical Education Teachers:  
A Qualitative Multi-Case Study**

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**Abstract**

*This multi-case study explored the learning and collaboration of six Career and Technical Education (CTE) teachers in two different types of professional development experiences: (a) a course on integrating reading, writing, and mathematics skills into CTE curricula, delivered by a master teacher; and (b) a small teacher study group that met regularly for the purpose of improving teaching practice. Both professional development experiences occurred at a comprehensive senior high school and involved CTE and academic teachers. The study found that different types of teacher learning and collaboration occurred, depending on the context, process, content and structure of the professional development experience. While the integration course emphasized building knowledge and pedagogical expertise about integration, the study group focused on building professional knowledge and community through sharing and support. Both professional development activities provided teachers with opportunities to collaborate and to grow as professionals.*

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## **Introduction**

For nearly two decades, federal legislation has focused on the integration of academic skills into career and technical education curricula to increase academic achievement among career and technical education (CTE) students. CTE teachers, however, may not have the necessary skills to accomplish such integration and effectively deliver integrated lessons to their students (Cramer, 2004; Silverberg, Warner, Fong, & Goodwin, 2004). The recent Carl D. Perkins Career and Technical Education Improvement Act of 2006 (a.k.a. Perkins IV) emphasizes the importance of integration and requires CTE teachers to participate in professional development to prepare them for integrating rigorous academic skills into their technical curricula. The legislation calls for professional development that is high quality, on-going and classroom-focused in order to impact classroom instruction and the teacher's performance in the classroom; it cannot be one-day or short-term workshops or conferences. Perkins IV also recommends CTE teachers participating jointly in professional development with their academic colleagues. With these new federal requirements, CTE teachers will need to participate in more professional development that is on-going, school-based and collaborative. Consequently, state administrators and local school district personnel may be looking for ways to provide their CTE teachers with staff development experiences that meets these federal guidelines.

Professional development that promotes teacher learning and growth is critical for career and technical educators now more than ever before. Over the past few decades CTE programs have shifted their focus on new approaches to student learning in an effort to improve student achievement (Lynch, 2000). Such a shift has challenged CTE teachers to not only update their programs but also transform themselves as educators (Berns & Erickson, 2001; Brown, 2002a, 2002b; Maurer, 2000). Programmatic changes such as integrated curriculum, contextual and applied learning, new technologies, Tech-Prep, school-to-work, and career clusters place new demands on career and technical educators and require them to assume new professional roles (Berns & Erickson, 2001; Brown,

2002a, 2002b; Maurer, 2000). In addition to the traditional role of technical expert, CTE teachers must act as coach, mentor, facilitator, collaborator, and technology advocate to help students develop the academic and technical knowledge and skills they need to be successful in the 21<sup>st</sup> century workforce (Berns & Erickson, 2001; Brown, 2002a, 2002b). Partnering with representatives of private industry, coordinating with administrators, working closely with parents and community organizations, and collaborating with peers requires CTE teachers to have collaborative skills and the ability to work as part of a team (Brown, 2002a, 2002b).

Participating in professional development that promotes collaboration and team learning will help CTE teachers to become more skilled practitioners capable of filling these complex roles. However, more than a decade ago researchers and educators were concerned that training alone is not enough for teachers to change themselves and their practice in response to complex educational reform (Little, 1993). The literature on professional development suggested that on-going, collaborative professional development within the context of the workplace is necessary for significant change to occur in teachers' practice (Darling-Hammond & McLaughlin, 1995; Fullan, 1995; Lieberman, 1995; Little, 1993); however, not all professional development is on-going and collaborative. Current professional development commonly takes a one-size-fits-all approach and is often designed in the most economical way (Diaz-Maggioli, 2004). Learning, when it does take place, tends to be individualistic and not shared with peers in the context of the classroom; such learning promotes a culture of isolation rather than one of cooperation (Diaz-Maggioli, 2004). Teachers themselves have complained about participating in traditional in-service training, particularly if it "smacks of 1-day workshops offered by outside 'experts' who know (and care) little about the particular and specific contexts of a given school" (Wilson & Berne, 1999, p. 197).

If teachers are expected to change their teaching practices and reinvent themselves as educators, they need the opportunity to explore their understanding of teaching and learning with their peers—experimenting, reflecting, discussing, and assessing their

efforts as part of their daily routine (Darling-Hammond & McLaughlin, 1995; Lieberman, 1995; Little, 1993). This type of professional development expands the role of teacher into a teacher-learner who participates in a collaborative environment with other professionals; it should be structured so that it provides opportunities for teachers to share their knowledge and what they want to learn with other professionals within the contexts of their practice (Darling-Hammond & McLaughlin, 1995). Collaboration is necessary for on-going personal learning; without collaborative skills and relationships, teachers cannot bring about change in their practice (Fullan, 1995).

Finch (1999) suggested that CTE teachers are likely to change their teaching practice when they participate in professional development that involves them in all aspects of the reform, and when they receive assistance and support through the change process. Such professional development should emphasize teachers teaching teachers and collective or team development, be continuous rather than intermittent, and stress teacher autonomy and decision-making (Finch, 1999). In fact, professional teams and teachers teaching teachers are two approaches that can help teachers learn about integration strategies (Finch, 1999). Teachers teaching their peers has been a common form of professional development in the integration literature (Stasz, Kaganoff & Eden, 1994), and “a powerful way of linking professional development with team building” (Finch, 1999, p. 11). In addition to participating in teamwork and collaboration, teachers teaching teachers can also be used informally to help peers learn skills and knowledge associated with specific lessons (Finch, 1999). In their review of the literature, Rolheiser and her colleagues found that teachers teaching teachers can have positive outcomes, including increased opportunities for teacher leadership, increased communication, and increased learning among teachers; asking teachers to share classroom strategies with their peers reduces their isolation and promotes the sharing of knowledge and increases teacher reflection (Rolheiser, Ross & Hogaboam-Gray, 1999).

In addition to teachers teaching other teachers, educators, policymakers and researchers recently have explored the concept of

learning communities as another professional development model that can bring about positive changes in teacher practice. The National Staff Development Council (NSDC) (2001) included the concept of learning communities in its revised standards for staff development for all teachers. The NSDC learning community standard indicates that “the most powerful forms of staff development occur in ongoing teams that meet on a regular basis, preferably several times a week, for the purposes of learning, joint lesson planning, and problem solving” (<http://www.nsd.org/standards/learningcommunities.cfm>).

Such learning communities can provide opportunities for teachers to have on-going discussions, reflection and experimentation among peers that promote collaboration and learning; teachers can collectively deal with student issues and explore ways of improving their practice (McLaughlin & Talbert, 2001).

Models that involve team learning have developed in the past decade, but teachers often do not have the on-going support to implement a reform in their teaching practice, even after being involved in an intensive reform training program. The School-to-Work Professional Development Institute established at the University of Delaware, for example, developed a professional development program to assist teams of academic, vocational and special education teachers to design, implement and assess integration strategies (Eisenman, Hill, Bailey, & Dickison, 2003). The institute was based on the Classrooms that Work model (Ramsey, Stasz & Ormseth, 1997; Stasz, 1997), which focused on classroom observation, included a work-based learning experience, and was oriented to research-based practices (Eisenman et al., 2003). The program required year-long participation of which six summer weeks was spent in university classes, business externships, and experimental classroom-based sessions; and activities such as worksite observations, curriculum and instructional design; piloting lesson plans with students; and peer observation and feedback. The fall and spring participation included team meetings and teacher documentation of activities, outcomes and issues (Eisenman et al., 2003).

In spite of this intensive year-long effort, the teachers had difficulty forming and maintaining collaborative teams due to participant drop-out and limited time during the school year; however, the most promising aspects of the program appeared to be “those that facilitated teachers’ boundary-crossing...that encouraged participants to step beyond their isolated classroom-bound teaching and consider other communities of practice in relation to their own” (Eisenman et al., 2003, p. 93). While this professional development provided an intensive, holistic experience for teachers, the on-going support in the school environment was its weakest component. These work teams had the specific purpose of designing, implementing and assessing integration strategies, but the researchers found that members did not have the time or organizational support to work collaboratively throughout the school year on improving teacher practice (Eisenman, et al., 2003).

### **Problem**

CTE teachers need professional development that facilitates their learning, collaboration skills, and strategies to help them integrate academic skills into their curricula, especially given the requirements set forth in Perkins IV. Such professional development needs to provide learning opportunities that help teachers to work collaboratively with other teachers (including academic teachers), experiment with different integration strategies, and modify their teaching practices based on what they have learned; however, more research is needed to better understand teacher learning and collaboration in different types of professional development experiences.

### **Purpose of the Study**

The purpose of this multi-case study research was to better understand and describe the types of learning and collaboration that CTE teachers experience by participating in two different types of professional development opportunities: a formal course on integration strategies delivered by a CTE master teacher (defined in this study as a secondary school career and technical educator with a

master's degree and several years of teaching experience), and a study group of six CTE teachers who met regularly to discuss issues related to teaching and student learning. This study describes how the CTE teachers' learning experiences in each of these professional developments activities were similar or different, and how each type of professional development provided opportunities for CTE teachers to collaborate with other teachers and make changes in their practice.

### **Conceptual Framework**

The purpose of professional development is to promote teacher learning and growth. Much of the literature suggests that, to improve teacher practice, teachers need professional development that provides on-going, classroom-based, learning experiences with other teachers in a supportive environment. Consequently, the conceptual framework for this study is based on the assumption that in-service teachers construct professional knowledge through their on-going interactions and experiences in the classroom and with other professionals.

Constructivist learning theory suggests that learning is a self-regulated process that occurs when individuals interact with their environment and organize, reflect on and integrate new information and experiences into their current cognitive structures (Fosnot & Perry, 2005). An important part of this process is constructing social and cultural meaning about the new information and experiences within the context of community, which provides consensus that such meanings are viable (Fosnot & Perry, 2005). The implication of constructivist theory to professional development is that new knowledge related to teacher practice is not transmitted to teachers in one-day in-service workshops; rather teachers must construct their own professional knowledge through contextually meaningful learning experiences.

Fosnot and Perry (2005) identified four key learning principles derived from constructivism that may be applied to professional development for teachers.

First, learning is a developmental process that requires the involvement of the learner. Teachers must be actively involved in

learning through discussing, questioning, experimenting, reflecting, and examining outcomes of their learning activities with other teachers. Second, learning involves disequilibrium, which challenges learners to explore other possibilities. Teachers must have opportunities to explore new teaching strategies, question their own beliefs about teaching and learning, and examine the beliefs and teaching strategies of their peers and other professionals. Third, reflective abstraction is the key to the learning process. Reflection through discussion and writing helps teachers to organize and make connections among their experiences. Finally, dialogue within a community of learners encourages further thinking. Teachers can share ideas with peers and generate approaches and strategies to problems they encounter in the classroom. This sharing helps teachers collectively to make meaning out of their learning experiences and socially construct professional knowledge. (pp. 33-34)

In addition to these basic constructivist principles of learning, a conceptual framework for studying professional development also should consider the environment in which learning takes place. In a review of research related to professional development for teachers, Loucks-Horsley and Matsumoto (1999) identified four key areas—content, process, structure and strategies, and context—that play a role in creating an environment that promotes teacher learning. The content of the professional development experience is the information that participants are expected to learn, and for teachers, it should be focused on practice to help them better understand their subject matter, their learners, and their teaching methods. Process involves how the content is to be learned and should consider how teachers create professional knowledge and apply it in their classrooms. Structure deals with how the content is organized for learning and what strategies are used to deliver it. Lastly, context includes the conditions under which the content is learned. Context considers the culture and climate of the learning environment (Loucks-Horsely & Matsumoto, 1999).

In summary, principles of constructivist learning theory, along with the four key elements that make up the learning environment, form a framework in which to explore how two

different types of professional development create different opportunities for teachers to learn and collaborate with their peers.

### **Research Questions**

Using a qualitative multi-case study design, the following questions were addressed:

1. What kinds of teacher learning occur in a formal integration course delivered by a CTE master teacher and in a teacher study group?
2. How do the learning experiences of participants in each professional development experience differ and how are they the same?
3. To what extent did collaboration occur among the teachers who participated in each professional development experience?

### **Methods**

The qualitative case study design was selected for this inquiry because of the researcher's interest to gain an in-depth understanding of two professional development situations and the meaning involved for those participating in them. Merriam (1998) acknowledged that case study sometimes serves as a sort of "catch-all" for research that is not a survey or an experiment. While case studies can be quantitative in nature, she asserted that they are more likely to be qualitative. However, Merriam differentiated case study from other forms of qualitative research because of its focus on intensive descriptions and analyses of a single unit or bounded system (e.g., individual, program, intervention).

Case study was used in this research to explore in-depth the complexities of learning and collaboration as experienced by CTE teachers in two different types of professional development experiences. Six teachers from different CTE programs in a comprehensive senior high school participated in one or both of the professional development opportunities offered on-site by a local university. The comprehensive senior high school had an enrollment

of approximately 1,000 students and was located in a predominately blue-collar city with a population of 32,500. Work-force preparation was an important consideration for this school as the city had over 11,400 workers in the manufacturing, healthcare, social services and education and retail areas. In addition to academic courses, the school offered programs in marketing education, family and consumer sciences, industrial technologies, health occupations, individual occupational training, and business English.

One professional development opportunity was a structured course, taught by a master CTE teacher, which focused on strategies for integrating reading, writing and mathematics skills into technical curricula. This course, designed around the needs of teachers as adult learners (Knowles, 1990), incorporated experimentation, reflection, and feedback among participants as they learned the various integration strategies over a four-month period. It was open to both CTE and academic educators to encourage collaboration among teachers in different disciplines. Participants could enroll for either academic or professional development credit. CTE participants received a \$250 stipend from their state agency for Career and Technical Education for successfully completing the course, while academic teachers received a \$250 stipend from the State Department of Education.

The second professional development opportunity was a teacher study group (Saavadra, 1996), which consisted of a group of CTE and academic teachers who got together regularly during the school year to discuss issues related to teaching and learning to improve their practice in the classroom. The study group was facilitated by the researcher and met nearly every two weeks from September to May for teachers to share and build their professional knowledge within the context of their practice. Participants could enroll for up to two professional development credits and received a \$100 stipend from their state agency for participating the entire year.

### **Data Collection and Analysis**

Data were collected over eight months from individual participant interviews, classroom observations, integration class and study group meeting notes, participant reflections and self-assessments, lesson plans and other artifacts from the teachers, and the researcher's field notes and reflections. Detailed field notes and reflections were maintained on a daily basis, along with an audit trail of when and how the data were collected and analyzed. Carefully constructed interview questions about a teacher's professional development experiences and learning were developed; and all interviews were prescheduled, tape-recorded and transcribed for accuracy.

The researcher reviewed the data and generated a list of more than 20 common data categories related to the participants' learning experiences and collaborative activities with other teachers. Data were sorted into these categories and then analyzed within the framework of content, process, structure and context to gain: (a) insights about the varied and unique contexts in which teachers learn; (b) a deeper understanding about the learning experiences of teachers in two different professional development activities, and (c) knowledge on the complex process of teacher learning and collaboration. As the researcher compared data in each category from case to case, similar to the step-by-step process described by Merriam (1998), similarities and differences among the participants' experiences in one or both of the professional development activities became evident. The researcher then synthesized data into several common themes about learning and collaboration in professional development activities in which the content, process, structure and context differed.

Six individual case studies were written up and several strategies were used to check the accuracy of the findings, including peer debriefing, member-checking and the use of rich description (Creswell, 2003). The cases were peer-reviewed by a faculty member familiar with the project, for feedback on the comprehensiveness of the cases and the literature regarding issues found within each case. In addition, each participant was given the opportunity to review his

or her case write-up and provide feedback regarding the accuracy of the data interpretations and the participant's understanding of his/her own learning. Feedback from peer faculty and participants was considered carefully during the on-going analysis, and appropriate changes and additions were made in the final analysis process. The six case-studies were introduced with vignettes written from the perspective of the participants (see Ely, 1991), and rich descriptions and detailed excerpts of data for each case were used to engage the readers to draw their own conclusions about the teachers' learning and collaboration in the professional development experiences (Creswell, 2003; Merriam, 1998).

### **Findings and Discussion**

The purpose of this study was to explore teacher learning and collaboration in two professional development experiences, which had very different content, process, context and structure. Table 1 briefly summarizes the content, process, structure and content for each of these professional development activities, and Table 2 provides a summary of the teacher learning and collaboration that occurred in each professional development setting.

#### **Research Question 1—What kinds of teacher learning occurred in the formal integration course delivered by a CTE master teacher and in the small teacher study group?**

The teachers who participated in the integration course learned about integration and how to integrate their technical curricula with reading, writing, and math integration strategies. In particular, they learned useful integration strategies that they could apply to their classroom practice and how to develop rubrics to assess integrated learning. The master teacher felt that the integration course was meaningful to the teachers because of its practical application: "Teachers' outcomes are focused not only on the integration but on the application because they prepare lessons that they use immediately in their class" (Interview, 11/27/06). One teacher noted that she was able to pick up numerous strategies throughout the

Table 1

Comparison of Learning Environments of the Integration Course and the Study Group

Learning Environment	Integration Course	Study Group
Content	Specific instructional strategies for integrating reading, writing and math into the curriculum and authentic assessments of learning such strategies	Specific ideas and strategies to build upon teacher knowledge, including classroom strategies, learning approaches, classroom management, and student motivation.
Process	Modeling, experimentation and reflection	Conversations and storytelling about classroom experiences; reflection
Structure	Formal course structure; master teacher as facilitator; class meetings scheduled to meet teachers' needs; syllabus, activities and assessments related to teachers' own classrooms; formal reflection paper	Informal group facilitated by researcher; regularly scheduled meetings that accommodated teachers' schedules, loosely structured for sharing and topic discussion time; choice in topics to be discussed; reflection journal
Context	Course supported by administration for professional development; structured collaboration for development and use of integrated lessons and feedback on strategies; respect for teachers' as professionals; inclusive environment	Study group supported by administration for professional development; established group norms; informal venue for collaborating through communication with peers and sharing of pedagogical knowledge; respect for teachers' professional knowledge and experiences; safe environment for taking risks; inclusive environment

Table 2

Summary of Teacher Learning and Collaboration in the Integration Course and the Study Group

Summary of Learning and Collaboration		
	Integration Course	Study Group
Teacher Learning	Learned about integration; obtained useful information for classroom practice; gained confidence in using integration strategies; increased pedagogical knowledge and expertise	Obtained useful information for classroom practice; increased pedagogical knowledge and expertise; made meaning out of classroom experiences; gained a better understanding of students; developed professional identities as teachers
Teacher Collaboration	Worked with academic teachers to integrate reading, writing, and math strategies into curricula	Developed professional relationships by obtaining and giving support; creating community

course to help her teaching and “assess [student] comprehension more” fully (Final Reflection Paper, 12/05/06). Another teacher wrote that she found strategies that she could use that “actually helped students” (Integration Course Survey, 12/05/06).

The master teacher modeled these strategies, and some of the teachers in the course commented that the modeling helped them to learn how to use the strategies in their classroom. For example, the health occupations teacher commented about one of her attempts at using an integration strategy from the course:

I learned that by modeling and giving examples, I had so much success with student understanding. I had fewer questions than with other assignments. (Reflection Journal, 11/17/06)

The family and consumer sciences teacher explained how the modeling helped her and other course participants further develop their understanding of the integration methods:

Being responsible for modeling three techniques, we needed to develop a more thorough understanding to demonstrate it to the class. Likewise, seeing the methods demonstrated, clarified the method and furthered my understanding. (Feedback, 03/27/07)

The teachers were encouraged to model, experiment and reflect as they applied the integration strategies in their classrooms. One individual occupational training teacher explained how her experimentation with reading strategies made a difference in her students' performance:

I really have enjoyed the different reading strategies and have used them in my classes in a number of different ways. I have found that the students did much better on test scores when they did paired reading and worked with each other on the reading assignments. (Final Reflection Paper, 12/05/06)

In addition to experimentation, reflection is an important aspect of the experiential learning cycle (Kolb, 1984). The health occupations teacher explained how reflecting on her lessons helped her to become a more thoughtful teacher:

Reflecting on what was done made me realize...that a lot of the students did not know the essential math needed....Last year when I presented this lesson, I just gave them the assignment without much instruction....Now that I look back, I see and understand why they were struggling. (Final Reflection Paper, 12/05/06)

In the process of learning by doing and reflecting, the teachers developed more confidence in their abilities to design and deliver integrated lesson plans. The master teacher explained that the teachers gained an "increased awareness of what integration is and how it impacts our classes" (Interview, 11/27/06). Building their confidence as competent CTE teachers who could effectively integrate their lessons was an important aspect of their learning. One teacher commented that she felt "more freedom to try things...experiment a little bit, [and] to be open a little more" (Interview, 10/24/06).

Another teacher explained, “I learned how to better implement reading strategies into my class and provide students with a variety of opportunities to make sure that the students got the information” (Final Reflection Paper, 12/05/06). She also reflected on how some of the writing activities helped to improve her skills along with her students.

Finally, the teachers’ final integration project was an authentic assessment activity that included developing integrated lessons and an evaluation rubric to be used in the classroom, and providing feedback on student performance from the lessons. The use of classroom-related activities in the integration course helped to make the professional development experience more meaningful to the teachers. One participant commented, “Everything that I created I used in my class and for most will continue to use” (Final Reflection Paper, 12/05/06).

Overall, the CTE teachers in the integration course learned and applied strategies for integration, they increased their confidence in using the strategies in their classrooms, and in some cases, they increased their academic content knowledge as they experimented and discussed the strategies with their peers. The integration course helped the teachers to enhance their pedagogical knowledge, particularly as it related to integrating academics into their curriculum.

The study group provided a different type of learning for teachers. Although they were not learning specific integration strategies, the teachers found that the study group was an informal venue for sharing classroom knowledge and resources and for developing professional relationships. One teacher noted that the study group “was constructed in a manner that promoted professionalism and an environment that was warm and friendly” (Study Group Self-Assessment, 12/11/06).

It was in this environment that the teachers learned about practice through conversations and personal stories, a way for teachers to make meaning out of their classroom experiences (Clark & Florio-Ruane, 2001). The teachers shared stories about their students’ lack of motivation, responses to lessons, and attitudes about school, learning and work. This talk was not only a way for teachers

to vent their frustrations and concerns but also a way for them to understand their students better and to think about changes they could make in their practice to improve student learning. The industrial technologies teacher, for example, explained how other teachers helped him to better understand his experiences with a difficult student:

Something that, to me, really helped was hearing that other teachers have the same problems....I thought it was just me and then after talking with [another CTE teacher]I...learned quite a bit, and I think he [the student] has a lot of problems going on of his own, too. (Interview, 11/27/06)

In addition, the teachers discussed topics related to instruction, assessment, and broader educational issues, including student motivation, learning principles and different approaches to teaching. They exchanged ideas and reflected on how to use strategies and classroom activities, how to motivate and engage students, and how to manage difficult behavior.

One teacher explained the value in this type of discussion: “[The] group often reaffirms an individual when we share lessons by [saying], ‘That was a great idea,’ but it is also an opportunity when others say, ‘But have you tried this?’” (Feedback, 03/27/07). She shared a rubric assignment and two student essays with the group; she wanted feedback on whether she was “on track” grading the essays. The feedback from a colleague helped her to see that her grading was similar to how the other teachers, including academic teachers, would have evaluated the assignment, which was reassuring for her. In summary, the teachers’ conversations in the study group were learning opportunities to share and expand their pedagogical knowledge, expertise and professional support.

**Research Question 2—How did the learning experiences of participants in each professional development experience differ and how were they the same?**

Both the integration course and the study group provided teachers opportunities to learn and improve their practice. While the integration course focused more on building content knowledge and

pedagogical expertise related to a specific topic (i.e., integration), the study group offered teachers opportunities to direct their own learning and explore classroom issues that were most pressing on their minds. The integration course provided structured opportunities for discussion, experimentation and feedback on integration and related assessment strategies; the study group had opportunities for discussion and reflection, and less-structured opportunities for experimentation (which some teachers did on their own) and feedback (which teachers readily gave). One teacher felt that the study group needed more structure and direction, but the others appreciated the flexibility that the study group provided. While not as focused as the integration course on course content, the opportunities for pedagogical learning were more diverse in the study group.

Both professional development opportunities helped teachers work together as professionals. The master teacher explained that the integration course provided an “opportunity to collaborate...outside of our departments” which was beneficial because “we’ve had the chance to work with people we normally don’t” (Interview, 11/27/06). Likewise, she believed that the study group was

a great idea and opportunity because people can actually sit down and...communicate about issues....Sometimes just talking about things, understanding what other people are doing...can be beneficial. (Interview, 11/27/06)

In many respects, the two professional development experiences were complementary; together, they provided collective learning opportunities that met the complex and diverse needs of the teachers who participated. By working together, teachers got the opportunity to learn from each other and reflect upon their practice. The integration course provided structured learning opportunities about integration, while the study group, which met biweekly throughout the school year, provided on-going opportunity for discussion, reflection and peer support. As the master teacher summed it up,

I think [in] teaching, by nature, we get pretty isolated, and so having that group setting, or the learning community, or whatever it might be, is an opportunity, not only to learn, but to reflect.” (Interview, 11/27/06)

**Research Question 3—To what extent did collaboration occur among the teachers who participated in each experience?**

The integration course provided an environment that offered structured collaboration in and out of class as teachers developed their integrated lessons and applied what they had learned in their classroom. First of all, the integration course was open to both CTE and academic teachers, which encouraged collaboration among disciplines. The master teacher noted that “the best part of the integration class is to lay a platform for professionals to work together and really talk about some issues” (Interview, 11/27/06). As integration strategies were discussed, the English and math teachers offered their expertise in their content areas, while the CTE teachers shared their ideas about applying the integration strategies in a contextualized fashion. The academic teachers supported and provided ideas to the CTE teachers on how to evaluate writing and math, and the CTE teachers shared activities that effectively integrated reading, writing and math skills in learning situations.

The individual occupations training teacher thought that having the English and math teachers in the integration course was helpful because she could benefit from their experiences (Interview, 10/24/06), and the consumer and family sciences teacher liked the mix of participants because they offered different perspectives:

I liked the idea that we had people who weren't in CTE and also...somebody that was at the college level...to gain some insight from them.” (Interview, 10/24/06)

In addition to the collaboration among the course participants, three guest speakers (also educators) came to class to discuss integration strategies for their specific academic area (i.e., reading, writing or math). The teachers found some of this information enlightening and helpful to their learning about integration. It was an opportunity for the teachers to meet a specialist—someone they could call if they needed help with integrating a particular content area. One teacher shared, “When [the language arts guest speaker] came in and showed some strategies using other people's reading materials, I thought that was great” (Interview, 10/24/06).

Finally, teachers were given time to collaborate with their colleagues as they prepared their final integration projects, which included the integrated lessons, an evaluation rubric, and teacher feedback on student performance from the lessons. The integration course, from start to finish, was a collaborative learning experience for the teachers who participated.

The study group provided an informal venue for collaborating through communication with peers and sharing of professional knowledge. The fall 2006 study group was open only to CTE teachers, who shared information and supported each other in their discussions during and after the study group session. The teachers felt that this informal collaboration was very beneficial because it helped them feel more connected and less isolated from other teachers. The health occupations teacher explained that hearing “what’s going on” with other teachers was “comforting” and helped her not to “feel so alone” (Interview, 10/18/06).

Some teachers felt that the collaboration helped them to address problems with particular students and learn new instructional strategies and activities that they could use in their classrooms. One teacher discovered that he was not alone in experiencing problems with difficult students and the students’ inappropriate behaviors were not necessarily directed at him or initiated from being in his class:

I actually had a problem with a student that the other teachers had in class before, so we talked about what they did and how they handled certain situations with this student. (Study Group Self-Assessment, 12/11/06)

Because the teachers felt that the study group was a safe environment, they took risks and shared lessons that didn’t work well and asked for suggestions and help from their peers. The family and consumer sciences teacher found the study group to be a safe place to take such risks: “Though we’re a small group, people are free to talk and admit that they have weaknesses in certain areas” (Interview, 10/24/06). This environment remained safe when the study group was opened to teachers outside the CTE department (three non-CTE teachers joined the group). Open sharing and discussion continued in the enlarged study group.

The environment of openness, respect, and on-going communication among the study group members encouraged informal collaboration through the sharing of classroom stories, activities, and strategies. In this collegial environment the teachers established and strengthened their professional relationships with peers by giving and receiving support to each other, and in doing so they began to create a sense of community among group members. The study group was an opportunity for teachers to build community through their sharing of professional knowledge and supporting one another.

### **Significance of Findings for CTE Teachers**

In this era of mandatory educational reform, professional development for teachers has become an important component of the reform process. Teachers not only need to learn about innovations and programs but also how to assume new roles as educators and change their teaching practice to implement reforms to bring about improvements in student learning. Career and technical education teachers, in particular, have been tasked with complex changes through Perkins legislation. Such changes involve not only creating curricula that incorporate state and industry standards, but also academic skills to better prepare students for the 21<sup>st</sup> century workplace and for postsecondary education, which many occupations require.

CTE teachers have been tasked with integrating reading, writing and math skills into their technical curricula, which requires changes not only in the way they teach in their classrooms but how they think about teaching in general. To bring about change in CTE teacher practice, professional development should introduce teachers to integration and help them learn how to implement integration and related assessment strategies in their classroom. In addition, because these changes take time and require support and feedback from peers, professional development needs to be on-going and collaborative.

The findings of this multi-case study on teacher learning and collaboration suggest that the integration course, which was designed

to help CTE teachers to experiment, reflect, and model integration strategies within the context of their classroom, and which provided them with opportunities to collaborate with academic colleagues in the process, was an effective way for these teachers to learn about integration strategies, practice them, and incorporate them into their practice. Study participants consistently reported that experimentation and reflection, along with peer feedback, helped them as teachers to gain confidence in their abilities to integrate their curriculum, deliver it to their students, and assess the outcomes. Such a professional development experience, designed and delivered around the unique needs of adult learners, accomplished the introduction of an innovation to CTE teachers and provided them with the experiences they needed to practice, collaborate, and apply to their practice what they learned about the innovation.

The teacher study group, on the other hand, provided a different context for learning, was structured differently, and the content was more teacher-driven. This professional development experience was not designed to introduce an innovation or reform for teachers to learn and practice; rather it provided teachers with meaningful opportunities to get together as professionals to explore day-to-day issues from their classrooms and to discuss how to enhance their practice in different classroom situations. Communicating, supporting and sharing with colleagues over the academic year not only helped the teachers to think about improving their practice but also provided them with opportunities for continual professional growth.

The study group professional development experience complements the integration course because it is well-suited for providing the on-going support and collaboration that is needed for teachers who have been introduced to a reform innovation and must make complex changes in their practice over the long-term. Adapting an innovation such as integration is complex and varies depending on the classroom context. Teachers need flexibility and professional judgment to make adaptations and enhancements, and they need feedback and support from their professional colleagues as they work through this process. The study group can provide this collaboration and support on an on-going basis. Together, the more formal

structure of the integration course and the on-going and flexible study group environment, provide a meaningful design for professional development for CTE teachers who must learn how to integrate academics into their technical curricula and adjust their practice to improve student achievement.

### **Recommendations for Future Research**

This multi-case study is one brief glimpse into the different types of teacher learning and collaboration that can occur within the context of a formal course on integration and within the informal learning of a teacher study group. In this study, learning and collaboration were bound within the contexts of the teachers and their different professional development experiences. The rich descriptions help to show connections and common themes across and among the varied cases in this study; however, it is the readers' responsibility to take what they have learned and apply it to their situations, if they think it is applicable (Merriam, 1998).

The two professional development experiences in this study offered different types of learning and collaboration for both CTE and academic teachers, and in many ways, these learning and collaboration experiences were complementary for the teachers. On-going learning and collaboration is needed for teachers to improve their practice. While the integration course focused on specific pedagogical knowledge, such as strategies for integrating reading, writing, and math skills into a technical curriculum, and increased content knowledge of these academic areas, the study group was structured around conversations about on-going issues that teachers face in their classrooms, such as student motivation and behavior, different approaches to learning, and effective strategies and activities for cooperative learning. Together, both professional development experiences offered teachers a variety of experiences that can help them grow as professionals in all respects—in their content area, their pedagogy, their knowledge and understanding of students, their professional relationships, and their ability to collaborate. While the integration course is a one-time opportunity,

the teacher study group is an on-going professional development activity that can continue throughout the school year.

Further research is needed to more deeply understand how these different professional development environments enable different types of learning. This research was a multi-case study of six career and technical educators in a comprehensive high school, but there are many other contexts that merit exploration, such as technical schools, academies, urban high schools and middle schools. In addition, additional research on the different content, process, structure and context of professional development could help educators better understand the different experiences that provide meaningful professional learning for teachers.

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# **An Evaluation of the “Computer Technology and Programming” Curriculum in the Vocational Higher Education System in Turkey**

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## **Abstract**

*The purpose of this study was to evaluate the “Computer Technology and Programming” curriculum offered at vocational colleges with a focus on the goals of the curriculum and student thoughts. Document analysis and semi-structured interviews were conducted to gather the data. Results revealed that there were mainly four problematic issues related to the “Computer Technology and Programming” curriculum. These were: poor quality of education, inadequacy of industry-based education, limited areas of specialization, and poor environment and inadequate opportunities. Results were discussed extensively and recommendations were offered regarding the structural problems of vocational colleges and the “Computer Technology and Programming” curriculum.*

## **Background**

The main goal of vocational and technical education is to help individuals to become knowledgeable, skillful, practically proficient,

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and to carry out essential tasks of the job. Its basic function is to enable individuals to earn money, and thus to contribute to the society in social and economical terms (Alkan, 1999). With this function, vocational and technical education has the power to influence the industrial and economical growth of the country. Therefore, developed countries put special emphasis on vocational and technical education at the secondary and higher education level within their education system. Developing countries spend great efforts to improve vocational and technical education for the purpose of increasing the quality of the workforce which is necessary for the rapid development of the society and for a more powerful economy (Saglam & Adiguzel, 2007).

The struggle of Turkish industry to participate in the global world market has substantially increased the importance of the institutions of vocational higher education. It is of vital importance for the Turkish economy to train the workforce that will keep up with the current developments and that has professional skills and knows the business world well. This trained workforce will help Turkey to follow up the technology which is rapidly-renewed and constantly-developing parallel to the developments in science. It will also enable the Turkish economy to compete with the developed countries in the global world market.

On the other hand, vocational and technical education in Turkey is neither qualitatively nor quantitatively at a desired level in terms of secondary and higher education. In the academic year of 2005–2006, the number of students at the secondary level of vocational and technical education constituted only 32% of the total number of students from all educational institutions (Higher Education Council, 2006).

In Turkey, students graduated from primary school (8 year) attend one of the schools of general education or vocational-technical education at the secondary level. However, they have to choose their school as a result of their success in the Entrance Exam for Secondary Education Schools organized by the Ministry of National Education throughout the country. The duration of secondary education is four years. General education, the basic goal of which is to prepare students for academic higher education, is given in general

high schools and in the foreign-language-based schools, science-oriented schools, social-sciences-oriented schools and fine-arts-oriented schools. Vocational-technical education, the basic goal of which is to prepare students for jobs and for two-year vocational colleges in higher education, is given in vocational high schools and technical high schools. Those who want to attend a higher education institution are required to be successful in the Higher Education Entrance Exam organized in the whole country in June every year. Parallel to their secondary education, students choose one of such areas as Turkish-Mathematics, Mathematics-Science, Social Sciences and Foreign Language in the Higher Education Entrance Exam. According to their score types of the related area, students who succeed in the exam choose a certain number of majors, and then, are placed in one of the higher education programs by the Center for Student Selection and Placement Center according to students' performance on the test and their choice of majors (Saglam, 2006).

Earlier in 2007, seventeen new universities were founded in Turkey, in addition to a total of ninety-nine universities, of which sixty-eight are state universities, twenty-five are foundation universities, and six belong to the Ministry of Internal Affairs and the Ministry of National Defense. Except for the newly-established universities, state universities and those of the foundations currently include 591 faculties that deliver four-year academic and vocational programs. In addition to these faculties 179 teach at four-year colleges and 474 teach at two-year vocational colleges (Higher Education Council, 2006).

Vocational Colleges in Turkey have been included into the university system by Higher Education Law published in 1981. The foundational aim of the vocational colleges might be defined as educating vocational and technical secondary school graduates in their study fields; therefore, growing them up as high qualified workforce who could adapt himself/herself to scientific and technological developments work life needs and achieve qualified production. According to the Higher Education Law, the number of vocational colleges has increased noticeably from the administrative, financial, educational perspectives since 1982. The data of 2005-2006 academic

year reveals that, 474 Vocational Colleges in the Higher Education System have been providing vocational education. In vocational colleges, 262 two-year vocational college programs (e.g., science, technical, accounting, finance, management, law, business, tourism, agriculture and health) have been implemented (Higher Education Council, 2006). Approximately 400,000 students have been attending these programs and this corresponds to nearly 28% of the students in the formal higher education system. To increase this ratio, beginning from the 2002-2003 academic year with the help of 4702 Numbered Law, graduates of vocational and technical secondary schools had the opportunity to attend vocational colleges without dealing with the entrance exam. With the help of the "Attendance Project without Examination," it was predicted that the number of vocational college students would increase. However, more students attend four year higher education institutions rather than two year ones. In Turkey, 138 vocational colleges have closed since the request for these schools is not enough (Higher Education Council, 2006). Factors negatively influencing the request for vocational colleges were examined in two main areas (Saglam and Adiguzel, 2007): Absence of teaching staff and environmental and hardware inadequacies.

#### *Absence of teaching staff*

Since vocational colleges are units within universities, the absence of teaching staff in universities and the ill-balanced distribution of them within and among the institutions are generally more obvious in vocational colleges. For instance, according to the statistics from the Council of Higher Education, in the education period of 2004-2005, the number of teaching staff working in the schools of vocational colleges was 5,787, and there were 56 students per instructor. This ratio is 5 students per instructor in Germany, 10 in Belgium, 11 in Hungary, 14 in Holland and 20 in England (Higher Education Council, 2005). Qualitative and quantitative deficiencies of teaching staff in vocational colleges cause a decrease in the quality of education and consequently these effects expectations of management, education and economy domains from vocational colleges and the appealing of these colleges negatively.

*Environmental and Hardware Inadequacies*

Despite the fact that vocational colleges are connected to the universities, most of them are located outside of the university campus. Especially in recent years, due to political reasons, many schools of vocational colleges have been placed in smaller districts of cities where the university campuses are not found. These districts are generally 50-200 kilometers away from the city centers. Since the majority of the university professors live in the city centers where their universities are located, they do not prefer to travel and teach some of the classes in the vocational colleges. For this reason, the need of teaching staff for vocational college is supplied from the teachers working in vocational and technical secondary schools in the region. Another important problem of the vocational colleges in small residential districts is that they don't have enough laboratories, workshops, areas for application, course materials and tools, and technological equipment, all of which are necessary for teaching. Just as in the report of "I. National Vocational Colleges Administrators Meeting", these problems of vocational colleges related to the technological inadequacies were indicated. In this report, it is specified that in most of vocational colleges laboratories were not equipped with modern technologies (Higher Education Council, 2004).

With the "Development of Curriculum of Vocational Colleges Project" prepared by the Ministry of National Education, developmental studies to solve the problems related to legal and organizational and educational dimensions have been started. Accordingly in the direction of the needs of vocational colleges and industry, 15 new curricula of vocational colleges have been developed in six months with the help of 130 experts and have been implemented since 2002. One of these curricula, "Computer Technology and Programming," was planned to be a two-year program consisting of 28 credit hours a week in a semester. Those who graduated from the programs of "Information Processing", "Computer", "Computer Hardware", "Computer Management", "Computer Management Technician" and "Computer Software" at

the vocational and technical high schools can attend this program. The program was intended to train computer technicians who are knowledgeable about software production, (PC, network and the internet), equipment maintenance (hardware) and about the establishment and management of computer networks, yet who are specialized only in one of these areas having more theoretical information than a technician and practically more skillful than an engineer. The “Computer Technology and Programming” curriculum is a combination of the previous curricula of “Computer Operation and Technician”, “Computer Programming”, “Computer Hardware”, “Computer Technology and Programming”, and “Computer and Information Systems.”

### **Purpose**

The aim of this study was to evaluate the curriculum and function of “Computer Technology and Programming”. There are three reasons for choosing this program to evaluate. The first reason is that information and communication technologies have become more widespread. In this fast developing world, it is highly important to educate a qualified workforce in Turkey to reach a dynamic, competitive, and economic structure. Second, this curriculum is one of the curricula developed and implemented within the scope of the curriculum development studies. Therefore, the operation of this curriculum serves as an example for other curricula. Third, because of high demand in the industry for a qualified workforce related to computer technology and programming, the curriculum of “Computer Technology and Programming” is preferred more by students than the other curricula of two-year vocational colleges.

In the scope of this study, the aim was to answer the following questions:

1. Is the curriculum of Computer Technology and Programming consistent with the aims of the curriculum?
2. Do the problems indicated for other vocational colleges apply for the curriculum of Computer Technology and Programming?

3. What are the views of the students regarding the institution they were attending and the curriculum of Computer Technology and Programming?

## **Method**

### *Participants*

The study was carried out on the second year students attending the program of “Computer Technology and Programming” in Porsuk Vocational College of Anadolu University, Eskisehir, in the academic year of 2006–2007. Second year students were selected for the purpose of the study since it was thought that they would have extensive knowledge about the curriculum and be able to evaluate it. Participants were students with different academic achievement levels who signed the consent form and agreed to participate in the study. The students were separated into three groups based on their achievement level (Low level: GPA lower than 2.50; Moderate level: GPA between 2.50 and 3.00; High level: GPA higher than 3.00). Only four students in each academic achievement level agreed to be interviewed voluntarily. Therefore, interviews were done with a total of 12 students totally.

### *Research Design*

A qualitative research method was used. Within the scope of the qualitative research method, the data were gathered through the examination of the written documents and semi-structured interviews.

### *Data Collection*

Document analysis. In order to collect the research data, the curriculum of “Computer Technology and Programming” in vocational colleges was examined with the method of descriptive analysis.

Semi-structured interviews. There are different taxonomies related to the interviews which are a type of data collection technique in qualitative studies. Fielding (1996) defines interviews as “standardized”, “semi-standardized” and “non-standardized”. Like Fielding (1996), Minichiello, Aroni, Timewell, and Alexander, (1990) also define three types of interviews. The first type, structured interviews, consist of questions and answer choices decided before the interviews. The second type of interview, semi-structured interviews, involve open-ended questions under main topic. Participants are directed to answer the questions freely and then is interviewed deeply. The interviewer previously prepared the questions related to the interview topics, asked these questions during the interview and directed explanatory questions, when necessary, in order to clarify the answers given to the questions. The last type of interview is unstructured interviews in which there is no classification of questions and any other classification (Punch, 2005). According to these taxonomies in this study the semi-structured interview type was chosen to collect data on interview topics decided before the interviews.

The interviews lasted 25-35 minutes on average, and all the interviews were audio-recorded. Prior to the interviews, the participants were asked for oral and written permission. During the interviews, several questions were directed to the issues of “information about the structure and the content of the program of “Computer Technology and Programming”. For this issue, the following questions were asked:

*Questions Related to the Quality of Education:* “What are you thinking about the relationship and wholeness between your learning in secondary education schools and in vocational colleges?” “How is the opportunity of practice in courses related with software and hardware?” “What is the ratio of theoretical course hours and applied course hours?”

*Questions Related to the Environment and Facilities:* “What are the difficulties/limitations/problems related to the facilities of the colleges?”

*Questions Related to the Specialization Fields:* “Does the education you have here provide you a specialization in any computer-related fields? Could you please explain this?”

*Questions Related to the Organizational Structure and Content of the Industrial Education:* “Related to industry-based education (internship), what are the problems you came across before the internship, during the internship and after the internship?”

### *Data analysis*

Document analysis. For the analysis of the education program, evaluations were made regarding such issues as the description of the profession, the goals of the program, the distribution of the credits of the compulsory and elective courses and the classification of the elective courses according to the specialization areas.

Analysis of the semi-structured interviews. Descriptive analysis of data gathered through semi-structured interviews was run as follows (Blanchet & Gotman, 2001; Yıldırım & Şimşek, 2005): (1) all the interviews were transcribed into texts; (2) depending on the data obtained and considering the related literature and the conceptual framework, a thematic frame was formed and the themes determined were given codes; (3) in line with the thematic frame, data were read and the frequencies of the themes were found. The themes determined were classified under main headings. In this phase, for the reliability of the thematic frame formed of the data, two researchers work independently on the whole data set and produced themes individually, then they worked together and came to consensus on the themes and frequencies of data; (4) the results were supported by direct quotations.

## **Results**

In order to find answers to the question of “Is the Computer Technology and Programming consistent with its goals?” the relationship between the goals of the curriculum and the distribution of the courses were examined. Results of document analysis

depending on the description stated in the curriculum about a computer technician that, “She or he has more theoretical information than a technician and more experience in practice than an engineer”, the course hours allocated to the applied and theoretical courses in the program were examined. In addition to this, considering the objective stated in the curriculum that “training computer technicians who are knowledgeable about software (PC, network and the internet), equipment maintenance (hardware) and about the establishment and management of computer networks, yet who are specialized only in one of these areas,” analysis was made regarding the alternative specialization areas students were provided with. The results of this analysis are presented in Table 1.

Table 1 shows that 69% of the curriculum was found to be allocated to theoretical courses and 31% to applied courses. Therefore, although experience in practice is quite significant in vocational colleges and this significance is frequently stated in the curriculum, it was revealed that the applied courses have a very small proportion in the curriculum. Moreover, according to Table 1, 72 hours of the total course hours were allocated to the compulsory courses and 36 hours to the elective courses. When the distribution of the compulsory and elective courses in the curriculum were examined, it was observed that there were not enough alternatives for specialization in different computer-related areas and that specialization in an area tended to be achieved through elective courses. When the elective courses given in the curriculum for the purpose of specialization in a computer related area were examined, it was seen that 60% of the elective courses were in the specialization area of software, 70% was found to be theoretical courses and 30% were allocated to the applied courses. Hence, it was concluded that there was not a wide range of elective courses in the curriculum and students were mostly encouraged to be specialized in the area of software via software related compulsory and elective courses which were mostly theoretical.

In order to better understand these results obtained through the examination of the curriculum, the data collected via semi-structured interviews held with the students were analyzed to reveal how they perceived the curriculum and how their education processes were

influenced. The views of the students retrieved from the semi-structured interviews with the students were analyzed. During the interviews, perspectives of participants focused on four main themes by stating a total of 71 statements pointing out these themes. Of 71 statements, 38 (54%) statements were regarding the poor quality of education while 15 (21%) were related to the inadequacy of internships and 13(18%) were regarding limited areas of specialization. Only 5 (7%) of the statements were associated with issues of poor environment and inadequate opportunities.

Poor quality of education: The analysis of the interviews held with students demonstrated that most of the statements of the students were on the problems related to the quality of education. Out of 71 statements, 38 (54%) statements were regarding this issue. Further analysis of this issue based on statements made by participants was conducted to explore this issue in depth. Four main sub-issues were identified (see Table 2).

The curriculum of “Computer Technology and Programming” of Two-Year Vocational Colleges enrolls the students who graduated from computer technology-related programs of vocational and technical secondary schools and entered vocational college without the entrance examination in addition to the students who graduated from general secondary schools and entered entrance examination. It was identified that students whose educational backgrounds and levels of readiness were different viewed this as a problem. One of the views stated by the participants was as follows:

[S7-“*In fact, we didn't take education on computer at all. As we were in vocational high school, we took courses like electronic and electric. And in our third grade of the school, we as the department of computer were on probation. Actually, it wasn't consistent with the education given here.*”]

Table 1.  
*Course Distributions of Curriculum "Computer Technology and Programming"*

COURSES	Weekly Course Hours	
	Total	Applied
COMPULSORY COURSES		
I. Programming		
a. Algorithm	4	3
b. Data Structures	4	3
c. Visual Programming	8	6
d. Microcomputer Systems	4	3
TOTAL	20	15
II. Operating Systems and Hardware		
a. Basic Electronic	4	3
b. Computer Hardware	4	2
c. Integrated Office	4	3
d. Computer Network Systems	6	3
e. Operating Systems	4	3
TOTAL	22	14
III. Internet		
a. Internet Programming	8	6
b. Graphic and Animation	4	3
TOTAL	12	9

Table 1 continued

Table 1 (continued)

IV. Database					
a. Database Management Systems	8	6	2		
TOTAL	8	6	2		
V. Management and Organization					
a. Quality Assurance and Standards	2	1	1		
b. Business Management	2	1	1		
c. General and Technical Communication	2	1	1		
d. Technology and Scientific Principles	4	3	1		
TOTAL	10	6	4		
COMPULSORY COURSES GENERAL TOTAL (CCT)	72	50 (69%)	22 (31%)		
ELECTIVE COURSES					
e. Delphi Programming	8	6	2		
f. C-Programming	8	6	2		
g. Visual Basic Programming	8	6	2		
h. Computer Aided Design and Modeling	4	3	1		
i. Entrepreneurship	2	1	1		
j. Accounting and Commercial Software	4	2	2		
k. Research Techniques	2	1	1		
ELECTIVE COURSES GENERAL TOTAL (ECT)	36	25 (70%)	11 (30%)		
GENERAL TOTAL ((CCT+ECT)/2)	54	37.5 (69%)	16.5 (31%)		

Table 2.  
*Distribution of sub-themes according to theme  
 “Poor Quality of Education”*

Sub-themes according to theme “Poor Quality of Education	Frequency of statements	%
Differences between the levels of student readiness	12	32
Insufficiency of applied courses	11	29
Limited follow-up of the current developments	8	21
Limited duration of education	7	18

During the interviews, the students mentioned the inadequacy of applied courses and pointed out that the courses were mostly theoretical in content and emphasized that they did not have enough opportunities for practice to reinforce their theoretical knowledge during their education. They also noted that even the courses related to hardware and network systems—which were shown as applied courses in the curriculum—were given on theoretical basis. These views stated by the students are compatible with the results derived from the analysis of the curriculum of “Computer Technology and Programming,” that is, “courses are mostly theoretical”. Some of these views are presented below:

[S2- *“We took a course for computer hardware here, too, and it is always the same: the teacher tells us about course-related subject, and we write them down on our notebooks. There wasn’t any practice, that is, we never turned on a computer and we didn’t do anything ...”*]

[S8-“*Our teachers teach the computer programs quite well. They help us but theoretically, this shouldn’t be enough. That is, we should practice, because we only make an introduction to all the programming languages. We write down all the codes, but that isn’t enough...*”]

The students believed that the curriculum did not cover the recent developments thoroughly. The students also stated that the courses given in the college were far from the developments in business life and that this situation decreased their level of motivation. Two of the views stated by the participants were as follow:

[S1-“*They don’t talk about up-to-date issues at college, that is, we only learn what is taught by the curriculum. They don’t inform us about recent developments ...*”]

[S11- “*There are things that our teachers are interested in or they wonder about. They tell us about the new things, for example. If it is time for it, they spend five or ten minutes telling us about the developments. That’s all ...*”]

The students think that the duration of education in vocational college was not enough. The students believe that the limited duration of education was the reason that there were not an adequate number of elective courses, that the courses were not planned as to follow up the recent developments and that the number of applied courses was low. These views which were set forth by the students were matched up with the “inadequate number of elective courses and encouraging students to specialize mainly on software” which was the result of the curriculum analysis. Some of the participants discussed these issues as follows:

[S12-“*The duration is not enough of course. It is only two years. We must certainly take more education, but if not, we should in a way sit in front of a computer and develop ourselves and find a*

*place in business life. The duration is short, for example, if it is a one-term course, there are at most thirteen or fourteen weeks or so, but we don't learn much though. That is, we don't learn the subject well. It is not enough..."]*

[S4- *"In fact, the time is not enough. All is given only in two years, there are many hard subjects to learn in two years. It could at least be three years, for example. Some courses are really difficult at times..."*]

Inadequacy of internships. The analysis of the interviews held with students demonstrated the problems related to the quality of internships. Out of 71 statements, 15 (21%) statements were regarding this issue. Further analysis of this issue based on statements made by participants was conducted to explore this issue in depth. Three main sub-issues were identified (see Table 3).

Table 3.

*Distribution of sub-themes according to theme  
"Inadequacy of Internship"*

Sub-themes according to theme "Inadequacy of Internship"	Frequency of statements	%
Lack of guidance and formative assessment	6	40
Discordance of studies carried out during internship with the study field in vocational college	5	33
Inadequate summative assessment of internship	4	27

According to the analysis of interviews, the students stated that they did not receive enough guidance during the period prior to their internships or adequate assistance while choosing the workplaces where they were going to do their internships. Moreover, they mentioned that the educational conditions in workplaces were not inspected during their internships. The students, for these reasons, reported that the areas of education and studies they carried out in their workplaces were generally discordant with the fields of education in their school. Moreover, the students mentioned that there were not enough summative assessments of their internships. Some of the participants discussed these issues as follows:

[S4-“...to be honest, to tell the truth. You try to choose a workplace where you have a relative or an acquaintance. It could be a computer shop, either software or a hardware one...”]

[S9-“We didn’t share. They didn’t ask, nor did I tell anything.” (a response given about the assessment of the internship process at school following the internship)]

It is thought that among the causes of the problems put forward by the students related to internship, design of curriculum as predominantly academic education, and inadequacy of legitimate organization of internship are of the essence.

Limited areas of specialization. The analysis of the interviews held with students demonstrated that limited numbers of specialization areas are offered to the students. Out of 71 statements, 13 (18%) statements were regarding this issue. Further analysis of this issue based on statements made by participants was conducted to explore this issue in depth. Two main sub-issues were identified (see Table 4).

Table 4.

*Distribution of sub-themes according to theme  
“Limited Areas of Specialization”*

Sub-themes according to theme “Limited Areas of Specialization”	Frequency of statements	%
Areas of specialization being provided mostly in software	9	69
Limitation of elective courses	4	31

The students stated that the alternatives for specialization provided in the curriculum were limited. They also reported that the compulsory and elective courses were mostly related to software and that they could not find an opportunity to specialize in other areas through elective courses. This result is consistent with the result of the analysis of the curriculum. Therefore, following the examination of the curriculum, it was confirmed through student interviews that the alternatives for elective courses were limited and that the elective courses were mostly related to software. Some of the participants discussed these issues as follows:

[S12- *“We can’t choose both of them. We have to choose only one course. In fact, if we could choose more, it would be better, but this is not enough. Therefore, we can’t choose all of them at the same time. We have to develop ourselves and learn the things in a way.”*]

[S8-*“If we consider what we have learnt here, it is enough. That is, I am specialist on software. There is no guidance in this respect, but the courses are enough. We learnt a lot of*

*programming languages. I know all of them. But I can't say so for design or hardware... ”]*

Although there are mostly software-related courses in the curriculum, most of the students stated that they felt they were at an average level in this area. Two of the views stated by the participants were as follow:

[S6- *“Well, about the use of software's, well I can't do well. Not bad, not good, well I can do very simple things”*]

[S8- *“I don't feel myself competent in any area”* (the response of the student to the question of “In what computer areas do you feel you developed yourself?)]

Poor environment and inadequate opportunities: The analysis of the interviews held with students demonstrated poor environment and inadequate opportunities. Out of 71 statements, 5 (7%) statements were regarding this issue. Further analysis of this issue based on statements made by participants was conducted to explore this issue in depth. Two main sub-issues were identified (see Table 5).

Students noted that they could use computer laboratories only in working hours, and they complained about the distance of the vocational college to the main campus of the Anadolu University. Two of the views stated by the participants were as follows:

[S1- *“There is only one laboratory open for our use. All the college students can use it. We can use it in working hours, but after this, all the laboratories are closed... ”*]

[S8- *“The facilities of the college are somehow limited, the college is rather distant from the university, the facilities in the campus are a bit better... ”*]

Table 5.

*Distribution of sub-themes according to theme "Poor Environment and Inadequate Opportunities"*

Sub-themes according to theme "Poor Environment and Inadequate Opportunities"	Frequency of statements	%
Limited study opportunity in the computer laboratories	3	60
Distance of the vocational college from the university campus	2	40

### **Limitations**

The results of the current study should be interpreted by considering the following limitation. In the scope of the study, the fact that the qualitative data gathered through the interviews held with a limited number of students from the same university. However, the issues revealed in the result of this study are supported by the findings of studies conducted in the literature. It is believed that this qualitative study can be considered a base study for further both qualitative and quantitative studies to be conducted with more participants, different settings and various data collection methods. This will help to extend the knowledge-base of the topic covered in the present study.

### **Conclusion & Recommendations**

The results of the research reveal that the curriculum of "Computer Technology and Programming" was influenced by the structural problems of vocational colleges. In addition to this, some problems related to content and the teaching-learning process of the curriculum including, quality of teaching, managements of

internship, and limitations of the specialization choices provided by the curriculum were identified. Therefore, this case study reached its aim in terms of focusing attention on the problems of vocational higher education system in Turkey. It is hoped that evaluation results would be an example for future research on developing or evaluating curricula of vocational colleges.

Based on the results of the current study, some issues regarding industry-based education (internships), alternatives for the areas of specialization, and improving overall the quality of education in vocational colleges need to be considered. To cover these issues, the following recommendations were offered related to the results.

*Precautions should be taken to improve the quality of education.*

The students who attend the program of “Computer Technology and Programming” should take preparatory courses. This way, the students with different backgrounds of field-knowledge can develop fundamentals of the field and reach the same level of knowledge. The course hours of applied courses could be increased, which could help to reinforce the knowledge of students. Recent developments in the area of computer technology and programming can be transferred to the curriculum, and the applied courses can be re-planned in line with the real-life problems. These recommendations towards the improvement of the quality of education are directly related to the duration of the education program. It was observed that a two-year education period within the current system might not be enough to train the qualified workforce. With structural reforms, the programs of vocational colleges should be re-organized, and the education period should at least be increased to three years.

*Industry-based education (internships) should be redesigned.*

Although it is specified that one of the important aims of the curriculum of “Computer Technology and Programming” is to educate the workforce who have more theoretical knowledge than secondary vocational school graduates and more practical skills than engineers, it is observed that this curriculum is designed as academic

education and relationships with industry are very limited. Due to the fact that contributions of enterprises to the finance of the vocational education are very limited, all the load of the vocational education is on the government (Alkan, Dogan & Sezgin, 2001; Alkan & Sezgin, 1980; Cetin, 2002). In this context, developing curricula of vocational colleges as a project-based, business-based education model should be considered with the business world assisting with the financing of vocational higher education.

*Alternatives for the areas of specialization should be increased.*

Within the curriculum of “Computer Technology and Programming,” alternatives for specialization could be increased. Elective courses should be planned to include software, design and equipment equally. Students can be guided through different areas of specialization according to their success, interests and future expectations.

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**The Effectiveness of Instructional Methods based on  
Learning Style Preferences of Agricultural Students: A  
Research Tool for Continuous Improvement for Faculty in  
Career and Technical Education (CTE) Programs**

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**Abstract**

*This study was conducted to research learning style preferences of agriculture students. Specifically, the objectives which guided the study were: (1) to determine the learning style preferences of undergraduate agricultural students enrolled in a given Soil Science course and (2) to ascertain if there were differences in the students' course grade average (CGA) in the given Soil Science course when the treatment group were taught according to their learning style preferences versus the control group. For research question two, there was a hypothesis statement to determine if modifying the instructional approach to the students' learning style preference for the treatment group produces a higher course grade average (CGA) than the control group. The Productivity Environmental Preference*

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*Survey (PEPS) was used to obtain the students' preferred learning style preferences. Results indicate that modifying the instructional approach to the students' learning styles preference (Structure) would result in a higher course grade average (CGA) for the treatment group versus the control group.*

### **Introduction**

Two challenges that face faculty are how to engage in continuous improvement in delivering instruction to today's students and how faculty can use students' learning styles to improve the classroom environment. These questions present everyday challenges to improving learning outcomes and quality of instruction. According to Sims and Sims (2006), "Understanding the role of learning style in the learning process is an important concept for those committed to meeting the demands being placed on education and their own personal commitment to learning excellence" (p. xiv). To meet the demands of the 21<sup>st</sup> century classroom, instructors must be prepared to use a variety of instructional methods. Students' learning styles, or cognitive styles, involve their specific preferences when processing information. Burriss, Kitchel, Molina, Vincent, & Warner (2008) stressed, "Student learning styles can impact a variety of areas in the classroom, such as environment, student praise or reinforcement, class structure, and teaching methods" (p. 44). Careful assessment of student differences shows that students differ along several important dimensions (Alexander & Murphy, 1999; Humphreys, Lubinski, & Yao, 1993; Scarr, 1992); the acknowledgement of these individual differences has not, in our estimation, been an accepted formula for academic success in our colleges and universities.

Students come to class with diverse ways of perceiving information and with diverse needs for what constitutes a suitable learning environment or climate. Educators must provide all students, regardless of their background and ethnicity, the opportunity to be engaged in the learning process (Whittington, 2005). Therefore, faculty is challenged with positive learning

outcomes for today's faculty through developing multi-faceted instructional approaches. As faculty become more aware of their students' learning style preferences, they are more likely to apply efforts to accommodate their differences (Beck, 2001). Therefore, it is necessary for instructors to not only employ learning styles assessments, but to understand the results and to apply them to their instructional methods in the classroom.

Learning style research has been documented and used to assist in enhancing learning environments that fit students' needs and educate faculty on the impact that learning styles have on education. Learning style research has been viewed by some educators as very helpful in understanding the nature of learning in the classroom while some dismiss learning style research as unusable and invalid based on methodology and confusing constructs (Lemire, 2002). Learning style research must present consistent models where population and identification of assessments are similar in content (Kavale & LeFever, 2007).

## **Background**

### *Background on Learning Styles and Theoretical Framework*

There have been a myriad of learning theories that emerged in the past 40 years, such as Felder-Silverman (1996), Kolb's Experiential Learning (1984), and the Dunn and Dunn Learning Style Model (1978). Thelen (1954) was the first to use the term *learning style*, observing the changes in how groups learn and interact in a given environment. The term learning style was further developed using cognitive, affective, and physiological domains which are influenced by the environment (Keefe, 1987). Scarpaci and Fradd (1985) suggested learning styles are "ways in which individuals perceive, organize, and recall information in their environment" (p. 184).

The aim of learning style inventories is to identify, assess, and provide alternative instructional solutions to improve classroom outcomes. Hickox (2006) indicated that "researchers use learning styles as a byword to reflect that their field is seeking to meet the

needs of their students or population” (p. 8). The theoretical foundations of traditional and formal learning environments possess potential non-alignment with today’s students, which prompts further research to investigate and hypothesize relationships between aspects of learning styles and academic performance (Bedford, 2006).

Individuals have innate cognitive tendencies and, as Scarr (1992) suggests, they seek out environments and experiences that reinforce those natural tendencies. As they do so, they are reinforced positively or negatively and become conditioned to specific environments and experiences. The theory shares elements of Guilford’s (1965) model of the structure of intellect in which he differentiated between a number of cognitive operations that included convergent and divergent thinking. Hudson (1968) suggested that divergent thought was nothing more than an individual’s preferred style of thinking. Hudson tested this theory with science and arts students, finding that science students generally preferred a convergent style of thinking, and that arts students were more likely to be divergent thinkers (Lovell, 1980). Hudson’s work was crucial in tying what began as Cognitive Style Theory to what we now know as Learning Style Preference Theory.

The theoretical framework of learning styles is based on the Dunn and Dunn Learning Style Model which was developed in 1967. Dunn and Dunn (1993) used 20 elements grouped into five stimuli which consisted of: environmental stimuli (sound, light, temperature, design), emotional stimuli (motivation, persistence, responsible, structure), sociological stimuli (self-oriented, peer-oriented, or learn in several ways, (i.e. sometimes alone, with peers and/or with authority figures), physiological stimuli (perceptual, intake, time mobility), and psychological/ cognitive processing stimuli (global, analytic, hemisphericity, impulsive/ reflective). The Dunn and Dunn model is based on Cognitive Style and Brain Lateralization Theories. The Cognitive Style Theory is based on the learned responses and subsequent development of inherent traits, while the Brain Lateralization Theory is based on the idea that the two hemispheres of the brain control different abilities and information processing functions (i.e., functional specialization). For example, verbal/ sequential abilities are believed to belong to the left brain while

spatial and emotional/holistic abilities belong to the right brain (The NC Education Place, n.d.). Thus, individuals who are right brain dominant process information through their emotions or subjective reasoning; they tend to be relational information processors. Left-brain dominant process information sequentially and are therefore analytical information processors

The Cognitive Style and Brain Lateralization Theories address the cognitive and affective components of learning, but they do not address the socio-cultural origins of the individual's learning styles (Keefe, 1987). This nurture component of learning styles preference is also very important; individuals unable to make choices congruent with their naturally occurring ability profiles may become frustrated and/or disinterested. And, to date, the U.S. educational system has primarily been one dimensional and directed at convergent learners, while ignoring the learners with diverse learning styles (White, 2001).

*Studies Researching Learning Style Preferences in Agriculture and CTE Programs*

The majority of past research regarding the learning styles of agriculture students has utilized the cognitive approach (Dyer & Osborne, 1996; Garton & Thompson, 1999; Marrison & Frick, 1994; Rollins, 1990; Torres & Cano, 1994; White, 2004). However, these studies have not examined the influences of the classroom environment on learning to produce a more holistic approach to learning. There is literature on research examining the effectiveness of aligning students' learning styles preferences to instruction (Chiou & Yang, 2006; Dunn, Pratt-Johnson, & Honigsfeld, 2008; Faraks, 2003). These studies present a positive case for the success of student learning; however, there are other external factors or non-controlled factors that may contribute to student learning outcomes.

Research on improving the learning environment of Career and Technical Education (CTE) majors is an on-going effort to produce a well-qualified workforce. Universities must be able to produce exceptional employees for high wage and highly skilled technical jobs to compete in the global market. With an increasing enrollment

of a multi-ethnic student population in colleges and universities today, quality of instruction is a necessity. According to Ausburn and Brown (2006),

An effort to individualize instruction and improve the effectiveness of instructor-learner transactions, education and instructional research has addressed a wide assortment of learner variables and assessed their relationships to instructional methods and environments. (p. 6).

Gordon and Yocke (2005) used the PEPS to identify learning style preferences of graduates who entered the CTE teaching field. Results revealed that graduates with a standard score of 60 or more preferred mobility, structure, tactile, and authority.

### **Purpose of Study**

The purpose of this study was to determine the learning style preferences of undergraduate Agriculture students in a Soil Science course (treatment group) using the Productivity Environmental Preference Survey (PEPS) and to determine, when using the students' learning style preferences, if their course grade average (CGA) is higher versus the control group of the Soil Science course. In turn, modifying instruction will better fit the students' learning style preferences for the course. The study also sought to determine the students' preferred learning styles from the treatment group. There are two research questions which the study addressed:

- (1) What are the learning style preferences of undergraduate agricultural students enrolled in a given Soil Science class?
- (2) Is there a difference in the students' course grade average (CGA) in the Soil Science class when the treatment group is taught according to their learning style preferences versus that of the control group?

Research Question Two requires a hypothesis statement to test the significance of the treatment and control groups regarding the effectiveness of using students' learning style preferences, based on of an alpha level .05.

**H<sub>0</sub>:** There is no significant difference in the students' course grade average (CGA)s in the Soil Science class, when the treatment group is taught according to their learning style preferences versus that of the control group.

**H<sub>a</sub>:** There is a significant difference in the students' course grade average (CGA)s in the Soil Science class, when the treatment group is taught according to their learning style preferences versus that of the control group.

### Methodology

#### *Research Design*

To answer the research questions and hypothesis statement, the research design for this study required a treatment group and a control group. The treatment group consisted of students enrolled in a Soil Science course (AGR 344) for the fall semester of 2007 with instructor A. The control group represents students enrolled in a Soil Science course (AGR 344) in the spring semester of 2008 with instructor B. See Figure 1 for research design layout<sup>1</sup>.

	Treatment	Course grade average (CGA) (Final)
Treatment Group (Fall 2007)	X	G <sub>1</sub>
Control Group (Spring 2008)	---	G <sub>2</sub>

Figure 1. Research design layout for determining the effectiveness of learning style preferences.

<sup>1</sup> Adapted from Campbell, D.T. & Stanley, J.C. (1966). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand McNally & Co.

There were two different instructors used for this study. For the treatment group, instructor A was in charge of the treatment group, has ten years experience in industry and taught the course for six years. Instructors A and B were equally qualified. Instructor B had

no prior information of learning styles to contaminate the study and Instructor B taught according to the objectives and learning outcomes of the course syllabus. Both instructors utilized the same lesson plan package (i.e., lab assignments) for the courses.

The weakness in the research design was that neither Instructor A nor Instructor B was observed in the classroom. However, the study was conducted in this manner to prevent outside influences for potential contamination by outside observation. In essence, the research setting was a natural state.

Instructor A was provided with a learning style mini-workshop along with a learning style instrument for the study. The authors are aware of the internal threats to validity for this research design and used necessary safeguards (i.e. non-disclosure of study to instructor B and its students) to ensure the success of this research study.

#### *Population of Subjects*

The subjects for the study were Agricultural students who are required to take the soil science course as part of their major coursework. There are approximately 1,000 Agricultural majors in the department at a university located in the southwest region of the United States (see Table 1).

Table 1.

#### *Demographics of Participants of Treatment and Control Groups*

Group Type	No. of Participants
Treatment (Fall 2007)	46
Control (Spring 2008)	41

The course was selected based on availability in the scheduling rotation for the 2007-08 academic year. Purposeful sampling was used for the treatment group because of the researchers' knowledge

of the population and subjects' majors which would provide the best information needed for this study (McMillan & Schumacher, 2001).

### *Instrument for Study*

The instrument used in the study was the Productivity Environmental Preference Survey (PEPS), which is based on the Dunn and Dunn Learning Style Model. PEPS is a comprehensive approach to identify how adults would prefer to learn and concentrate in work environments or educational settings (Price, 1996).

The researchers selected the Dunn and Dunn Learning Style Model because of its approach to assessing the way students learn in a classroom environment. Furthermore, the Dunn and Dunn Learning Style Model is used in post-secondary classrooms, with the support of validity data from a large source of empirical studies (Lovelace, 2005). PEPS has been used by researchers (Fazarro & Martin, 2004; Fazarro & Stevens, 2004; Gordon & Yocke, 2005; Larkin-Hein & Bundy, 2001) in college disciplines including agriculture, physics and engineering.

The PEPS contains 20 learning styles/elements, which are used to assess one's learning style preferences. There are 100 statement items on the Scantron survey to be completed by the respondent. This instrument uses a Likert-Scale to assess *how students like to learn*, not *why* (Price, 1996). Each of the 20 elements functions as a mini-scale for a preference related to the cognitive, environmental, or affective domains. Thus, for example, a student with a high score on the visual element has a learning style preference for learning information using illustrations, PowerPoint slides, and computers. Scores for the PEPS elements range from 20 to 80. Students who score 40 or less are "least preferred" for that particular element while a score of 60 or more indicates a "most preferred" element (i.e., style). The PEPS instrument has reliability scores equal to or greater than .60 in past research (Bevard College, 2003; Price, 1996).

### *Statistical Analysis Used*

The study employed descriptive analysis and independent t-tests. The rationale for the descriptive analysis was to identify the preferred learning style preferences of the students according to the mean score of the learning style/element. The mean score of the preferred learning style was identified in the 60-80 range, the “most preferred” element. The scores generated by the PEPS were for the treatment group. The purpose for using the independent t-test was to compare the mean scores for two different groups course grade average (CGA) of the treatment group-fall 2007 versus the control group-spring 2008 and to test the hypothesis statement for significance between the groups.

### *Data Collection Procedures*

The investigator was provided necessary documentation to IRB-Human Subjects at the participating university for approval and to the participating department before permission was given for the research study. Steps were taken to ensure the study was not contaminated and that any internal threat to validity did not exist for the treatment and control groups. Instructor A was asked to not disclose the study’s information to Instructor B.

### *Treatment Group*

The study commenced in the fall semester of 2007 on September 10<sup>th</sup>. The study for the treatment group took 15 weeks to complete. Instructor A had been briefed on the research study’s purpose and procedures to collect the data before the study, and was asked to participate in a one-day mini-workshop to receive basic information about learning styles, which include theory and usage of the PEPS. The instructor had little knowledge of learning styles and its application in an education setting. After the mini-workshop was completed, the principal research investigator established a time and date to disburse the PEPS to the Agriculture majors in the class. The

instructor had been provided directions for disbursement of the survey.

On October 1<sup>st</sup>, the students were given the surveys to complete. The survey was disbursed on a volunteer basis, and every student in attendance agreed to participate. This was documented on the IRB-Human Subjects paperwork. Students who wished to view their learning style preference profile were sent to Instructor A for pick up. The investigator mailed the completed PEPS to Price Systems in Lawrence, Kansas to be scanned and the data was sent back to the research investigator. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) to observe the mean scores of the learning style/element for the treatment group. Instructor A used the students' preferred learning style which was signified by identifying the highest mean score for the learning style/element. The SPSS output of the students' preferred learning style preferences was discussed with the instructor. The learning style/element with the highest mean score from the 20 preferences was used enhance his lessons and instructional methodologies. Instructor A was asked to maintain a journal every two weeks to record any changes in the students' grades and attitudes toward the course throughout the semester. On December 4<sup>th</sup>, course grade average (CGA)s were provided by Instructor A for the course. All journal entries for the two months were collected for the study. Students in this academic department were active in several events and organizations during the semester (e.g. National FFA meeting, state fair, homecoming activities). The instructor began modifications to teaching only after these excused absences were completed. This delayed implementation of instructional modification toward the later portion of the semester.

#### *Control Group*

Instructor B began teaching the soil science course for the spring semester of 2008 with no changes or enhancements in the instruction. Instructor B was not provided information about the study. At the end of the spring semester, the researcher obtained

grades through Instructor B. The researcher did not use names and student identification numbers, only grades.

## Results/Findings

### *Obtaining Learning Style Preferences*

The learning style preferences of the students were ascertained by SPSS. The results were generated before implementation of the modified instructions to enhance instructional approaches. Table 2 reports the preferred learning style preferences for 46 students in the soil science course.

The preferred learning style/element ***Structure*** was the most preferred among the students. From the 20 learning style/elements, ***Structure*** was frequently scored. There were 36 out of 46 students who scored several times in the most preferred range with 60, 64, 67, 70, and 74. According to Price (1996), the element/learning style 'Structure' is described as follows:

For standard score of 60 or more, be precise about every aspect of the assignment; permit no options; use clearly stated objectives in a simple form; list and itemize as many things as possible, leave nothing for interpretation; clearly indicate time requirements and the resources that may be used; required tasks should be indicated as successful completion is evidenced, gradually lengthen the assignment and provide some choices from among approved alternative procedures; gradually increase the number of options; establish specific working and reporting patterns and criteria as each task is completed.

For standard score of 40 or less, establish clearly stated objectives but permit choice of resources, procedures, time lines, reporting, checking, etc.; permit choice of environmental, sociological and physical elements; provide creative options and opportunities to grow and to stretch talents and abilities; review work at regular intervals but permit latitude for completion if progress is evident. Some employees may not prefer structure but require close supervision (p. 9).

Table 2.

*Summary of Preferred Learning Style Preferences*

Learning Style/Element	M	SD
Noise Level	51.70	6.029
Light	48.50	10.191
Temperature	50.37	10.058
Design	49.89	8.481
Motivation	52.74	5.702
Persistence	54.52	5.819
Responsible (Conforming)	46.17	10.109
<b>Structure</b>	<b>62.76</b>	<b>6.819</b>
Learning Alone/Peer-Oriented Learner	50.78	10.673
Authority-Oriented Learner	58.83	8.001
Several Ways	47.20	6.017
Auditory	52.26	10.030
Visual	48.07	7.344
Tactile	59.02	7.006
Kinesthetic	56.37	5.135
Requires Intake	56.26	8.619
Time of Day	47.70	9.928
Late Morning	49.46	10.178
Afternoon	56.78	11.053
Mobility	56.52	8.123

*Note.* Bold type signifies the learning Style preference preferred by students for the course

The preferred learning style *Structure* was used by Instructor A to design a new instruction prescription for the course (see Figure 2).

An independent t-test was conducted to determine if the treatment (learning style preference “Structure”) which was employed by Instructor A assisted in the increase of the group course average (GCA) versus the control group. To verify that SPSS output was valid, assumptions were checked to determine if there were any violations. The assumptions were not violated.

Using a two-tailed .05 alpha level, the null hypothesis was rejected and the alternative accepted. The treatment group ( $M=3.17$ ,  $SD=.54007$ ) course grade average (CGA) was significantly higher than the control group ( $M=2.67$ ,  $SD=.64383$ ),  $t(85)=3.919$ ,  $p=.000$ . The eta squared statistic (Cohen's  $d=.83\sim.38$ ) indicate a medium effect size.

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*Oct. 22 , 2007    Begin evaluating results of survey and develop a strategy of implementation.*

*Nov. 5, 2007      Begin modifying teaching*  
*Class begins with quick energetic review of previous lecture material (4 to 6 minutes)*  
*Pop quizzes replaced with assignments*  
*Assignments consist of students placed into groups of 2 to 3 people with all groups having the same question to answer and elaborate (3 to 5 minutes).*

*Nov. 25, 2007    Assignments continue (once or twice a week)*  
*Send an e-mail to every student*  
*I put each student's name in the greeting of the e-mail*  
*Words of encouragement*  
*Current grade average (100 point scale) included*  
*Give invitation for additional assistance with course material*

*Dec. 3, 2007     Review Session before Exam IV*  
*Conduct a question/answer session with one question for each student and allow each student time to answer his/her question. Questions cover most recent material covered in lecture and lab.*  
*Floor open to all questions from students*  
*Tell students to check their e-mail for a message from me (Nov. 25<sup>th</sup> e-mail)*

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Figure 2. *Sample-modification of instruction used for the preferred learning style **Structure**.*

### Conclusion and Discussion

Even though there was significance in the study, the authors would suggest that readers approach findings with caution. The findings should not immediately be generalized to the greater population due to the smaller sample size and lack of random sampling techniques utilized in the present study (McMillan & Schumacher, 2001). Even though the hypothesis of this study indicated there was a significant difference in the treatment group's course grade average (CGA) when compared to the control group's course grade average (CGA), one must conclude that there were uncontrollable external variables (i.e. parent pressure, monetary incentives, and self-motivation) which may have contributed to the higher course grade average (CGA). This study indicates that learning researchers have found that teaching to students' learning style preferences does make a positive impact quantitatively. However, common sense must be used to interpret the findings of learning style research, rather than being used as a cure-all for student success in the classroom.

According to McGee, Dobbins & King (2001), “[Agriculture instructors]...have a tremendous responsibility in working with students who have a variety of learning styles and intellectual capabilities within the...classroom” (p.27). Instructor A had a challenge to accommodate 46 students in the course; however, it required persistence and dedication to ensure the success of his students. An excerpt (see Figure 3) from the journal entry of Instructor A indicates a difference in the students' ability to address their learning styles.

The preferred learning style *Structure* is consistent with the Gordon and Yocke (2005) study that revealed *Structure* as being one of the preferred styles by the subjects. This preferred learning style and perhaps others that CTE majors possess are aligned to the established paradigm of CTE disciplines which attract students who desire to learn a technical skill. Ausburn and Brown (2006) emphasized, “providing CTE students with hands-on learning activities, clear explanations, multiple learning resources” (p. 32),

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*By implementing their preferred learning style Structure for the rest of the semester, participation by students, in the form of asking questions and feedback through comments about a lesson, increased compared to earlier in the semester. Assignments were precise with more focused objectives, which everyone understood. Some students have expressed thanks and appreciation for the email. As an instructor, there is now greater ease in holding the student's attention for 65 to 75 minutes. This research has allowed me to understand all students do not learn the same and their style of learning may come from different experiences outside of the classroom or by how other teachers taught their classes.*

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Figure 3. *Instructor A's journal entry on the observations of the students' engagement in learning.*

which this study attempts to provide using active research in learning style preferences to improving the learning environment. Instructor A implemented *Structure* to allow for a positive learning environment and to motivate students to understand the material.

This study is a catalyst for faculty to reflect on the growing number of students, especially first-generation students, who are presently in higher education classrooms. Faculty face socio-economic, cultural, gender, and age issues that complicate the learning environment and sometimes discourage effective teaching in the classroom. Learning style research in the past 30 years has been scrutinized and embraced as a possible means to change the paradigm of teaching in today's society. Rather than promoting learning styles as the only viable solution to effective teaching, this study can assist faculty to gaining increased knowledge about students' learning patterns. Sims and Sims (2006) stressed that, "The notion that all learners' [learning styles] are identical in educational institutions demonstrates arrogance and elitism by either sanctioning one group's style of learning while discrediting the styles of others or ignoring difference altogether" (p. xiv). For learning style research to

be educationally significant, alternative instructional tools should be provided to enhance the learning environment. For the universities' mission to be met, today's instructors must be in a continuous mode, striving for self-improvement, to ensure courses are taught effectively by using students' learning patterns.

The authors recommend that this study be a catalyst for further research to continue to investigate undergraduate student learning styles. Replications of this study should take place in other agriculture and related CTE disciplines at other universities. Additional research will provide a deeper understanding of teaching to student preferred learning styles and to further promote continuous improvement in utilizing different instructional approaches.

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**Certification of Postsecondary Career and Technical  
Instructors: Issues for Debate**

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Recently, the long-standing, though relatively low key, debate surrounding certification requirements for career and technical instructors at the postsecondary level has been revived as a critical issue. These discussions have led to extensive examination of: (1) current credential requirements for instructors; (2) recent changes to state and federal policies; (3) synthesis of available literature; and an understanding of current and future trends (Bartlett, 2002; Olson & Spidell, 2008). Despite the widespread assessment and renewed debate of this topic, a consensus has yet to be reached amongst the decision makers. The following document is intended to add fuel to these much needed discussions. It is important to note that the authors are in no way intending to sway the opinions of any potential reader. Rather, we hope to provide a solid starting point from which further conversation can occur.

It is also essential to this discussion that this document does not provide any specific recommendations on a design that requires certification licenses for career and technical education instructors at postsecondary institutions. For years a number of individuals have advocated for this. Several individuals within the field of career and

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technical education (CTE) believe a certification process similar to the existing regulations for secondary vocational teachers should be implemented, since Tech Prep, School to Work, and Perkins IV have all served to expand the linkage between secondary and postsecondary technical programs. There are also those who disagree with any new initiative for potential certification requirements. They believe implementation of such a policy would be counterproductive to postsecondary CTE.

When attempting to initiate a discussion regarding these different perspectives one must ask the following three questions. (1) What's in the best interest of the students who enroll in career and technical education courses at postsecondary institutions? (2) What's in the best interest of career and technical education instructors at postsecondary institutions? (3) What's in the best interest of the field of career and technical education at postsecondary institutions? Some may argue these questions are the same. In an idealistic world this would be true. However, when dealing with the complexities of education, cohesiveness is virtually impossible.

As previously stated, providing recommendations that choose a side is not beneficial to this debate. Previous meticulous investigation of the issues has provided us with the philosophical awareness that both sides have a legitimate case. With this understanding in mind, the following is organized to assist stakeholders of career and technical education in developing a clearer understanding of the issues that make it difficult to reach consensus on the implementation of required certification for all CTE instructors at the postsecondary level.

### **Issues related to not adding certification requirements**

Enrollment at postsecondary institutions has increased over the past two decades. The majority of the students enrolled at a postsecondary institutions attend one that offers a number of vocational education courses (Cohen & Brawer, 2003). Previous research has offered an explanation for this phenomenon. According to Gray and Herr (1998), of the 147 million estimated jobs for the year 2005, only 32 million of those jobs would require a college

degree. These statistics have resulted in a additional accountability of faculty and staff at these institutions to provide their students with the training needed to succeed in their chosen vocation (Gray & Herr, 1998; Hyde, 2007). Scholars of vocational education view this increase as reason for excitement due to the employability aspect (Gray, 1996).

Excitement within the field has caused some concerns related to the availability of CTE teachers. The field of vocational education has experienced a shortage of CTE teachers over the past few years (Walter & Pellock, 2004). This is troubling considering the demand for CTE continues to grow (Hyde, 2007). According to Hyde (2007), there is an ongoing debate as to how great of a demand for career and technical education teachers exist. Hyde (2007) explains this lack of consistency:

One article quoted that an additional 2.5 million additional teachers would be needed throughout remainder of the present decade (Abramson, 2001). Others cited figures that appear to be just as grossly exaggerated. In 2002, the National Education Association (NEA) stated there would be a need for an additional 2 million teachers by 2010. An explanation on how they arrived at this figure could not be found, but their estimate does contradict the 571,000 cited by the U. S. Department of Labor (DOL) in 2002. The U. S. Department of Education's (DOE) 1999 estimate placed the need to be around 500,000 additional teachers through the year 2011. However, in 2001 the National Center for Educational Statistics (NCES) projected the need to be between 310,000 to 380,000. (p. 26)

Despite the inability to establish an agreed upon number, a shortage does exist. If interventions are not made to correct the shortage of CTE teachers by faculty, staff, and the various legislative educational subcommittee of each state, this will hinder our ability to effectively address this nation's further transition towards a global economy (Hyde, 2002).

The field of career and technical education is also experiencing concern regarding graduate research. Since the 1970s the number of doctorates granted in technical education has decreased steadily (Baltzer, Lazaros, & Flowers, 2007). The lack of emerging scholars in the field leaves a serious research void. Researchers believe this

void has the potential to cause a number of lingering effects (Volk, 1997). According to Baltzer et al. (2007), the growth of the field of vocational education has reached a critical point and steps must be taken to reenergize it. This cannot be done if the number of scholars within the field continues to decrease. Wicklein (1993) believes there is a “need to further identify the working theories and concepts of technology education...in order for the field to move forward as a legitimate academic discipline” (p. 70).

The decreases in doctoral education and research are believed to also have a direct link to poor performances of some technical programs at both the secondary and postsecondary level. The declining number of doctoral degrees in technical education has occurred at the same time as the closure of a number of technical programs throughout the nation (Rogers, 2002). Further, concerns exist due to the expected retirement of a number of current CTE faculty at all levels. According Baltzer et al. (2007), the average age of CTE faculty is 50 years old. Many of these teachers are expected to elect retirement by the end of this decade. Thus further creating the potential for a shortage of qualified teachers of bachelor’s level career and technical education programs. Replacing this population will not be easy, as attracting new CTE faculty has always been problematic. The initial salary for CTE faculty has discouraged qualified individuals from applying to be faculty members (Goldberg & Proctor, 2000). Many believe the possibility of a postsecondary certification requirement will further discourage individuals from applying. Discouraging individuals from applying at such a critical period is possibly counterproductive.

Establishing a certification process is potentially difficult considering the inability of the field to develop an agreed upon structure. Hyde (2007) cites Lynch’s (1996) idea “there is no agreed upon conceptual framework or knowledge base related to education for the workplace and workforce development that professionals or professional associations have codified as important in the preparation of teachers” (p. 26). Considering these afore-mentioned citations the question must be asked. If certification requirements are developed will they be a benefit or detriment to the field considering its current state?

### **Issues related to adding certification requirements**

As previously mentioned there is a growing concern regarding the current and future need for career and technical education teachers (Baltzer et al., 2007; Hyde, 2007; Walter & Pellock, 2004). Yet lowering the standards and qualifications for individuals who teach CTE is not a proactive way of addressing the problem. Hyde (2007) cites the opinion expressed by Roth and Swail (2000) that “teacher shortages should be dealt with in greater detail rather than simply placing a warm body in a classroom” (p. 20). Teachers have a responsibility to teach their students the essential skills needed to succeed in their individual professions. Without these skills students are placed at an extreme disadvantage. Hyde (2007) concluded, “with the advancements and rapid changes in technologies, today’s CTE teachers must continuously improve the level of instruction that is being provided because as the technologies change, the skills must be taught to match the current and emerging occupations” (p. 19). This continued improvement is more vital than ever before (Baltzer et al., 2007; Joerger, & Bremer, 2001). Failure to provide dedicated students with the best education possible is unacceptable.

The movement toward programs of study, also known as career pathways, is also contributing to this side of the debate. Perkins IV requires articulation similar to Tech Prep between secondary and postsecondary CTE programs and evaluation of student achievement at both levels as well. Traditionally, postsecondary representatives have typically dominated articulation discussions because of their degree granting status. However, with the emphasis, with financial implications, placed upon highly qualified teachers and student achievement within the federal legislation, will more stringent standards for faculty and programs follow?

As difficult as it is to get all stakeholders to agree to certify postsecondary CTE teachers, that pales in comparison to the difficulty of constructing the framework needed to establish a certification process. While some have suggested adopting the current regulations for secondary vocational teacher certification, this adaptation may not work well on the postsecondary level. A

separate framework may have to be adapted or created to serve the specific needs of career and technical education at the postsecondary level. Creating a long-term model that is stable and enduring is exceedingly difficult considering the assortment of methods of certification that currently exist frequently change (Hyde, 2007).

Although establishing a certification process is difficult, it is not impossible. It is important to note certification of postsecondary CTE teachers does exist in a number of states. These following states have certification requirements for CTE faculty at two-year institutions: Colorado, Idaho, Iowa, and Wisconsin. Certification models such as those adopted by these states could be quite beneficial (Olson & Spidell, 2008). Certification also exists for faculty at community colleges in: Arizona, Alabama, California, Connecticut, Georgia, Hawaii, Illinois, Iowa, Maryland, Minnesota, Nevada, New Jersey, Virginia, West Virginia, and Wisconsin (Olson & Spidell, 2008). However, tailoring a single certification model based on these existing models is complicated, particularly since there is a lack of consistency from state to state. Perhaps the time has come for a national certification model or set of standards. Generating such a model will take some time based on the various terminologies, policies, and procedures of each state. However, this obstacle must not deter a serious discussion within the field of career and technical education. If administrators, faculty, industry representatives, and members of the states' boards of education want to truly serve their students such a framework possibly needs to be considered.

### **Summary**

Attempting to provide CTE students with the best education possible without handicapping the field will not be solved in this discussion. This dilemma will exist for the foreseeable future, especially since many in the field view the issue differently. In many respects, it seems as if we are speaking different languages. As we attempt to move forward through intense and meaningful discussion, it is critical that we find a dialect that makes sense. We can't afford to ignore this issue any longer. This is especially true with the current economic crisis. Moreover, the ability of the United States to

remain globally complete hinges on the ability of all career and technical education stakeholders to take action and address these issues aggressively through continued conversations. Taking action is the only hope this field has. So, what is your position in this debate?

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## **AWARDS and ELECTIONS**

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### **Twenty-Ninth Annual Outstanding Manuscript Award Recipients**

#### *Journal of Industrial Teacher Education*

Each year the Editorial Board of the *Journal of Industrial Teacher Education* acknowledges excellence in writing through its Outstanding Manuscript Awards. The awards task force, consisting of current and former *Journal* editors and officers of NAITTE, reviewed each published refereed manuscript from Volume 44, Issues 1, 2 and 3 of the *Journal*. The members first determined whether the manuscript merited recognition and then ranked the selected manuscripts. Individual rankings were combined to determine the recipient in each of the award categories. The awards task force for Volume 44 consisted of Daniel Brown, Janet Burns, Charles Gagel, Marie Hoepfl, Kara Harris, and George Rogers. The Editorial Board of the *Journal of Industrial Teacher Education* extends warm thanks to these individuals for their assistance in the awards selection process and for their continued service and commitment to NAITTE and the profession.

The Outstanding Manuscript Awards are presented to authors of refereed manuscripts based on three categories: research, conceptual, and dissertation. The Outstanding Research Manuscript is selected from published articles that were data based. The Outstanding Research Manuscript for Volume 44 was co-authored by Jeff M. Allen, University of North Texas and Kim Nimon, Southern Methodist University. Their article, published in the Fall 2007 Number 3 edition, was entitled *Retrospective Pretest: A Practical Technique for Professional Development Evaluation*. The authors provided a method to field test an instrument utilizing a pretest to determine whether it could be used as an assessment device for a professional development conference. The instrument evaluated in the manuscript provides the user a low cost approach to evaluating the quality of development interventions across a wide range of

disciplines. Information gained for the instrument under review in gauges whether or how much learning occurred.

The Outstanding Conceptual Manuscript Award is chosen from philosophical, historical, curricular, or expository pieces. Michael Kroth, University of Idaho authored the Outstanding Conceptual Manuscript for Volume 44, Number 2, Summer 2007 edition. His article, entitled *Maslow-Move Aside! A Heuristical Motivation Model for Leaders in Career and Technical Education*, provides another model of the motivational research being conducted in Career and Technical Education. The author suggests that Maslow's Hierarchy of Needs is often used as an example for much of the research conducted. He goes on to say that research is being conducted that is not widely known. Today educators need a method to utilize workplace place motivation models based on existing theory helping employees reach their potential.

The Outstanding Dissertation Manuscript award is selected from articles that report the findings of a thesis or dissertation. The Outstanding Dissertation Manuscript for Volume 44 was co-authored by Paul A Asunda and Roger B. Hill, The University of Georgia. Their article, which appeared in issue Volume 44 Number 1, Spring 2007, was entitled *Critical Features of Engineering Design in Technology Education*. The study conducted collected data through interviews that would enable the authors to develop activities and rubrics for integrating engineering design with technical education.

The Outstanding Manuscript Award recipients were recognized by NAITTE at a reception following the Engineering and Technical Education division business meeting at the Association for Career and Technical Education Conference, Charlotte, North Carolina, December 2008 annual conference. The recipients were presented plaques for their achievement. Once again, the *Journal* Editorial Board and NAITTE congratulate the award recipients of Volume 44.

NAITTE Colleagues:

As the NAITTE Trustee in charge of the 2008 officer elections, it is my responsibility to notify you of the election results. Please welcome the following new NAITTE officers:

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Thank you for a successful election.

Charles W. Gagel  
NAITTE Trustee

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