THE EFFECTS OF A CURRICULUM INTERVENTION ON ARKANSAS STUDENTS' INTERESTS IN MANUFACTURING AS MEASURED BY THE KUDER CAREER INTEREST ASSESSMENT

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A Dissertation presented to the faculty of Arkansas State University
in partial fulfillment of the requirements for the Degree of

DOCTOR OF EDUCATION

Arkansas State University
May 2010

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ABSTRACT

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The Kuder Career Planning System administrative database results for the past five years have shown a low interest in the manufacturing career cluster among Arkansas students. The low student interest and shortage of high-skilled labor in manufacturing prompted the Arkansas Department of Career Education to invest grant funds in a new manufacturing curriculum for career orientation teachers to implement as an *intervention* in their classrooms. The intervention intent was to inform eighth graders about career opportunities in manufacturing and the skills necessary to compete for high-skill, high-wage, and high demand manufacturing careers in an effort to help alleviate the shortage of skilled manufacturing workers in Arkansas. The purpose of the current study was to investigate if the intervention influenced Arkansas students' interests in manufacturing as measured by the Kuder Career Interest Assessment (KCIA).

The data presented represent the results of a quantitative control and experimental group study. The control group received the traditional manufacturing curriculum, whereas the experimental group received the curriculum intervention. The teachers administered the KCIA as a pretest and posttest to measure the effects of the curricula on students' interests in manufacturing careers.

Research results produced no significant difference between pretests and posttests for either the control or experimental groups. Posttest scores for the manufacturing cluster for the control and experimental groups were lower than the pretest scores for both groups, although the mean differences were not significant. Males in the experimental group scored significantly higher than did females on the posttest for the manufacturing cluster; no gender differences existed for the control group. Teacher differences, revealed through qualitative survey questions, in preparation and instruction time for both the traditional and intervention curricula had no statistically significant effect on students' resultant career interests in manufacturing.

ACKNOWLEDGEMENTS

I would like to thank my parents, brother, and sister for their love and support. I want to thank my loving husband Dr. James Shemwell, who not only encouraged and supported me through this journey but also gave me constructive feedback on this study with his knowledge and experience in organizational leadership. You are the best thing that ever happened to me. I thank God each day for bringing you into my life. I also want to thank Zack and Vince for being the most kind-hearted young men that I have been given the privilege to know.

I am grateful to Dr. Daniel Cline for his tough love and dedication to helping students. I appreciate Dr. George Foldesy's sense of humor and positivity throughout the doctoral process. I want to thank Dr. David Agnew for providing me with the opportunities to present my research at conferences across the United States. I am pleased to have Dr. David Cox on my committee, who taught me how to be a service-oriented leader. I want to recognize Dr. David Saarnio for challenging my ideas and teaching me to see different perspectives. Finally, great thanks to Joyce Mann for her Christian example and love for others.

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CHAPTER I

INTRODUCTION

The purpose and approach to guidance and counseling in schools have evolved throughout the 20th century from providing a service to providing comprehensive guidance programs (Gysbers & Henderson, 2001). The expansion of school guidance practices occurred in response to national policy initiatives, economic events, school reform movements, and societal needs (Herr, 2001b). Many early pioneers, such as Parsons, saw the need for societal and educational reform as the United States transformed from an agriculturally based economy to an industrial economy requiring a skilled work force (Herr, 2002). The subsequent transition in the United States from an industrial based economy into the information-technology age brought about significant changes in the workplace and in the preparation of the workforce by requiring higher skill levels (Zunker, 1994).

Along with social and educational reform in the twentieth century came career theorists and practitioners, such as John Holland and Donald Super, who influenced the strategies and programs applied in educational environments. School career planning practices and guidance programs have become a part of the educational process to assist students in making informed education and career decisions. Guidance and counseling programs in schools provide resources and strategies that support, facilitate, and encourage student achievement and development (Lapan & Turner, 2002).

Technological resources supply teachers and school counselors the opportunity to create more effective and efficient school programs by providing data to help students make informed decisions (Paisley & McMahon, 2001). Teachers can capture data through many means, such as school-wide testing, evaluation processes, guidance lessons and units, individual advising sessions, and both informal and formal career assessments (Trusty, Niles, & Carney, 2005). Career assessment data provide teachers with information about students' needs, characteristics, and educational-career goals to help students with self-awareness and the career development process (Trusty & Niles, 2004).

There is an apparent need for valid and reliable career assessment and counseling services for young adults as students make decisions that affect their future (Osborn & Reardon, 2006). Students are expected to make educational and/or career decisions as early as the middle school years. In addition, early career decision-making can have an effect on youths' future lifestyle development and occupational satisfaction. The task of career decision-making can be complicated, causing some individuals to have difficulties before and after the decision-making process (Amir & Gati, 2006). However, Thomas and McDaniel (2004) found that students completing a career-planning course demonstrated enhanced knowledge of career options and confidence in their career decision-making abilities.

Career orientation is a one or two semester career-planning course required of seventh or eighth grade students in Arkansas to explore career options and to understand the relationship between career planning and the decision-making process. The Arkansas Department of Career Education (ADCE) requires, upon the completion of the eighth grade, each student to have a four-year career action plan on file of the courses to be taken in high school (Arkansas Department of Career Education, 2004). A student's career action plan involves decisions about academic classes, career and technical programs, and course selections that have definite implications for career preparation and options. Therefore, ninth grade students make educational choices and career decisions at the beginning of their freshman year.

As part of the Arkansas Career Orientation Curriculum Content Frameworks, students should be able to evaluate their own interests, skills, and values assessment results, develop a career portfolio, and identify career opportunities within the 16 career clusters. The 16 career clusters, designed to prepare students to transition from high school to postsecondary education and employment, include: 1) agriculture, food and natural resources, 2) architecture and construction, 3) arts, audio-video technology and communications, 4) business, management and administration, 5) education and training, 6) finance, 7) government and public administration, 8) health science, 9) hospitality and tourism, 10) human services, 11) information technology, 12) law, public safety, corrections and security, 13) manufacturing, 14) marketing, sales and service, 15) science technology, engineering and mathematics, and 16) transportation, distribution and logistics.

Career orientation teachers spend 26 hours per semester teaching the 16 career clusters as part of the state curricular frameworks. In unit five, Exploring the 16 Career Clusters, career orientation students "identify the 16 career clusters, explore interests, skills, education/training, and labor market data for each career cluster, and perform job-related activities to identify which clusters best match one's interest, skills, aptitudes, and values" (Arkansas Department of Career Education, 2006, p. 6-7). Career orientation students are provided free access to the online Kuder Career Planning System (KCPS) to take career assessments and evaluate their results as they align to the career clusters.

Various versions of the Kuder career assessments have existed since 1939. The Kuder assessments have “a long and respected role in career guidance and counseling” (Zytowski, 2007, p. 1). The online KCPS combines research-based interest, skills, and work values assessments with information based on the 16 career clusters. The KCPS provides a career portfolio and resources to explore career opportunities, including occupationally specific skills, wages, and education/training needed for each career cluster during the career orientation course (Arkansas Department of Career Education, 2006). In addition, assessment results are stored in the Kuder Career Planning System administrative database for review and evaluation purposes. The ADCE uses the KCPS administrative database to evaluate Arkansas students’ assessment results in order to develop programs and training opportunities that meet school and workforce needs.

According to the Arkansas Department of Career Education, the KCPS administrative database results from 2002 – 2007 showed that students in Arkansas have a low interest in the manufacturing cluster (J. Davidson, personal communication, October 12, 2007). The low student interest and the shortage of high skilled labor in manufacturing prompted the ADCE to purchase a new manufacturing curriculum for career orientation teachers to implement as an intervention when they teach the manufacturing cluster during unit five, Exploring the 16 Career Clusters. The new manufacturing curriculum supports knowledge and skills related to math, science, technology, communication arts, and entrepreneurship with an emphasis on career opportunities, salary data, and educational and planning advice from high school through postsecondary options. The ADCE approach aligns with Gardner’s (2007) contention that schools can prepare students for jobs by supplying an intensive math and science curriculum that relates academic work to the type of skills needed and careers found in manufacturing.

The Arkansas Department of Career Education hosted a conference titled “Manufacturing: A New Vision – Women Mentors can Change the Future” on November 13-14, 2007 in Little Rock. The purpose of the conference was to help school administrators, middle school career orientation teachers, and guidance counselors understand the manufacturing career cluster and the careers available. Representatives of the new manufacturing curriculum demonstrated how to implement the curriculum lessons. The instructional materials included problem-based learning activities that emphasized knowledge and skills in math, science, and technology in an attempt to inform students about the educational and career opportunities available in manufacturing.

Statement of the Problem

A low student interest in the manufacturing cluster concerns the ADCE because of the need for skilled production workers in Arkansas industries (Collins, 2005). The vast majority of U.S. manufacturers are experiencing a shortage of qualified workers, having an impact on businesses and the country to compete in a global economy (National Association of Manufacturers, 2005). According to the National Association of Manufacturers (2005), the manufacturing sector has experienced a shortage of highly skilled workers, as the nature of manufacturing processes has become more technology driven. The decline in manufacturing employment in Arkansas implies little growth in per capita income over the near future (Collins, 2005).

The Arkansas Department of Career Education adopted a curriculum intervention for participating schools to increase students' decision-making toward manufacturing careers in an effort to alleviate the current labor shortage in the Arkansas manufacturing sector. A study to investigate if the intervention actually influenced Arkansas students' interests in manufacturing was needed to determine if the State's investment in the program and teacher training was addressing the skilled labor shortage in manufacturing. A control-experimental group research design was used to evaluate Arkansas eighth grade career orientation students' interests in manufacturing before and after the curriculum implementation using the Kuder Career Interest Assessment. A supplemental qualitative teacher survey was used to explore and clarify quantitative research findings.

Purpose of the Study

The purpose of this quantitative study was to determine the extent to which the curriculum intervention influenced Arkansas career orientation students' interests in manufacturing as measured by the Kuder Career Interest Assessment, pre- and posttest. The rationale underlying the ADCE-sponsored curriculum was to better inform students about career opportunities in manufacturing and the skills necessary to compete for high-skill, high-wage, and high-demand manufacturing careers. The ADCE introduced the curriculum intervention to help alleviate the shortage of skilled manufacturing workers in the state. The curriculum intervention represented the study's independent variable, while students' career interest scores represented the dependent variable.

Eighth grade career orientation students from schools located in the west, southwest, northeast, and central regions of Arkansas comprised the sample population. Four of six career orientation teachers administered the Kuder Career Interest Assessment pretest to the control group at the beginning of the fall 2007 semester, taught the traditional manufacturing curriculum during unit five, and administered the Kuder Career Interest Assessment posttest at the end of the semester. All six career orientation teachers administered the Kuder Career Interest Assessment pretest to the experimental group at the beginning of the spring 2008 semester, taught the new manufacturing curriculum during unit five, and administered the Kuder Career Interest Assessment posttest at the end of the semester. Students' career interests in the control and experimental groups were measured by implementing the Kuder Career Interest Assessment before and after curricula delivery in both groups. To better interpret research results, a supplemental teacher survey was used to gather qualitative data relating to preparation and instructional time spent on curricula delivery, implementation experiences, and suggestions for improvement.

The study answered the following four research questions: Is there a significant difference in participating students' interests in manufacturing in comparison to the national average? Does the curriculum intervention have a significant effect on the experimental group's interests in manufacturing in comparison to the control group? Are there significant gender differences in students' interests in manufacturing across experimental and control groups? Is there a significant difference in students' interests in manufacturing based on individual teachers across experimental and control groups? By measuring pretest and posttest means of Kuder Career Interest Assessment scores before and after curricula delivery, the study determined the effect of the curriculum intervention on students' career interests in manufacturing.

Significance of the Study

Determining the influence, if any, of the curriculum intervention on students' career interests assessed whether or not the state's resources invested in the curriculum and teacher training were likely to address the skilled labor shortage in manufacturing. The ADCE introduced the curriculum intervention in the Arkansas career orientation classes because of the shortage of highly skilled manufacturing workers affecting the economic growth of Arkansas. The study was important for investigating whether the grant money and strategic initiative that Arkansas has expended for students to have access to the new manufacturing curriculum influenced eighth grade students' career interests in manufacturing.

The study may reveal that usage of the curriculum intervention significantly influenced students' career interests in manufacturing. A finding of positive influence will provide an impetus for continued usage. Conversely, the study may reveal that the curriculum intervention did not influence student interests in manufacturing careers or produces a negative influence, possibly prompting administrators to consider alternate methods of increasing student interests in manufacturing careers.

The study of measuring students' career interests before and after the implementation of the curriculum intervention will benefit leaders at the State Department level by determining if the grant money invested in the new manufacturing curriculum was advantageous. Study results will inform school administrators regarding the potential influence of a cluster-specific curriculum intervention. Furthermore, the research may contribute to future studies by modeling a method to collect evidence on students' career interests relating to a curriculum based on one of the 16 career clusters, possibly leading to research of other cluster-specific curricula.

Limitations

A convenience sample of six career orientation teachers that attended the manufacturing conference were selected to participate in the study. Four of six career orientation teachers administered the Kuder Career Interest Assessment as a pretest and posttest to the control group in the fall 2007 semester. All six career orientation teachers administered the KCIA as a pretest and posttest to the experimental group in the spring 2008 semester. The limitations associated with convenience sampling, specifically, that convenience sampling may not produce a truly random sample, will apply to the study.

The internal validity of the control-experimental group design possibly could be limited by differences on the pretest and posttest outcomes, the career interests, due to potential pre-existing group differences, such as learning differences and maturation. The group differences, rather than the curriculum, could influence student interests in manufacturing instead of the intervention (Gall, Gall, & Borg, 2007).

Treatment integrity issues may be a factor in this study regarding intervention implementation. Typically, researchers address treatment integrity in psychotherapy research through training, supervision, and providing a manual that describes the specific methods for implementing the career treatment (Kazdin, 2003). Treatment integrity applied to this study represents the specific methods teachers used to implement the curriculum intervention. During the manufacturing conference in Little Rock, teachers received training on curriculum implementation and were given an instructional manual including the materials. However, the teachers were allowed the freedom to select which lessons to implement, how to implement the new manufacturing curriculum, the number of preparation hours, and the number of sessions for implementing the curriculum.

Statistical regression, which is a tendency for participants to score closer to the mean when career interests are measured a second time because of familiarity with the pretest, could account for students' gaining more interest in manufacturing, instead of the curriculum intervention having an effect on posttest outcomes (Gall, Gall, & Borg, 2007). However, a one-way analysis of covariance, with the pretest as a covariate, was used to adjust any initial differences between the groups.

Definition of Terms

The following terms used in this study are defined as:

Career action plan (CAP) is a four-year plan of the coursework a student will complete in high school. The CAP should be completed for each student near the end of the career orientation class (Arkansas Department of Career Education, 2007b).

Career development represents the skills acquired to understand the relationship between personal qualities, education and training, the world of work, and career decision-making (Gysbers & Henderson, 2001).

Career guidance is the process of career-related events conducted by a variety of professionals including information dissemination, counseling, curriculum, and program interventions (Goodman & Hansen, 2005).

Career interest represents an individual's enthusiasm for a particular field and the key factor in making career choices (Super, 1984).

Career orientation is an occupational exploration course with an emphasis on decision-making, employability skills, work habits, attitudes, and occupational research to help students choose and plan for a career (Arkansas Department of Career Education, 2007c).

Career portfolio is a means for collecting and organizing data for career planning (Trusty, Niles, & Carney, 2005).

Curriculum Intervention or *Intervention* is the term used to describe the new manufacturing curriculum or program.

Kuder Career Interest Assessment is an online career interest assessment with immediate online scoring of career interests based on career clusters. Person match career sketches are provided to explore information about working individuals whose interests closely match your own (Kuder, Inc., 2007).

Kuder Career Interest scores represents a self-interpreting report providing scores that display interests based on the career clusters, person match career sketches, and provides online links to explore occupation and educational options (Kuder, Inc., 2007).

Kuder Career Planning System is a comprehensive internet-based program for career planners. The system includes an online career portfolio, online career interest, skills, and work values assessments, and an administrative database management system (Kuder, Inc., 2007).

Kuder Career Planning System administrative database is a database system that manages and tracks individual and aggregate Kuder assessment results to assist educators and administrators with education planning and career guidance (Kuder, Inc., 2007).

New manufacturing curriculum is an academic and career development program supporting career cluster knowledge and skills and a context for learning about manufacturing careers for 21st century workers.

Sixteen career clusters are a grouping of occupations within a cluster with common knowledge and skills (Arkansas Department of Career Education, 2007d).

Summary

By the end of the eighth grade, Arkansas students are required to have a career action plan on file of the courses to be taken in high school. The state frameworks contained in the career orientation curriculum are structured to help students make informed career decisions based on the 16 career clusters. The ADCE received a state grant to implement a new manufacturing curriculum into the career orientation classes. The purpose of the intervention was to inform students of the skills required and career opportunities available in manufacturing in an attempt to alleviate the shortage of highly skilled manufacturing workers and improve the economic growth of Arkansas. The study investigated whether the curriculum intervention influenced eighth grade students' career interests in the manufacturing field, thus achieving the State's objective of developing a more highly skilled manufacturing workforce for the future. Chapter II presents a review of literature and prior research related to the current study.

CHAPTER II

REVIEW OF THE LITERATURE

The current chapter discusses the role that career development and career orientation programs play in preparing students for life after high school. Because most students will enter the workforce either at the conclusion of high school or college, students possess career development needs, regardless of their plans after high school. Educators may incorporate activities into career orientation programs, such as the new manufacturing curriculum, that are relevant to students' career development needs and the requirements for success in the changing workplace.

Chapter II examines how career development in public schools evolved throughout the 20th century into comprehensive guidance programs that provide opportunities for students to learn about their skills, values, interests, educational and career opportunities. By learning about various educational and occupational options in a career-planning course, students may be able to make informed career choices.

The current chapter provides an explanation of the concept of various career theories and social cognitive career theory by applying career development influences to students' career choices, performance, and persistence. The literature suggests that students can learn to make effective career decisions by learning about their beliefs, expectations, and level of career maturity. The current chapter also highlights career planning and interventions in schools to meet the career development needs of students and the economic development needs of the state.

The History of Vocational and Career Guidance

During the time of the industrial revolution, there were a great number of immigrants in the country, poor living and working conditions, and a need for industrial workers. Vocational guidance emerged as a profession in response to these social and economic conditions. Improving industry working conditions and reforming education were the original purposes of vocational guidance (Gysbers, 2001). However, there were different perspectives on the purpose of vocational guidance and training at the start of the 20th century (Gysbers, 2001).

According to Gysbers (2001), a perspective shared by David Sneeden and Charles Prosser on the reason for vocational guidance and vocational training was to sort individuals based on abilities and prepare them for a specific job to help the efficiency of the economy. John Dewey had an opposing perspective of vocational guidance, which was to help students find a purpose in pursuing an education and employment. Both of these perspectives cultivated the Progressive Movement, to improve the underprivileged social and working conditions associated with the Industrial Revolution.

Since the late 1800s, many educational reform initiatives, legislation, career and developmental theories, and social and economic changes have occurred to influence guidance practices in schools (O'Brien, 2001). Frank Parsons, known as the father of guidance, was an early pioneer during the vocational guidance movement (Pope, 2000). Parsons established the first settlement house, the Vocation Bureau of Boston in 1908, which provided immigrants and unemployed workers with vocational guidance and job placement (O'Brien, 2001). The placement of people into jobs to meet industry and immigrant needs was the aim of the new agencies that surfaced during the early 1900s

(Pope, 2000). The Vocation Bureau was the first institution to provide structured guidance and counseling services. The services also were incorporated into Boston public schools (Herr & Shahnasarian, 2001). Another early pioneer, Jessie B. Davis, organized a vocational guidance program in a Michigan school to promote the guidance of students on courses and extracurricular activities (Herr & Shahnasarian, 2001).

Parsons was an advocate for evaluating guidance interventions and programs to develop effective strategies that enhanced vocational potential and research (O'Brien, 2001). However, vocational guidance tenets were not grounded in theory or research. Instead, Parsons applied simple logic and common sense with clients based on observational and data gathering information (Pope, 2000). According to Hartung and Blustein (2002), Parsons' goal for vocational guidance was to use rationality and reasoning to help people make satisfying occupational choices. A three-step model included an understanding of self, an understanding of the work requirements found in various types of occupations, and matching the information about self with occupations (Whiston, 2003).

The scientific procedures of psychological testing and self-assessments became an important element in establishing and justifying vocational guidance methods during the early years (Pope, 2000). The use of psychometrics increased as Alfred Binet published intelligence scales to assist the Paris educational systems with classifying students (Lambie & Williamson, 2004). Educators, social workers, and vocational guidance psychometrics promoted the establishment of the National Vocational Guidance Association (NVGA) in 1913 (Lambie & Williamson, 2004). The U.S. Department of

Labor and the Bureau of Labor Statistics also were founded in 1913. These organizations reinforced the support and growth of vocational guidance (Pope, 2000).

The Army Committee on Classification of Personnel developed and administered tests for occupational classification and selection to use in World War I. There was a public concern about vocational guidance being used for classifying and selection purposes. However, laws that were supportive of vocational guidance received social support. The Smiths-Hughes Act of 1917 established secondary school vocational education training as an important part of the public schools and provided reimbursement for vocational guidance services (Herr & Shahnasarian, 2001).

In the late teens and early 1920s, the term educational guidance emerged, which emphasized aptitude, instruction, and learning rather than providing guidance to help individuals find vocational work (Gysbers, 2001). The change in vocational guidance purposes can be attributed to concurrent movements in mental health, child development studies, and progressive education. During this time, social and industrial issues were not at the forefront of concern. Educational guidance shifted the emphasis from helping individuals choose a vocation to focusing on the personal and educational aspects of individuals (Gysbers, 2001).

During the 1920's, John Dewey proposed that people move through hierarchical stages of cognitive development. Dewey believed the school's role was to help students develop cognitively, personally, socially, and morally. Eventually, the contribution of Dewey's work led to schools integrating guidance strategies into educational curricula to advance student development (Lambie & Williamson, 2004).

Because the economic depression of the 1930s left many adolescents out of school and out of work, a transition in vocational guidance occurred (Herr, 2002). A placement approach in vocational guidance was reemphasized and social and legislative processes, such as the George-Dean Act, provided reimbursement of vocational-guidance services (Herr & Shahnasarian, 2001). The term vocational guidance emerged in schools as helping individuals prepare for an occupational choice and entering the job market. The trait and factor theory created by E.G. Williamson in the 1930s expanded Parsons' vocational guidance tenets of reason and rationality to provide schools with a directive approach to guidance. The trait and factor approach provided students with facts for gathering information in order to make educational and occupational choices (Lambie & Williamson, 2004).

The return of veterans from World War II encouraged the use of classification tests and promoted the importance of guidance and counseling services at the secondary and postsecondary levels. The George Barden Act provided funds for vocational counselors' salaries, counselor-training courses, and travel expenses. The George Barden Act encouraged appropriate course requirements, counselor certifications, and counseling as a profession (Herr & Shahnasarian, 2001). The Vocational Education Act of 1946 provided funds for a federal office, state supervision of guidance, and support for vocational guidance in the schools (Gysbers, 2001).

The mental health movement led to the domination of personal counseling in theory and practice. A clinical approach to guidance was associated with helping individuals adjust to environmental variables, such as religion, society, family, school, and work (Gysbers, 2001). Theoretical contributions and research at the time influenced vocational guidance, the counseling profession, and counseling approaches. Carl Rogers's book Counseling and Psychotherapy: New Concepts and Practices published in 1942 replaced interests in psychometrics by emphasizing psychotherapeutic procedures (Gysbers, 2001). Rogers viewed clients as people that need empathy and a safe environment to explore problems, cope with challenges, and grow towards self-actualization. The term *guidance* was soon replaced with *counseling* in the literature with the onset of Rogers' contributions (Lambie & Williamson, 2004).

The Soviet Union launch of Sputnik in 1957 influenced the counseling services that were provided in schools (Lambie & Williamson, 2004). The impression that America had not succeeded in the space race led to Congress responding by passing the National Defense Education Act (NDEA) in 1958. The intent of the NDEA was to identify students with high math and science aptitude and guide those students to pursue technological careers. The NDEA allocated funds to high schools for employing additional counselors and providing occupational and educational resources, such as tests, to develop local guidance and counseling programs (Herr, 2002). The counseling services involved were the testing of students, identifying students that were competent in math and science, and encouraging them to prepare for college. In addition, the NDEA provided funds to colleges and universities to develop programs that would train professional school counselors and upgrade the qualifications of secondary school counselors (Lambie & Williamson, 2004). During the period in which NDEA provisions supported the career development of students, Donald Super and John Holland advanced career-development and vocational-development theories (Herr & Shahnasarian, 2001). As child and adolescent developmental theory and research were applied to student motivation, performance, educational and career decision-making, the school counselor's role became more comprehensive (Herr, 2001b).

The NDEA of 1958 significantly increased the number of professional school counselors, counselor education programs offered, school counseling literary works, and K-12 school guidance programs (Herr, 2002). In contrast, the mid-1960s was an era of economic recession with high drop out and youth unemployment rates. The purpose of school reform was to expand apprenticeship opportunities, provide more programs to educate students about work, and develop a system integrating educational and work experiences (Herr, 2002). The aim of President Johnson's Great Society initiative and school reform legislation was to prepare students for the workforce through vocational education (Herr, 2002). The Manpower Development and Training Act of 1962 and the Vocational Education Act of 1963 advocated the provision of career guidance for students enrolled in vocational-education courses. The legislation promoted the concept that schools should prepare vocational-education students for the work force and the transition from school to employment (Herr, 2002). The Vocational Education Act Amendment of 1968 emphasized the importance of career programs by expanding guidance and counseling into the elementary schools and providing services to the physically handicapped. The legislation of the 1960s spawned a sudden increase of national and state conferences focused upon career guidance, counseling, and placement (Herr & Shahnasarian, 2001).

The evolution of guidance and counseling to a comprehensive program of student development occurred in the 1970s (Gysbers & Henderson, 2001). The Career Education Incentive Act of 1978, sponsored by the U.S. Office of Career Education, advanced a national model of career education. The School-Based or Comprehensive Career Education Model integrated career development activities and themes into the K-12 curriculum. National, state, and local models emphasized the school counselor's task as providing career guidance and counseling to address educational and workforce needs. School counselors assisted students with identifying career options, understanding the possibilities of these options, and creating educational plans to achieve desired goals or decisions (Herr, 2002).

Legislation and publications during the1980s and 1990s further influenced the direction of school reform and the function of vocational guidance and placement (Lambie & Williamson, 2004). In 1983, the National Commission of Excellence in Education reporting a significant decline in student achievement published *A Nation at Risk*. The report called for the improvement of academic standards, particularly related to science and math, and graduation rates in high schools, to prepare students for college (Herr, 2002). In 1990, the U.S. Department of Labor convened The Secretary's Commission for the Achievement of Necessary Skills (SCANS, 1991) to analyze American workplace demands in determining the ability of the current and future workforce to meet those demands. The commission identified commerce and industrial globalization along with technology growth as the two major reasons why American schools were not preparing students adequately for the workforce. The SCANS report outlined the basic workplace skills needed by all students, such as effective access of technology, problem solving and research, critical and creative thinking, sound decision-making, effective communication, teamwork and conflict resolution, and learning how to seek, secure, and persist in employment. A follow up report (SCANS, 1993) suggested that schools should integrate the skills into all core curricula. For instance, teachers could incorporate thinking critically and creatively into English, math, science, and social studies courses.

The changing workforce and globalization of industry renewed interest in vocational guidance, as reflected in federal legislation, such as the Carl D. Perkins Vocational Education Act of 1984, the Carl D. Perkins Vocational Education and Applied Technology Education Act Amendments of 1990, and the Carl D. Perkins Vocational-Technical Education Act Amendments of 1998 (Gysbers, 2001). The federal vocational education legislation authorized funds for career guidance and counseling programs to concentrate on the career development and employment potential of all students. The various modifications of the Carl D. Perkins Act have been significant in defining comprehensive career guidance programs in schools (Herr, 2002). These changes include the School to Work Opportunities Act of 1994, which supported students transitioning from school to employment (Lambie & Williamson, 2004), and the Workforce Investment Act of 1998 that reinforced career exploration, guidance, and counseling for youth, as well as adults and unemployed workers (Herr & Shahnasarian, 2001).

The Carl D. Perkins Career and Technical Educational Improvement Act of 2006 (Perkins IV) gives emphasis to the academic achievement of career and technical education students, an alliance between secondary and postsecondary education, and state and local accountability. “Perkins IV envisions that all students will achieve challenging academic and technical standards and be prepared for high-skill, high-wage, or high-demand occupations in current or emerging professions in the 21st century global economy” (U.S. Department of Education, 2007, p. 1). Perkins IV requires public schools to implement career and technical programs in at least one or more of the 16 career clusters recognized by the Office of Vocational and Adult Education (OVAE).

Career Clusters and Orientation

The 16 national career clusters are a grouping of occupations comprised of knowledge and skill statements that describe what learners need to know to be successful in a particular cluster or profession. Career clusters also have various plans of study, called career pathways, which list the academic, career, and technical courses and training needed in grades nine through sixteen to prepare students for a range of occupations. The implementation of the 16 career clusters in Tech Prep, career academies, work-based learning programs, magnet and charter schools, and high schools is a way to organize instruction and prepare students for postsecondary requirements and employer expectations (States' Career Clusters Initiative, 2008).

The National Career Technical Education Foundation (NCTEF) established a program called The States' Career Clusters Initiative (SCCI) to help states connect career technical education to school, workforce preparation, and economic development by promoting the implementation of Career Clusters within states. The SSCI activities include working with states, schools, employers, industry groups, and other stakeholders to create curriculum guidelines, academic and technical standards, assessments, and materials for the 16 career clusters (States' Career Clusters Initiative, 2008).

The Office of Vocational and Adult Education (OVAE) use Perkins IV funds to help states incorporate rigorous academic standards for career and technical education programs through the State Scholars Initiative (SSI). The SSI is a national program involving partnerships between state-level business leaders and selected school districts.

The business leaders make presentations to eighth graders and encourage them to complete a rigorous course of study in high school that will prepare them for success in college and a career. The focus is to educate students on various career options, monetary benefits, and to motivate them to compete in a global economy and contribute to the nation's economic growth (State Scholars Initiative, 2008).

Arkansas has adopted all 16 career clusters under the direction of the Arkansas Department of Career Education (ADCE). The course sequences for the 16 career clusters align with specific career pathways or programs of study for curriculum implementation in the public schools (Arkansas Department of Career Education 2007d). Arkansas public schools offer eighth graders a career orientation course that introduces students to the 16 career clusters and a wide variety of career fields. The course helps students understand themselves, the world of work, and the career decision-making process. Students in the career orientation course use hands-on activities and research to explore career interests, required skills, necessary education and training, and labor market information for each of the sixteen career clusters. Students also identify employability and entrepreneurial skills, and establish individual career plans (Arkansas Department of Career Education, 2006).

Feller (1996) characterized career development as a vital proponent of secondary education if educators are going to prepare students for the challenges of a competitive and changing workforce. It is essential that secondary educators ensure that students are prepared to enhance their potential for success in the workplace. The way administrators, educators, and counselors prepare students for the world of work is to nurture students' career development throughout their K-12 schooling. For students to be prepared to meet the demands of a changing workforce, Feller emphasized that educators must make career development a high priority.

According to Hughey and Hughey (1999), some students may not decide on a specific occupation or degree to pursue after high school, but educators should still help prepare students in how to make career decisions. Attainment of career decision-making skills will help students in choosing a major, occupation, or the various options they consider. In addition, students need to learn employability skills to deal with the challenging changes of the workplace as part of their career development.

Schools utilize an assortment of different methods to cultivate student career development. Lane (2000) suggested that school personnel use a scientific method approach early in career development to teach students how to make career decisions. The technology to gather data and diagnostic instruments is available to improve the career decision-making process by assisting students with assessing their strengths. Computer programs and models are also available to help students make better academic, career, and personal decisions. According to Lane, strong interpersonal, decision-making, technological, and information-processing skills, in addition to skills specific to particular careers, will be necessary to be productive in the 21st century.

Career Development Theories and Assessments

Throughout the 20th century, national goals, policies, and legislation contributed to the evolution of vocational and career guidance. Social and economic conditions helped shape the preparation, role, and practices of vocational and career guidance in public schools. School reform pertaining to vocational and career guidance focused on identifying youth or adults based on their ability to perform certain types of jobs or to promote national goals to meet military or scientific needs (Herr, 2001b). During the mid-part of the twentieth century, federal legislation continued to influence vocational guidance and placement practices in schools, while progress in career development theories was being made (Herr, 2001b).

The National Career Development Association defines career development as "the total constellation of psychological, sociological, educational, physical, economic, and chance factors that combine to influence the nature and significance of work in the total lifespan of any given individual" (National Career Development Association, 2003, p.1). The theories applied to explain career behavior are: 1) Frank Parsons' three-step model, which matches people's traits with work conditions and vocational factors; 2) Donald Super's career development across the life span; 3) John Holland's career typology; 4) Frederic Kuder's person match, which describes how career interests can be matched with a range of individuals employed in various occupations; and 5) Albert Bandura's self-efficacy theory. Social Cognitive Career Theory can explain how environmental and learning experiences affect adolescents' career interests and choices.

Parsons three-step model.

At the turn of the 20^{th} century, the industrial revolution transformed the national economy toward mass manufacturing requiring divisions of labor, a skilled labor force, and employing people from diverse cultures (Herr, 2002). People migrating from farms to urban areas to find industrial jobs, immigrants looking for work, child labor, and the need to match people with jobs began the work of Frank Parsons, an early pioneer of career counseling (Herr, 2002). As industrial firms applied scientific management principles to early 20^{th} century jobs, Parsons became interested in industrial education and vocational guidance to alleviate the injustice of forcing children and immigrants to work in factory jobs (Herr, 2001a).

As an educational reformer, Parsons was concerned that the schools were not providing the type of education needed to change industrial society. Parsons believed schools should focus on societal needs and balance academics with industrial education (Herr, 2002). Parsons, as a social reformer, saw a need to connect people's understanding of self with knowledge about job requirements (Collin, 2006). Parsons published a book, *Choosing a Vocation*, in 1909 while he was establishing the Vocation Bureau of Boston as a forerunner for career-counseling centers in the nation (Hartung & Blustein, 2002). The book featured industry and vocational classifications, the various vocational working conditions, and general industry information (O'Brien, 2001). Parsons developed a three-step guidance and counseling model to help individuals with the career decision-making process (Hartung & Blustein, 2002). This model was inspired during a period of educational and social reform because of the management of workers in industrial organizations (Herr, 2001a).

Important studies on counseling procedures and measuring individual differences were being researched in universities in Europe and the United States. However, no scientific basis for vocational guidance or counseling procedures existed at the time (Herr, 2001a). Practitioners began to develop their own counseling techniques and create a knowledge base to build upon. Parsons developed a three-step model to help individuals assess and match their traits with satisfying job options in order to make effective career choices (Herr, 2001a). The three-step model included, first, an understanding of one's aptitudes, abilities, and interests. The second step of the model is knowledge of job requirements, opportunities, compensation, and the different job options available and, third, gathering these facts and using *true reasoning* to help people make satisfying choices (Parsons, 1909). Parsons used *true reasoning* or decision-making methods with schoolchildren, adolescents, and adults to inform them of available job opportunities (Herr, 2001a).

According to O'Brien (2001), Parsons advocated that the role of the counselor was to help clients make decisions instead of telling them which occupation to choose. Counselors were to communicate openly with clients, help them to understand how they project themselves to others, and to overcome obstacles that might impede occupational success. Parsons' vocational and guidance practices were seen as practical and humane in helping people make rational and satisfying occupational choices rather than being forced to choose a job because it was immediate and available (Herr, 2001a).

Parsons pioneered a career decision-making model later inspiring trait-and-factor career counseling approaches (Hartung & Blustein, 2002). Herr (2001a) recognized Parsons' three-step model as advancing the evolution of vocational guidance during the first half of the twentieth century. Practicing counselors continue to facilitate individuals' career decision-making processes based on Parsons' leading principles of discovering self-awareness, exploring information about work opportunities and options, and using this knowledge to choose a career rationally (Hartung & Blustein, 2002).

The research of Donald Super.

The need to match individuals to jobs to create and build a labor force cultivated interests in career development and decision making throughout the 20^{th} century (Collin, 2006). Trait and factor career theories, such as Parsons' are inclined to focus on career-related choices at one point in time. In contrast, Super's theories take a continuing developmental perspective. Super theorized that individuals progress through stages of vocational development acquiring tasks at each stage. In addition, Super's theories take into account the interaction of multiple roles, work, family, educational, and community roles, which an individual manages across a life span.

Super also considered self-concept and career maturity as factors in occupational choice (Savickas, 1997). Super theorized that a person's changing self-concept represents an amalgam of biological characteristics, the enactment of social roles, and interpretation of others' reactions. According to Super, a person selects an occupation based on one's self-concept (Super, 1990).

Donald Super's research since the 1950s incorporated definitions, models, and practices of career development and interventions (Herr, 1997). Viewing entry into the workforce as an event that occurred in late adolescence, Super conceptualized a vocational or occupational decision as a process of choices leading to a career. Super postulated career development as a transitional lifelong process, meeting personal needs for information and assessment of roles, commitments, and identity. This research brought about a change in the direction of career guidance from matching a person to an occupation to focusing on the personal and social characteristics of an individual (Herr, 1997).

Super evolved the life span, life-space approach over four decades to include three segmental theories: career development theory, self-concept career theory, and life-role theory. Super's Career Development Theory (CDT) explained how individuals construct and negotiate their work lives, tasks, and coping behaviors as they develop their careers

(Savickas, 1997). Counselors used the theory to help individuals anticipate tasks, form decisional attitudes and competencies, and engage in vocational coping behaviors. A model that derived from CDT was based on adolescents' career readiness or maturity to make vocational or educational choices. The career maturity model has four dimensions. There are two dimensions on attitudes toward career planning and career exploration. The other two are cognitive dimensions on knowledge about occupations/careers and knowledge about the practice of career decision-making (Savickas, 1997).

Super's Self-Concept Career Theory explained how self-concepts are formed, interpreted, and implemented and how this process affects vocational behavior (Betz, 1994). Young people that have not made the transition into adult career roles lacked the career development needed in adolescence. The initial stage of career exploration focuses on the crystallization of vocational preferences, devising implementation plans for career choices, and committing to the pursuit of training or education needed for the occupation selected. Young people gain career maturity by acquiring self-knowledge and information about careers to base their education and career decisions (Betz, 1994).

Super suggested that life stages are not biologically determined, but influenced by social and psychological factors. The life roles theory explains how individuals balance their work roles among their other life roles while trying to fulfill their personal values. Super's perspective emphasized an array of life roles that interact with one's career experiences. According to Super, individuals will adaptively resolve life situations by recycling through the life stages of exploring, planning and deciding (Savickas, 1997).

Super tried to bring life-stages and role theory together to portray a life span, life-space approach with designated elements and interactions. Super used the Life-Career

Rainbow model to illustrate the different parts of the life span and the roles people play independently or simultaneously. The Life-Career Rainbow depicts the roles that individuals play across their lives and how these roles interact and shape decisions (Herr, 1997).

As described by Herr (1997), Super added to the Life-Career Rainbow concept by designing the Archway model, illustrating how the status of natural resources, economy, the family, and other environmental factors influenced the development of aptitudes, interests, and values. The Archway model allowed counselors to understand a client's situation, foster a client's development and well-being, and to help match the client with occupations that correspond with his/her lifestyle and life roles.

According to Savickas (2005), Super's career development theory has advanced in recent years by proposing that individuals progress through five stages of career development throughout the life span. The stages are growth, exploration, establishment, maintenance, and disengagement. During the growth stage, individuals develop a self-concept and become aware of different occupations. During the exploration stage, individuals learn more about career options and gather specific information about occupations to make decisions based on interests and capabilities. Individuals in the establishment stage focus on advancement, promotion, and stability in their chosen occupation. During the maintenance stage, individuals are deciding whether to maintain their current job status or change their occupational roles. Individuals in the disengagement stage are concerned with establishing a self-concept or image that is independent and separate from work (Savickas, 2005). Super proposed that people recycle through the life career development stages when choosing another career (Super, Savickas, & Super, 1996).

John Holland's career typology.

In the 1960s, John Holland advanced a career development theory predicated upon personality type as the major influence in career choice (Herr, 2001a). The work of Holland and Super led to new career assessments and counseling interventions that were embedded in career theory (Herr, 2001a). In the later part of the 20th century, career development practices were integrated into career intervention programs (Herr, 2001a).

John Holland (1985) viewed career development as a person-environment fit and developed career assessment tools used to assist individuals in choosing satisfying educational programs, work pursuits, and leisure activities. Holland's (1997) typological theory categorizes vocational personalities and work environments into six personality types or codes: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (RIASEC). Holland's approach makes it possible to use the same classification system for both persons and occupations. The typology allows individuals to group their interests and personal characteristics in terms of the six types and combinations of the types. Therefore, an individual's interests, values, and abilities can be assessed by considering their most dominant personality type (Miller & Miller, 2005). Holland based his theory on the assumption that personality types within vocations are similar and that people tend to self-select careers and work environments matching their personality traits (Miller & Miller, 2005).

Holland's RIASEC typology has become a familiar tool used in career guidance and counseling practices to classify persons and work environments. The RIASEC is incorporated into the comprehensive database, Occupational Information Network (O*NET), which provides information about occupations, skills, and job preparation requirements. The O*NET has been included in many computer-based career information delivery systems (Reardon, Bullock, & Meyer, 2007). Most career assessments base individual score reports on the Holland codes for connecting people and occupational choices, such as the Self-Directed Search, Strong Interest Inventory, and the Kuder Career Interest Assessment (Reardon, et al., 2007). The Kuder Career Interest Assessment does not have homogenous scales like the Self-Directed Search or the General Occupational Themes of the Strong Interest Inventory; instead, the inventory has criterion group scales. Matching members of the Person Match pool to the occupations that make up each cluster represents the means of assembly of Kuder career clusters. Members of the Person Match pool are assigned to a given cluster based on the first letter of their Holland code for occupations specified in the O*Net data (Zytowski, 2007). Holland's (1996) premise that one can apply activities in several occupations reinforces the use of career clusters instead of occupational titles to explore occupational options.

Kuder Career Interest Assessment.

Frederic Kuder's (1980) concept that a person can be matched to many individuals that are employed in related occupations based on areas of interests and particular job performance or duties are known as *person match*. The methodology of person match is that "a person might find satisfaction in a job or occupation of another person that is similar to him or her" (Zytowski, 2007, p. 14).

Frederic Kuder's first Preference Record was established in 1939 using a forced-choice model of responding and homogenous vocational preference scales followed by the Kuder General Interests Survey (Zytowski, 2007). The Kuder Occupational Interest Survey emerged which included criterion group scales matching individuals' similarities with groups of people in more than 140 occupations and college majors. The most recent version developed is the Kuder Career Interest Assessment, in which vocational preferences are matched with a range of men and women employed in occupations that represent vocational preferences (Zytowski, 2007).

The internet-based Kuder Career Interest Assessment, a component of the Kuder Career Planning System, provides an online inventory and an interactive report. The internet-based Kuder Career Interest Assessment contains 60 items in a forced-choice triad based on most, next most, and least preferred activities. An individual's Activity Preferences are compared to each of the profiles in the Person Match pool and provided job sketches or descriptions of people employed in occupations similar to their interests (Zytowski, 2007).

A criterion-group scale is used to report the results. Career clusters are reported in rank order by percentile scores. The report contains occupational titles and job sketches or descriptions of people from the top five career clusters. The job sketches describe a person's duties, educational background, and or current occupational position whose preferences are most similar to the inventory taker. The report contains links that are connected to cluster definitions and Person Match sketches or descriptions. The occupational titles listed within the sketches are linked to information provided from the Occupational Outlook Handbook. Additional links provide information on occupations that are available based on educational levels, college majors associated with each cluster, and a college search engine (Zytowski, 2007).

The Kuder Career Planning System not only provides the online Kuder Career Interest Assessment, but also the Kuder Skills Assessment, Super's Work Values Inventory-revised, the Kuder Career Portfolio, and the Administrative Database Management System. Practitioners review individual assessment results using the Administrative Database Management System. The aggregate data can be viewed by cluster, gender, grade level, and ethnicity. Students use the Kuder Career Planning System to take assessments, search occupations, research financial aid, develop a portfolio and resume, and learn about postsecondary opportunities. The Kuder electronic portfolio and resume offer students continued use and the inventory results are maintained in the Kuder Career Planning System (Zytowski, 2007).

Bandura's self-efficacy theory.

Bandura's (1997) self-efficacy theory presented two types of expectancy beliefs: efficacy expectations and outcome expectations. *Efficacy expectations* are beliefs about one's ability to perform the actions required to produce the outcome. *Outcome expectations* represent beliefs that specific actions will result in specific outcomes. A divergence between the two beliefs occurs when individuals believe that certain actions will produce a specific outcome, but doubt that they possess the ability to accomplish the required actions. Self-efficacy beliefs and outcome expectations obtained through learning experiences stimulate interests and inspire behavior (Lent, 2005).

According to Social Cognitive Career Theory (Lent, 2005), positive self-efficacy beliefs may be acquired and learning environments can be altered by applying Bandura's (1997) four learning experiences: personal performance accomplishments, vicarious learning, social persuasion, and physiological and affective states. Personal performance accomplishments have the most influence on self-efficacy beliefs. If students have successful learning experiences and performances in a particular activity, such as math this may increase students' self-efficacy for that task or domain. In contrast, recurring failures in a domain tend to lower self-efficacy for a task or domain (Lent, 2005).

Vicarious learning experiences involve individual's observing others similar to them perform certain tasks. The experience of identifying with others can improve one's perception of inadequacies. Social persuasion is a verbal affirmation within a setting to encourage participation and convince others of their capabilities. Physiological and affective states are influenced by mental and physical conditions that affect perceptions of capabilities. Altering and reducing students' negative emotions by fostering positive emotional conditions encourage students to focus on their capabilities and the current learning situation (Lent, 2005).

Bandura's (1997) self-efficacy theory can be applied to career choice and vocational behavior in the career development of individuals. Self-efficacy beliefs are relevant to career development when choosing a career or succeeding in a specific career. An individual has perceived self-efficacy that could affect career choice options and behavioral consequences. The behavioral consequences of perceived self-efficacy are a selection of approach or avoidance behavior, quality of performance, and persistence in the presence of obstacles or failure (Bandura, 1997).

Betz (2004) suggested that a behavioral consequence of approach versus avoidance behavior applied to career development would be what a person will try or approach compared to what a person will not try or avoid in choosing a career. The causes of perceived self-efficacy, such as performance results, vicarious learning, emotional arousal, or social affiliation may determine the behavioral consequence in an individual. A behavioral consequence could be the educational majors or careers an individual will try or not try (Betz, 2004).

Betz (2004) recommended that an individual's family of origin, gender, ethnicity, and or socioeconomic status influence the causes or sources of self-efficacy beliefs. When applied to career development, a counselor uses the source of information to design interventions that will strengthen and build a client's self-efficacy beliefs during career counseling. Brown and Lent (1996) recommended helping individuals develop a wide range of career options and to counsel those experiencing occupational choice difficulties.

Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT), as elaborated by Brown and Lent (1996), is grounded in Bandura's theory and emphasizes three key variables: self-efficacy, outcome expectations, and goals. The focus of SCCT is on how these variables interact with social and environmental factors (gender, ethnicity, social support, and barriers) to influence career development. According to SCCT, *self-efficacy beliefs* are thoughts about personal capabilities and are responsive to environmental conditions. Positive or negative social, emotional, and physiological experiences can influence self-efficacy beliefs. *Outcome expectations* are beliefs about the consequences or outcomes of performing a particular task. Both types of beliefs guide behaviors (Lent, 2005).

Goal setting directs people in deciding their own educational and vocational behaviors (Brown & Lent, 1996). How well a student works through the goal setting process depends on the cultivation of career interests, exploration, and decision-making skills. The attainment of self-efficacy and outcome expectations, development of career-relevant interests, and formation of career goals or aspirations are skills acquired during the elementary and middle school grades. As children begin to develop their self-efficacy beliefs from positive performance experiences and the outcome of activities, they are learning to form career-relevant goals.

The social cognitive career theory model of interest development suggests that self-efficacy beliefs and outcome expectations developed through different activities can guide children's academic interests, goals, and perceived span of career options. Perceptions of self-competence resulting from the outcome of an activity along with positive performance experiences lead to motivation and continuation of the activity. However, negative perceptions of ability and outcome experiences can lead to activity dislike or avoidance. Children may not consider pursuing these activities as a goal or a career option (Brown & Lent, 1996).

Holland (1985) suggested that barrier perceptions might hinder an individual from finding and entering congruent occupations. Brown and Lent (1996) maintained that educators could apply a social cognitive framework to assist students in developing career options and overcoming barriers to career choice, which limits self-efficacy beliefs. Social Cognitive Career Theory suggests that academic and occupational interests develop from self-efficacy beliefs and outcome expectations. Therefore, many students may have eliminated many occupational choices because of faulty self-efficacy beliefs or outcome expectations that create barriers. These perceptional barriers may keep students from considering their interests as an occupational choice. To counteract the faulty perceptions, counselors can help students acquire new success experiences, review previous performance accomplishments, and determine the benefits from these experiences.

Career possibilities can be restricted at an early age if children are not exposed to activities or experiences that build self-efficacy and outcome beliefs (Lent, Hackett, & Brown, 1999). Restriction of career possibilities also can occur because people acquire inaccurate information about self or occupational outcome expectations. Therefore, efforts to promote positive self-efficacy, outcome beliefs, and the attainment of skills are most effective during the elementary and middle school years so that interests and perceived options are not restricted. Children's own cognitive processes can hinder efforts to improve their self-efficacy beliefs through activity performance. Students may discount their accomplishments and attribute success in performing an activity to other factors, such as luck or the activity was easy, instead of relating achievements to their capabilities.

Advancing the social cognitive viewpoint, Lent, Hackett, and Brown (1999) suggested that interests and skills could develop and change as children have experiences both in and outside of school. A social cognitive viewpoint proposes that many people base their career decisions on other factors besides personal interests. Occupational choices may be guided by financial, educational, physical, or social factors, such as, acceptance from a support system, accessibility options, self-efficacy beliefs, and outcome expectations.

Magnuson and Starr (2000) discussed the relationship between early and middle childhood experiences and life career planning. Children depend on supportive adults to provide learning opportunities and interactive experiences. With support, children can develop skills and attitudes that will strengthen their knowledge and understanding. They develop the ability to incorporate career awareness, exploration, and goal setting as they learn to make decisions about life career planning. Lapan, Gysbers, Multon, and Pike (1997) found that middle school students who form career planning and exploration competencies understand the correlation between learning and work, can obtain information about various jobs, and comprehend the career planning process.

Career Decision-Making and Adaptability

Traditional career development theory emphasized a trait and factor (matching) approach, also known as person-environment fit counseling. Person-environment fit theory suggests that individuals seek occupations or work environments that match their personal characteristics or personality. The information provided from career assessments is used to match individuals to a job. The better the person-environment fit or match, the better the outcome. Counselors usually administered traditional career assessments to individuals to predict career choice outcomes and use the results for career planning and decision-making. Assessment tools were commonly used to match or place people in a career path or work environment based on their interests, aptitudes, values, and personality. Social cognitive theories stressed that individuals pursue certain tasks or careers based on their environmental and learning experiences. People become interested in or will choose a certain career if they have the self-competence or self-efficacy beliefs to perform those specific tasks that will lead to positive outcomes. Eccles (1994) and, subsequently, Wigfield and Eccles, (2000) proffered that self-competence perceptions are linked to increased interest and value for an activity, which leads to spending more time on a task and improving one's skills, resulting in long-term achievement outcomes.

During the 20th century, traditional career development theory dominated counseling practices because occupations during the industrial age required workers to develop *task-specific self-efficacy* or master a fixed set of skills to perform their duties efficiently. The traditional career choice models reinforced the hierarchical stages of matching and decision-making. Workers that accomplished career goals in stages or developed specific skills had the opportunity to move up along a linear career ladder. The traditional approach to person-environment fit counseling by administering assessment tools to place people in a college or work setting to learn and perform specific tasks for certain occupations no longer applies in today's digital age workforce.

According to Van Vianen, De Pater, and Preenen (2009), the conventional linear career path that leads to job stability should be replaced with nonlinear career concepts that require workers to constantly change, learn, and adapt in the 21st century workforce. Future nonlinear career concepts, such as Career Construction Theory suggests that workers in ever changing and unpredictable job markets need to master the art of adaptability as they rapidly learn new knowledge and skills in work environments that shift between activities, jobs, and occupational areas (Van Vianen, De Pater, & Preenen, 2009). Therefore, career adaptability should be the focus of future theory and practice rather than person-environment fit and linear career planning and decision-making.

Gelatt (1989) suggested that the decision-making process included predicting the outcomes, considering the value of the outcomes, and selecting a suitable course of action by applying the scientific method. Gelatt (1989) proposed a counseling framework to decision-making called *positive uncertainty* to help clients become positive, comfortable, and confident when challenged with uncertainty. Gelatt (1989) issued guidelines in the event of uncertainty to recognize that information is limited, changing, and subjectively perceived. Maintaining that the counselor's role in the decision-making process is to facilitate while clients create goals, he recommended that clients use rationality, imagination, intuition, and flexibility.

Gati, Krausz, and Osipow (1996) viewed an ideal career decision maker as a person possessing awareness of the need to make a career decision and capability of making the right decision. Gati et al. proposed a taxonomy that included several categories of difficulties in making career decisions. The first major category, Lack of Readiness, included three difficulty categories, lack of motivation, general indecisiveness, and dysfunctional beliefs arising prior to the outset of the career decision-making process. The other two major categories, Lack of Information and Inconsistent Information, may arise during the actual career decision-making process.

According to Scott and Bruce (1995), there are five decision-making styles: rational style, intuitive, dependent style, avoidant style, and impulsive decision-making. The dependent, avoidant, and impulsive styles reflect indecision. Previous research and researchers recommended that a lack of career maturity, career competencies, and self-efficacy were determinants of career indecision (Creed, Prideaux, & Patton, 2005).

John Crites (1978) defined *career maturity* as the ability to select proper career choices, the awareness needed to execute a career decision, and the resultant realism and consistency of decisions over time. An alternate definition of career maturity is an individual possessing the requisite knowledge and ability to make informed career choices. The individual's readiness to make a logical, age-appropriate career decision and to cope with necessary career development preparation and tasks determines one's level of career maturity (Levinson, Ohler, Caswell, & Kiewra, 1998).

Crites's (1978) career maturity model includes both cognitive and affective dimensions. The cognitive dimension is represented by career choice competencies, whereas the affective dimension is represented by attitudes toward the career decision-making process. Crites (1997) supported relationships between career maturity and various career development factors, including higher career decision-making self-efficacy, an internal locus of control, career decidedness, realistic occupational expectations, and higher levels of career salience. The behavioral areas that have lower self-efficacy may limit career options or the success needed with which desired career options are achieved.

Levinson, Ohler, Caswell, and Kiewra (1998) asserted that one could identify an individual's career decision readiness by using tests and inventories that measure career maturity. Levinson et al. also maintained that one could use tests and inventories to identify personal knowledge and skill deficiencies, thereby enhancing realistic and informed decision-making. An individual's readiness can provide the basis for further exploration of interests, aptitudes, work values, and personality.

Powell and Luzzo (1998) evaluated the factors associated with the career maturity of students that included sophomores, juniors, and seniors from four urban high schools. The 253 participants completed the Assessment of Attributions for Career Decision Making and the revised Career Maturity Inventory. Results indicated a significant, positive relationship between career decision-making skills/competencies and attitudes toward the career decision-making process. The analyses revealed that an individual's attribution style related to attitudes toward the career decision-making process. In other words, individuals that believe they are responsible and have control over their career decisions have a general positive attitude toward career decision-making.

Traditional career development theory proposed by Holland (1985) emphasized that individuals seek out work environments matching their abilities, attitudes, and values. While Super's (1990) approach to career choice focused on attaining goals at different stages throughout the life span, Social Cognitive Career Theory (Lent, Brown, & Hackett, 1994, 2000), suggests that personal and contextual experiences, whether positive or negative, form an individual's occupational interests and choices. These well-known career theories imply that personality or learning experiences shape an individual's career development along a linear and fixed path.

Previous research and counseling practices focused on person-environment fit and the role of self-efficacy in career development. Subsequent career theory emphasized that individuals form choices through adaptation rather than maturation to construct a career. Career adaptability pertains to the life stages and associated role transitions experienced by individuals, as well as the coping strategies used to deal with these changes (Savickas, 2005). Career adaptability is an essential concept fundamental to the theory and practice of career construction (Savickas, 2002). Career construction methods are used to help individuals in understanding and drawing meaning, purpose, and direction from their vocational behavior. Counselors can apply career construction methods to assist individuals with developing strategies for coping and adjusting to the rapid learning, flexible and transitional roles expected in today's changing workforce by helping individuals evaluate their work and social expectations and how they respond to changing circumstances (Van Vianen, De Pater, & Preenen, 2009).

Savickas (2005) extended Super's five stages of career development (growth, exploration, establishment, maintenance, and disengagement) by defining four dimensions to help explain the problem-solving and coping strategies that individuals use to adapt to work. The four dimensions of the Career Adaptability Model are Concern about the future, Control over your life, Curiosity about careers, and Confidence to deal with barriers (Savickas, 2002, 2005). Individuals form distinct attitudes, beliefs, and career planning, selection, and adjustment competencies across Super's stages as part of the career adaptability development process (Savickas, 2005). Counselors and researchers apply the Career Adaptability Model to implement career interventions and evaluate their effectiveness and or encourage career adaptability in childhood and throughout the life span (Savickas, 2002).

Hartung, Porfeli, and Vondracek (2008) acknowledged that vocational development and career adaptability initiates during the childhood period and continues throughout the life span. However, personal and contextual factors may cause the rate and degree of career adaptability to vary given the individual. By enacting a short-term rather than long-term career focus, people can become more adaptable, choosing *good* options rather than the *greatest*, focusing on mastery of divergent roles rather than unchanging ones, and modifying behaviors to adapt to the environment rather than attaining stability.

The traditional theories and concepts of developmental stages, fixed roles, and job stabilization of the past do not apply to workers in future careers. Traditional career theory practices will not be suitable in helping individuals cope and adapt their behaviors to the constant learning and role flexibility expected in nonlinear careers. According to Van Vianen, De Pater, and Preenen (2009), the focal point of future career theory and practice should be career adaptability rather than decision-making. Adaptability has become a necessity in today's rapidly changing workforce. Adapting to changing job demands and conditions is essential for workers to remain productive and maintain employment. Therefore, adaptability is a fundamental attribute in the ever changing, competitive, and future workforce (Hartung, Porfeli, and Vondracek, 2008).

Today's Workforce and Economic Growth in Arkansas

According to the National Association of Manufacturers (2006), today's advanced manufacturing careers require individuals to have math and science ability and skills. Students are not taking the necessary math and science courses nor do they understand how these subjects translate into future careers. The United States is not producing enough skilled workers because students are not receiving up-to-date career guidance or the coursework to prepare them for future careers in manufacturing (National Association of Manufacturers, 2006).

According to Mazzeo, Roberts, Spence, and Strawn (2006), public education and training systems need to coordinate efforts with business and industry to meet the labor market needs in communities. Economic development, education, and workforce development policymakers need to know the labor market demands to meet the needs of business and industry. They must also work with development agencies to support strategies that promote economic growth and development (Mazzeo, Roberts, Spence, & Strawn, 2006).

Many communities do not understand that businesses and schools must work together to make the connection between workforce and economic development (Delano & Hutton, 2007). The workplace trends of the 21st century could affect the economic growth of these unprepared communities. The workplace trends include the retirement of baby boomers, which could influence the labor market and the shortage of skilled workers, and many communities training their own employees because they lack the critical thinking, problem solving, advanced communication, and math skills needed to compete in a global economy (Delano & Hutton, 2007).

Economists would agree that the world has transformed from an industrial economy to an economy characterized by instantaneous communication and information, fast decision-making, and a need for intellectual skills to address economic, social, or political issues (Niijhof, 1998). The new economic world consists of global activity, changing market demands and standards, and high-tech computers. The business environment is a place where roles and duties are constantly changing rather than workers just having knowledge of specific skills or tasks (Wirth, 1992). The workers who are adaptable and learn how to learn by acquiring new skills and knowledge are the people who will be in demand and earn higher wages (Friedman, 2005). This new economic reality differs greatly from the agricultural and industrial environment that promoted vocational education in public schools a century ago (Wirth, 1992). The influence of technology on 21st century work skills involves students acquiring digital-age literacy, inventive thinking, effective communication, and high productivity (North Central Regional Educational Laboratory, 2003).

Educational systems should offer career awareness programs to students early in the local schools. The local schools should provide a general curriculum to meet the needs of the college-bound and non-college bound students. Career programs and training standards should meet the needs of business and industry (Arkansas Department of Economic Development, 2006). A high quality education system on the primary, secondary, vocational/technical, and higher education levels is the key to a community's development. The economic advantages of having high quality educational systems is the ability to attract new companies to Arkansas and encourage the continued growth of current businesses (Arkansas Department of Economic Development, 2006).

An educational system contributes to a strong economy by supporting School-to-Work and Career Pathways programs (Arkansas Department of Economic Development, 2006). Businesses are dependent on public education and training systems to supply them with a knowledgeable workforce to be competitive in a global economy (Jenkins, 2006). In Arkansas, local organizations are responsible for industrial recruitment efforts, such as chambers of commerce, industrial development corporations, and city government committees. Communities develop an action plan to attract industry to their communities by creating jobs that match the labor force to industry and the training and infrastructure that is needed (Arkansas Department of Economic Development, 2006). The percentage of workers employed in the manufacturing sector in Arkansas exceeds the national average by more than six percent. The multitude of workers and successful record of accomplishment Arkansas has in attracting industry will allow many communities to continue recruiting manufacturing companies to Arkansas (Arkansas Department of Economic Development, 2006).

There is a high demand for industry workers that possess postsecondary training or credentials, technical skills, and the ability to learn quickly. These workers understand how to incorporate an entrepreneurial approach to work and career management. In today's economy, workers need these skills to earn family supporting wages and businesses need workers to possess these skills in order to compete globally. Educational leaders and policy makers understand the need for regional economies to attract and retain workers in order to grow and survive (Jenkins, 2006).

Factors Affecting Interest in Math and Science Careers

Hidi and Renninger (2006) proposed a four-phase model of interest development to describe how interest influences a person's attention, goals, and learning. The model includes phases identified as *triggered situational interest*, *maintained situational interest*, *emerging individual interest*, and *well-developed interest*. Accomplishment of challenging tasks, the emergence of opportunities, or help from others can support and develop a person's interest. Accordingly, self-effort, the environment, or other individuals can support interest development. However, any phase can become undeveloped, regressive, or nonexistent without the support of others.

According to Hidi and Renninger (2006), *triggered situational interest* arises from short-term exchanges among affective and cognitive processes. The affective component describes the positive or negative emotions a person has while being engaged in an activity, while the cognitive component describes the mental and physical interface between an individual and a specific activity. Unexpected information, personal relevance, and zeal for the activity can trigger situational interest. Group work, puzzles, computers, and hands-on learning encourage situational interest. Reengagement in particular activities over time may lead to more developed phases of interest.

Maintained situational interest involves focus and perseverance in a given activity over an extended period. Meaningful or personal task involvement maintains the situational interest. Project-based learning, cooperative group work, and individual tutoring can contribute to maintaining situational interest by promoting meaningful and personal involvement. Further engagement or more developed forms of interest may or may not result from a maintained situational interest (Hidi & Renninger, 2006).

According to Hidi and Renninger (2006), *emerging individual interest* is the beginning stages of seeking repeated engagement in particular activities over time because of positive feelings, acquired knowledge, and stored value. Based on previous experiences, an individual values and chooses to engage in and align with the emergent interest. The individual is curious and frequently generates questions about the content or activity and may exceed tasks in their work. The individual is resourceful in answering questions, anticipates steps in producing work, and considers the work effortless. Unlike the first two phases relying primarily upon external sources, the individual generates an emerging individual interest, but not exclusively. An emerging individual interest partially relies upon external support, such as role models, peers, and experts to increase knowledge by providing challenging tasks, opportunities, and encouragement when encountering difficulties. Instruction or learning environments promote development of an emerging individual interest. A well-developed individual interest may or may not result from an emerging individual interest.

The fourth phase in the Hidi and Renninger (2006) model of interest development is *well-developed individual interest*, representing the regular effort to reengage in particular activities over time because of positive past impressions of particular content or activities. A well-developed individual interest has the same characteristics of task or activity engagement as an emerging individual interest. A well-developed individual interest can maintain long-term productive and innovative activities and create effective strategies for completing tasks and solving problems. Although self-generated, well-developed individual interest may benefit from external support, such as role models, peers, and experts to increase knowledge. Persons possessing well-developed individual interest will persevere in carrying out work even during times of frustration. Personal interaction and knowledge-building work can facilitate the development of well-developed individual interest.

Hidi and Renninger (2006) suggested ways that teachers could improve educational interventions and practices by helping students develop their academic interest. In the initial phases of interest development, learning environments supporting positive affective responses may predicate further interest development. Teachers need to support students to develop and sustain interest. Students' feelings of self-efficacy may cause students to rely less upon external support as interest develops. During the transition from external to internal support, students acquire knowledge and skills to generate and answer their own curiosity questions. Curiosity questioning allows students to apply their current understanding to different challenges causing them to seek additional information. As individual interest emerges in the late phases, teachers should encourage curiosity questioning and expose students to role models that engage and challenge their thinking.

These questions can lead to understanding, connecting, and seeking additional knowledge and perseverance in a particular domain of interest. The process of engagement and interest development normally persists with support from teachers and others.

Eccles et al. (1983; Eccles, 2005) developed an expectancy value model of achievement-related choices to explain individuals' expectations for success and value assigned to task achievement. Expectations for success depend on an individuals' self-belief in their abilities and the perceived level of difficulty involved in mastering the task. Individuals form self-efficacy and task difficulty beliefs over time, shaped by subjective understanding of experiences related to school subjects and activities.

Eccles et al. (1983; Eccles, 2005) theorized that several factors influence subjective task value, including interest value, utility value, attainment value, and cost. Interest value is the enjoyment one gets from engaging in the task or activity. Utility value is the task or activity requirements needed to accomplish short or long-term goals. Attainment value is the correlation between a task and an individual's concept of self-worth and identity. Cost is the sense of loss one experiences after selecting a specific choice or pessimistic feelings related to a particular decision.

According to Eccles et al. (1983; Eccles, 2005), an individual's interests, values, and success expectations guide educational and occupational choices. Concepts of self-efficacy and outcome expectancies associated with various tasks form the bases for choices. The development of self-concept and interest has an internal and external component that influences beliefs over the course of time. The internal aspect is one's own beliefs about self and the external aspect or socializing process is others' beliefs about one's ability. Ferry, Fouad, and Smith (2000) found that socializing factors, such as parent support had significant effects on self-efficacy, outcome expectations, and math and science career interests among middle school students. Other socialization processes, such as gender, social class, religion, and ethnic group may also influence choices, as well as, the amount of time invested in pursuing one activity over another (Eccles et al. 1983; Eccles, 2005).

Eccles (2005), as well as Jacobs (2005), discussed the findings and implications of research conducted over the past twenty-five years on gender differences in math and science career choice. Gender differences relating to course planning, course selection and career aspiration in math and science still exist, but these differences were not due to math achievement because the gender gap in math performance has narrowed over the years. The gender differences in math participation are explained by adolescents' interest in math, perceptions of their ability in math, and expectations for success in math (Watt, 2005). Previous research results have shown that males possessed greater self-efficacy related to math ability, as well as higher values or interest in math than did females. Males also tended to select more difficult math courses than did females. Furthermore, actual and perceived social support continue to represent a vital role in students' educational and career selection decisions associated with math and science related fields (Eccles, 2005; Jacobs, 2005).

Betz and Hackett (1983), while investigating factors that promote interests in math and science careers, recognized that mathematics acts as a screening process that affects entry into scientific and technical careers. Fouad and Smith (1996) found that mathematics self-efficacy, math-related outcome expectations, and gender role socialization predict career interests in math, perceived career opportunities related to math and science, and academic and occupational choices among middle school students.

Hyde, Fennema, and Ryan (1990) suggested that the low representation found among women and minority groups in science and engineering is influenced by low levels of mathematics self-efficacy. Self-efficacy was identified as a critical factor in women's decisions to pursue non-traditional careers that were representative of Holland's Investigative and Realistic career types (Betz & Hackett, 1983).

Hackett and Campbell (1987) found that male college students display significantly greater self-efficacy in science and mathematics than do female college students. They also concluded that self-efficacy produced in males an interest in math and science. Lowered mathematics self-efficacy is a likely contributor to the relatively low number of women in the science and engineering fields because mathematic skills are required for working in those fields (Hackett & Campbell, 1987).

Career interest patterns are related to gender differences and gender stereotyping of occupations (Lapan, Adams, Turner, & Hinkelman, 2000). Gottfredson and Lapan (1997), through their circumscription and compromise theory, explained that socio-cultural learning experiences form a person's perception of what types of gender appropriate roles and behaviors are associated with specific occupations. This type of gender role socialization is a social-cultural variable that influences career choice (Lent, Brown, & Hackett, 1994). Individuals consider or eliminate occupational choices depending on how compatible an occupation is with his or her gender self-concept (Gottfredson & Lapan, 1997).

Ji, Lapan, and Tate (2004) measured 334 eighth grade students in terms of career interest, level of self-efficacy, and occupational sex-type ratings by using the Mapping Vocational Challenges (MVC) instrument. Career counselors selected 45 occupations that best represented each of the Holland Codes (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional). The students assigned each of the 45 occupations to a sex type based on their perception of men and women employed in that occupation. To measure self-efficacy, the students determined which occupations they felt capable of performing successfully. The results showed that girls had higher career interest and level of self-efficacy ratings than boys for those Holland Code occupations that were rated as employing mostly women. Boys had higher career interest and level of self-efficacy ratings than girls for those Holland Code occupations that were rated as employing mostly men. The eighth grade students, who perceived occupations as employing more of their own sex, also expressed higher interest and efficacy for those occupations (Ji, et al., 2004).

Lapan and Turner (2002) found that middle school adolescents' self-efficacy concepts related to particular careers, effectiveness of career planning/exploration, and perceptions of parental support interactively predicted occupational interests across Holland-type themes. Participants' perceptions accounted for gender and gender-typing differences. Participants perceived male employment as predominant in Realistic and Investigative careers, with boys having greater career interest as compared to girls. Conversely, participants perceived female employment as predominant in social careers, with girls having greater career interest as compared to boys.

Hackett, Esposito, and O'Halloran (1989) identified a lack of female role models in non-traditional careers as a barrier for women entering non-traditional professions. Smith and Erb (1986) found that female students' perceptions of role models represented a critical factor related to pursuit of non-traditional careers. Role models provide vicarious learning experiences that increase self-efficacy, which influences interests and choices in various career and educational fields (Bandura, 2000). Quimby and DeSantis (2006) found that role model influence and self-efficacy accounted for a significant variance in women's career choices for each of Holland's RIASEC types as indicated by multiple regression analyses.

Parental support and perceived parental expectations have been associated with career expectations in adolescence (Rojewski & Yang, 1997). Secure attachment relationships with parents have been associated with greater self-exploration, environmental, and non-traditional exploration (Ketterson & Blustein, 1997). Research on Mexican-American high school girls found that perceived paternal support from fathers correlated with the girls' academic plans and career expectations (McWhirther, Hackett, & Bandalos, 1998).

Turner, Steward, and Lapan (2004) tested a causal model and found that sixth graders' *math self-efficacy* was predicted by career gender typing, parental support for pursuing math and science careers, and family structure. *Math outcome expectations* were predicted by career gender typing and mother's support. *Math and science career interests* were predicted by math self-efficacy and outcome expectations. The study was based on Social Cognitive Career Theory, which provided both biological and environmental factors to explain math self-efficacy and outcome expectations as they predict career interests in math and science (Turner et al., 2004).

Koszalka, Grabowski, and Darling (2005) found that the use of regular web and human resources predicted science career interest for boys and girls. The use of web resources significantly predicted girls' interest in science careers, but did not predict boys' interests in science careers. The researchers hypothesized that the girls' interests in science careers may relate to participating in more collaborative and explorative activities during science class.

Gottfredson and Lapan (1997) suggested that career-related self-efficacy interventions could expand adolescents' circumscription or acceptable career options. O'Brien, Dukstein, Jackson, Tomlinson, and Kamatuka (1999) showed that engaging adolescents in the use of career interest inventories results to explore career options increased the volume of careers considered. Additionally, adolescents' engagement with career interest inventories improved the congruency between occupational interests and potential choices. Linver and Davis-Kean (2005) suggested that interventions designed to influence girls' interest in math related fields need to focus on academic achievement, parental support, and interest and self-concept at an early age. Parental support for girls could encourage an early interest in math activities and a sustained interest in course selection in later grades. For boys, since research concludes that most already have a high interest and self-concept in math, parental support is important for sustaining their math grades throughout the school years.

New Manufacturing Curriculum and Career Interventions

The integration of the new manufacturing curriculum into the career orientation classes aligns with labor market needs to help alleviate the shortage of workers by promoting high-demand, high-skilled, high-wage manufacturing careers that will impact economic development and the ability to attract industry to Arkansas (J. Davidson, personal communication, October 12, 2007). The concept of the new manufacturing curriculum is to offer students an opportunity to explore and learn about careers in manufacturing using their own skills and interests (Career Communications, Inc., 2006). The curriculum integrates academic, vocational technical, and employability competencies to encourage students to recognize the relationship between schoolwork and the real world. The goal is to inform students of the knowledge and skills needed for careers in manufacturing and the career opportunities that are available. This curriculum also provides students with opportunities to explore occupationally specific skills, contextual learning experiences, and the workplace basics to prepare for the transition to postsecondary education/training and or the workplace.

Brown et al. (2003) conducted meta-analyses of literature related to career choice interventions, identifying five vital factors individually associated with career choice outcome and collectively related to increases in career choice effect sizes. The five critical ingredients for career choice interventions include: (a) workbooks and written exercises requiring participants to write goals, future plans, and career analyses, (b) individualized interpretation and feedback relating to test results, goals, and future plans, (c) gathering information on the world of work and on specific career options while in session, (d) exposure to career exploration and decision-making models, and (e) activities designed to help participants build support for their career choices and plans. Brown et al. suggested that one could improve the effectiveness of career choice interventions, regardless of research design, with the inclusion of the five critical ingredients. The researchers also found that interventions that included none of the five critical ingredients yielded an average effect size of .22. Adding one, two, and three critical ingredients yielded average effect sizes of .45, .61, and .99, respectively.

Dawes, Horan, and Hackett (2000) examined the effects of a 7-week intervention program on the technical/scientific self-efficacy and career interests of seventh and eighth grade students. The intervention consisted of twenty-one modules that included hands-on activities involving specific tasks in a particular technical or scientific field. The participants chose three of the twenty-one modules to complete during the 7-week program. The intent of the intervention was to promote students' self-efficacy beliefs by providing students' with positive learning experiences as they performed the technical or scientific activities. The intervention was designed based on tenets derived from a social cognitive viewpoint associated with self-efficacy theory. Lent et al. (1994) suggested that individuals develop self-efficacy beliefs and outcome experiences by performing different activities. The beliefs and experiences could influence career interests, leading to influence upon career choice goals, which, in turn, affect career decision-making.

The Dawes, Horan, and Hackett (2000) study included 72 experimental group participants and 67 control group participants. Dawes, Horan, and Hackett predicted that student mastery experiences and performance accomplishments throughout the intervention program would improve students' decision-making toward technical/scientific careers. Pre- and posttest instruments were administered to assess the students' general and technical/scientific self-efficacy, general and technical/scientific career interests, and intended career choice and major.

Dawes, Horan, and Hackett (2000) found no significant treatment effects in this study. The researchers did report effects unrelated to the intervention. Pre-test scores indicated no pre-test differences between participants in the experimental and control groups. Females showed less technical/scientific choices than did males on intended major, while eighth graders scored higher than seventh graders on general self-efficacy and general career interest.

After the experimental group received the intervention, post-test scores indicated that the seventh graders had greater general self-efficacy, while the eighth graders scores declined. Males and females had comparable specific career interest in the eighth grade, while the seventh grade females scored lower than the males. Overall, females had lower specific career interest scores than the males. Students in the experimental group had higher specific career interest than the control group (Dawes, Horan, & Hackett, 2000).

Falco, Crethar, and Bauman (2008) examined the effects of a 9-week curriculum intervention, Skill-Builders, on middle school students' attitudes toward mathematics learning by using a pretest-posttest comparison group design. The Attitudes Toward Mathematics Inventory (ATMI) was administered as a pretest and posttest to 228 sixth graders involving four comparison classes and four treatment classes. The ATMI has four subscales: self-confidence, value, enjoyment, and motivation. The Skill-Builders curriculum was implemented in the treatment classes while the comparison classes received regular math instruction. The Skill-Builders was created based on concepts from social-cognitive theory and expectancy-value theory. The lessons were designed to foster students' self-competence in time management, goal setting, study habits, and help seeking behaviors related to learning mathematics. The purpose of the intervention was to improve students' self-efficacy beliefs toward mathematics learning, in return, increasing their interest and occupational choices in math.

The differences in ATMI posttest scores between the treatment and comparison groups by gender were significant. On the posttest scores, females in the treatment group scored higher than did females in the comparison group on all four subscales and the total score. Males in the treatment group scored higher than did males in the comparison group on value and total score. Both males and females receiving the Skill-Builders curriculum scored significantly higher from pretest to posttest. Gains for females were significantly greater than males. Falco, Crethar, and Bauman (2008) indicated that the findings support self-efficacy and expectancy-value theories that enhance students' self-competence beliefs in a particular domain, such as math, should improve students' value perceptions, satisfaction, and motivation in that particular domain, which also might influence their interest and decision-making toward math-related occupations.

Fouad (1995) implemented a one-year intervention, *Career Linking*, at an urban inner-city middle school to promote math and science career awareness in one eighth-grade unit. The intervention was infused into the math, science, English, and history curricula in eighth grade. Eighty-one students received the intervention and 58 students comprised the control group in another unit. A six-week unit was developed and repeated throughout the year for each of these career fields: health occupations, natural sciences, engineering, robotics, and service occupations. Each six-week unit consisted of Week 1) introducing students to a specific career field, Week 2) group field trip to businesses in a specific career field and activity assignments, Week 3 and 4) guest speakers in specific career fields, Week 5) job shadowing in a specific career field, and Week 6) student evaluations on a particular career unit.

Fouad (1995) tested five hypotheses regarding the *Career Linking* intervention. The Cognitive Vocational Maturity Test (CVMT) was administered to experimental group participants before and after the intervention to test whether the *Career Linking* units increased students' occupational knowledge. The Coopersmith Self-Esteem Inventory (CSEI) was administered to experimental group participants before and after the intervention to test whether the *Career Linking* units increased students' self-esteem. The third hypothesis was that the intervention would increase students' achievement and effort in math and science. The fourth hypothesis was that the intervention would result in the students making a high school choice based on interest. The last hypothesis was that the intervention would increase students' math and science course selection and achievement in high school.

Fouad (1995) found a significant difference in time effect for the experimental group pre- and posttest means and standard deviations on the CVMT subscales for learning more about fields of occupations, attributes required in various occupations, and duties. Fouad compared the experimental group pre- and posttest means and standard deviations on the CSEI. Fouad found significant time effects for one subscale: Social self-esteem, and for the Total self-esteem scale. Fouad analyzed math achievement and effort grades for the experimental and the control group, finding that the experimental group scored significantly better than did the control group.

Fouad (1995) found a significant difference between the groups on high school choice. Of the experimental group participants, 70 % chose a magnet school and 18 % chose an attendance area school. By contrast, 39 % of the control group chose a magnet school and 47 % chose an attendance area school. For the final hypothesis, there were significant differences between the control and experimental group in math and science courses taken. Minority students in the experimental group exhibited a greater propensity to take advanced math courses than did minority students in the control group. White male students in the experimental group exhibited a greater propensity to enroll in advanced science courses than did white male students in the control group.

Based on the research findings, Fouad (1995) recommended that the career awareness intervention, *Career Linking*, be replicated along with implementing career exploration and decision-making activities. These additional activities would help students identify their areas of interest and link how the field trips and guest speakers' relate to their own interests and abilities. In addition, Fouad suggested providing students an opportunity to observe role models and experience the world of work in ways relevant to their studies to help minority students make better and more informed choices.

Turner and Lapan (2005) evaluated the effectiveness of a career-related intervention, Mapping Vocational Challenges (MVC), used with 160 students from two ethnically diverse middle schools. The MVC is a computer-assisted intervention designed to enhance vocational interests in non-traditional careers and increase self-efficacy in career planning, exploration, and educational planning for specific occupations. The Unisex American College Testing Interest Inventory Revised (UNIACT-R), a 90-item interest inventory based on Holland's RIASEC themes, and the Missouri Comprehensive

Guidance Survey (MCGS) to measure self-competence were both administered to the treatment and control group participants as a pretest during the first week and a posttest during the fourth week. The treatment group received the MVC intervention during the third week.

The researchers recognized that gender differences act as a critical factor when selecting career paths or occupations. The researchers applied Gottfredson's (1981; 2002) Circumscription and Compromise Theory (CCT) to explain that occupational interests are formed by one's socialization experiences. By age nine, young people begin to identify or associate specific occupations with the gender mostly employed in that occupation, which may limit their choices for pursuing non-traditional careers. Based on the premise of CCT, the researchers developed the computer-assisted intervention to address potential occupational gender typing by increasing students' career-related self-efficacy and interests in non-traditional careers.

The MVC intervention was implemented with the treatment group and contained three modules: career exploration, career mapping, and interpretation. The career exploration module contained educational and occupational information for 250 different jobs displayed as cards on the computer screen. Students navigated among job cards by clicking on the cards to explore the specific occupational information. The career-mapping module consisted of a grid comprising an individual's occupational interests. To complete the grid, students rated 90 occupational titles presented in sequence. Students rated their interest levels in the occupation, perceptions of the number of men as compared to women working in that occupation, self-efficacy, and parent support perceptions for pursuing the occupation, and their assigned value for the occupation.

Students' ratings for each occupation produced scores used with the interpretation module.

During the interpretation module, students were provided instruction on how to interpret their individual career maps. The career maps were used to engage students in a group discussion about the educational and occupational opportunities available in non-traditional careers. A description of Holland's theory of occupational themes and Gottfredson's theory of gender-role socialization were discussed with the students. The group leader and students continued to discuss relationships between career interests and perceptions of gender typing of assorted careers. The intent of the discussion was to increase students' understanding of employment opportunities in non-traditional careers, thus, expanding possible career options based on their career interests (Turner & Lapan, 2005).

The results of Turner and Lapan's (2005) study showed that participation in the MVC, computer-assisted career intervention activities, increased the career-related self-efficacy of adolescents and their interests in non-traditional careers. Turner and Lapan found significant gender differences on pretest interest scores for males and females. Males favored realistic careers as compared to females, while females preferred social and conventional careers in comparison to males. For the control group, males experienced a significant decrease in artistic career interests. For the treatment group, the results indicated a significant increase in pretest to posttest scores for career planning and exploration efficacy and educational and vocational development efficacy. Males experienced significant increases in artistic, social, and conventional interests, while girls experienced significant increases in realistic, enterprising, and conventional interests.

Hirschi and Lage (2008) developed and evaluated a career workshop intervention to promote seventh graders' career choice readiness. The 334-student sample consisted of 156 students in the treatment group and 178 in the control group. The contents and process of the two-day career workshop were based on models from a Cognitive Information Processing (CIP) approach and the critical ingredients for effective career choice interventions as identified by Brown et al. (2003).

According to the CIP approach, counselors assist students in developing career problem-solving abilities independently (Sampson, Reardon, Peterson, & Lenz, 2004). The Pyramid of Information Processing Domains was presented to students as a model for career decision-making. The career workshop modules dealt with self-knowledge, knowledge of occupations, decision-making skills, and the career decision-making process.

The critical ingredients for effective career choice interventions, identified by Brown et al. (2003), were included in the career workshop by, first, exposing students to role models who had successfully mastered the career decision-making process. Second, students were provided individualized feedback relating to their career decision-making process. Third, students were encouraged to seek career information outside of the career workshop. Fourth, students were provided with recent information about career opportunities. Fifth, students wrote and compared different career options. Sixth, students wrote future plans and goals involving the steps in the career decision-making process. Seventh, students were provided assistance with developing a support network (Hirschi & Lage, 2008).

Hirschi and Lage (2008) administered four inventories, the Career Maturity Inventory for career decidedness, the Career Development Inventory for career planning, the Career Development Inventory subscale for career exploration, and the Vocational Identity Scale for interests, strengths, and values as a pre-and posttest to assess the students' degree of career choice readiness or outcomes. The researchers employed a Solomon four-group design, accompanied by a three-month follow-up, using two treatment and two control groups to evaluate intervention effectiveness. One treatment group and one control group completed a pre-test while the other two groups only completed the post-test and follow-up. The researchers randomly assigned two classes to the non pre-test groups within the treatment and the control group.

Hirschi and Lage (2008) found that the pre-test had no significant influence on the four outcome measures for either the treatment or the control group. Accordingly, the pre-test exhibited no significant influence on treatment outcome measures. Treatment group students showed significantly higher values on the posttest than did the control group for all outcome measures. At the follow-up stage, treatment group students still scored higher for every measure as compared to the control group, although differences for career decidedness and career planning were no longer significant. A significant increase in the control group's outcome measures for career decidedness and career planning from the posttest to the follow-up test accounted for the follow-up results, not because of any decrease in the treatment group measures of career choice readiness.

Theoretical and Conceptual Conclusion

The basis of the study is the evolution of vocational education and guidance, career choice theories, and the shortage of a highly skilled manufacturing workforce in

Arkansas. Political, economic, and social factors occurring in the United States in the late 1800s influenced vocational education and guidance movements at the time (Stephens, 1970). Career theories and practices emerged in the early 1900s out of a concern for the lack of industrial revolution workers, matching immigrants with available jobs, and the need for educational reform to address these changes (Herr, 2001a). In the following years, new research indicating individual differences associated with educational and vocational job performance stimulated guidance workers to use testing for predicting vocational and educational success. During the early part of the 20th century, the focus of school guidance practices was on assessment and academic placement. During the mid part of the century, the focus shifted to personal and social counseling services with a concentration on holistic development, while at the end of the century, emphasis was given to special education services, consultation, and accountability duties (Lambie & Williamson, 2004).

Legislation in the past and present has regulated the school's role in the preparation and transition of students into the world of work. The central tasks of career guidance and career education in schools today is to help students identify their career options, understand the implications of their career options, and wisely choose educational options that will achieve their desired goals (Herr, 2002). Federal legislation has reflected the goals of career guidance through school reform initiatives related to vocational education. The Carl D. Perkins Vocational Education Act of 1984 and subsequent amendments to this legislation have provided funding for programs that meet the career development and employment needs of vocational education students (Herr, 2002). State funds available to the ADCE are used to develop new programs of study in all areas (Arkansas Department of Career Education, 2007a). The intention of school reform a hundred years ago was aimed at altering educational requirements to match the industrial economy. Today, some school reform initiatives are in response to the industrial economy becoming more technologically based, in which highly skilled workers are central to international economic competition (Herr, 2002).

Education-career planning is most effective when curriculum is connected to academic and career intervention programs (Trusty, Niles, & Carney, 2005). In the information-technology age, schools are able to provide students with computer-assisted career guidance systems using the Internet. Internet-based programs, such as the Kuder Career Planning System, are used to help students explore academic and career options, test degrees of career interest, and use the information to develop personalized career action plans. The ADCE has made a proposal for the career orientation teachers to implement the new manufacturing curriculum in their classes to connect academic requirements with manufacturing career options in Arkansas.

Summary

The literature presented in Chapter II suggests that the public educational system needs to better prepare students for the workplace. All students need some level of proficiency in basic career readiness skills upon leaving secondary schools. Schools can teach career readiness skills in the academic, technical, and social programs offered in high schools today.

Social cognitive career theory and self-efficacy theory provide reasons for exposing students to programs and experiences that cultivate their career awareness, interests, exploration, planning, and development needs throughout their K – 12 schooling. Individuals recycle through the life stages of planning, exploring, and deciding by continually anticipating choices and transitions, exploring possibilities, and choosing directions that improve and develop the self. The resultant process affects vocational behavior by reinforcing the impact that career orientation courses can have on students.

The literature presented in Chapter II implies that career planning programs should provide students the opportunity to take career assessments with an explanation of the results. Students need help in understanding the results and factors that influence their self-efficacy beliefs, career adaptability, and decision-making skills. Educators can supply essential support in addressing students' career development needs and the economic needs of the state by preparing students for life after high school. Chapter III details the research design and research characteristics of the current study.

CHAPTER III

METHODOLOGY

This chapter details the research design of the current study and its appropriateness in answering the study's research questions. Also provided is an explanation of the study population, informed consent procedure, and confidentiality methods. This chapter also addresses data collection and analysis techniques, instrumentation, and reliability and validity issues related to the current investigation.

Research Design

The current study was a pretest-posttest design (Bauman, 2006). The population studied consisted of eighth grade students enrolled in career orientation classes in Arkansas public schools. The Kuder Career Interest Assessment (KCIA) was administered as a pretest and posttest to control and experimental groups to determine whether the curriculum intervention affected students' interests in manufacturing-related careers.

The students in the control group followed the traditional manufacturing curriculum during unit five when the teachers taught the manufacturing cluster. The teachers administered the Kuder Career Interest Assessment pretest at the beginning of the fall 2007 semester and the posttest at the end of the semester to determine if the traditional methods influenced students' career interests in manufacturing. Pretest and posttest results of the control group were compared against experimental group results to determine whether students' career interests were influenced with or without the implementation of the curriculum intervention.

The students in the experimental group received the curriculum intervention during unit five when the teachers taught the manufacturing cluster. The teachers administered the Kuder Career Interest Assessment pretest at the beginning of the spring 2008 semester and the posttest at the end of the semester to test the effects that the independent variable, *curriculum intervention*, had on the dependent variable, *students' career interests*, by measuring and comparing the pretest and posttest outcomes. The comparison of pretest and posttest means was designed to reveal whether the experimental group's Kuder Career Interest results were affected after the group was instructed in the curriculum intervention.

The design provided comparison groups that were used to evaluate the effects of the curriculum intervention on students' career interests. The pretest and posttest interest measures were gathered in the Kuder Administrative Database, converted into raw scores by Kuder Inc., and transported into SPSS. Descriptive statistics were used to describe participant characteristics and identify the pretest and posttest means and standard deviations for the manufacturing cluster.

The first research question of the study inquired as to any significant difference in participating students' interests in manufacturing in comparison to the national average. One-sample *t*-tests were used to compare the manufacturing cluster national average to the manufacturing cluster posttest mean for the control group, as well as comparing the manufacturing cluster national average to the manufacturing cluster posttest mean for the experimental group.

The second research question addressed whether the curriculum intervention had a significant effect on the experimental group's interests in manufacturing in comparison to the control group. Independent-samples *t* tests were used to compare the pretest means of the control and the experimental group for the manufacturing cluster, as well as comparing the posttest means of the control and the experimental group for the manufacturing cluster. Paired-samples *t* tests were used to compare the pretest mean to the posttest mean of the control group for the manufacturing cluster, as well as comparing the pretest mean to the posttest mean of the experimental group for the manufacturing cluster.

The third research question inquired as to any significant gender differences in students' interests in manufacturing across control and experimental groups. One-way analysis of covariance tests, with the pretest means as the covariate to adjust any initial differences between the groups, were used to analyze the effect of gender on the manufacturing cluster posttest mean for the control, as well as the experimental group. The fourth research question inquired as to any significant differences in students' interests in manufacturing based on individual teachers across control and experimental groups. One-way analysis of variance tests were conducted to compare the posttest means among the four control group teachers, as well as comparing the posttest means among the six experimental group teachers.

Validity and Reliability

The pretest-posttest design is a strong, widely used quasi-experimental design (Gall, Gall, & Borg, 2007). The design differs from the pretest-posttest control group design because the experimental and control groups are not randomly assigned. However, the current study lends itself to an *intact equivalent design*, as described by Gall et al., because the experimental and control groups were as much alike as possible. The career orientation students were similar in grade level, age, gender, and ethnicity. The six teachers selected for the study attended the manufacturing conference, received the training and curriculum materials, and administered the Kuder Career Interest Assessment as both a pretest and posttest to students. Four of the six teachers participated in the control group in the fall 2007 semester. All six teachers participated in the experimental group in the spring 2008 semester. The experimental and control groups differed in that the experimental group received the curriculum intervention and the control group did not.

As time or history passes between the administration of a pretest and posttest, events may occur that threaten or influence the posttest outcomes instead of the curriculum intervention. The individuals in the study at the eighth-grade level may have developed or matured during the experiment, which could have affected their measured responses between the pretest and posttest (Creswell, 2005). To safeguard against maturation issues, the individuals in both the experimental and control groups were similar in grade level, age, gender, and ethnicity.

In educational experiments, it is impossible to control and monitor all events (Creswell, 2005). However, with this design, threats to validity were diminished because the structure of the control and experimental groups involved the same teachers for both groups. In the current study, teachers of the students in the control group also taught students in the experimental group to reduce the influence of time and events on posttest outcomes and enhance research reliability.

The external validity of a study assumes that the curriculum intervention influences an outcome and rules out extraneous factors so that the results of the study can be generalizable to other persons and settings (Creswell, 2005). The study results are generalizable to those Arkansas students, schools, and career orientation teachers that share common similarities with the sample. The research results can be generalized in other schools in the United States to the extent that a career-planning course is taught to eighth grade students in public schools possessing characteristics similar to the students and schools in Arkansas. The extent to which the curriculum intervention pertains to other settings also may depend upon the need for or shortage of manufacturing workers in a particular region or setting in the United States.

Research Questions

The demographic variables for gender, ethnicity, and teacher were collected using the Kuder Administrative Database and summarized in SPSS using descriptive statistics. The pretest and posttest interest measures were gathered in the Kuder Administrative Database, converted into raw scores by Kuder Inc., and transported into SPSS. To answer the first research question, a one-sample *t* test analysis was used to compare the manufacturing cluster national average to the control group posttest mean for the manufacturing cluster. A separate one-sample *t* test analysis was used to compare the manufacturing cluster national average to the experimental group posttest mean for the manufacturing cluster.

To answer the second research question, an independent-samples *t* test was used to compare the control group pretest mean to the experimental group pretest mean for the manufacturing cluster. A separate independent-samples *t* test was used to compare the control group posttest mean to the experimental group posttest mean for the manufacturing cluster. A paired-samples *t* test analysis was used to compare the control group pretest mean to the posttest mean for the manufacturing cluster. A separate paired-samples *t* test analysis was used to compare the experimental group pretest mean to the posttest mean for the manufacturing cluster.

To answer research question three, a one-way analysis of covariance (ANCOVA) was conducted with the control group using the pretest mean as a covariate to measure the effect of gender on the manufacturing cluster posttest mean. A separate one-way ANCOVA was conducted with the experimental group using the pretest mean as a covariate to measure the effect of gender on the manufacturing cluster posttest mean. A pretest was used as a covariate in both ANCOVA tests to adjust for initial group differences in pretest means before comparing the posttest means of the two groups to ensure that any effects on the dependent variable were due to the curriculum intervention. To answer research question four, a one-way analysis of variance (ANOVA) was conducted to compare the posttest means among the four control group teachers. A separate ANOVA was conducted to compare the posttest means among the six experimental group teachers.

The teachers completed a survey at the conclusion of the spring semester. The first part of the survey included questions about the traditional manufacturing curriculum and the control group. The second part of the survey included questions about the new manufacturing curriculum and the experimental group. Teachers 1-4 participated in both the control and experimental groups and received the two-part survey. Teachers 5 and 6 participated in the experimental group and only received the second part of the survey questions regarding the curriculum intervention.

Teacher and Student Participants

The career orientation teachers selected to participate in the study attended the manufacturing conference in November of 2007 to receive the new manufacturing curriculum training and materials. Of the thirteen career orientation teachers invited to participate, six teachers consented to participate. Four teachers administered the pretest and posttest to the control group in the 2007 fall semester. The control group sample included 145 career orientation students in Arkansas public schools. These same four teachers, in addition to two more teachers, completed the pretest and posttest measures and implemented the curriculum intervention with the experimental group in the 2008 spring semester. The experimental group sample included 256 career orientation students in Arkansas public schools.

The control group was taught using the traditional manufacturing curriculum. The experimental group received instruction in the new manufacturing curriculum and the students in the control group did not receive the curriculum intervention. All students were administered the Kuder Career Interest Assessment to measure pretest and posttest career interests.

The public schools were similar in size in terms of employment and student enrollment, although some variance existed in terms of region. The study did not include public schools or teachers from regions that did not attend the manufacturing conference to receive the appropriate training on the curriculum implementation, thus minimizing the potential impact of confounding variables related to divergent teaching methodologies.

Instrumentation

The Kuder Career Interest Assessment was administered to measure the career interests of Arkansas career orientation students. The study did not exclude or modify any components of the Kuder Career Interest Assessment to maintain the integrity of the instrument. An additional questionnaire survey was distributed to evaluate the teachers' implementation of the traditional manufacturing curriculum with the control group and the curriculum intervention with experimental group. The survey data were used as a qualitative aid to identify potential group and teacher differences among schools.

Content and substantive validity of the Kuder Career Interest Assessment.

Frederic Kuder utilized a criterion-vector method for item selection (Zytowski, 2007). The Kuder Career Interest Assessment consists of 180 activities written at a 6th grade reading level. The Kuder Career Interest Assessment uses a forced choice response method for participants to record ranks of most, next most, and least preferred in a 1-2-3-triad format. The 60 forced-choice triads each consist of a transitive verb and an object. Occupational titles or school subjects are not used. The following is a sample of a survey item: "Interview a well-known athlete, Take a class on how to get into TV, Help a new citizen learn English" (Zytowski, 2007, p. 3). Instead of using a Like or Dislike response format, the forced choice methodology represents the idea that respondents make real choices between possibilities.

Structural validity of the Kuder Career Interest Assessment.

Scale intercorrelations, homogeneities, and temporal reliabilities are part of the structural validity found in the Kuder Career Interest Assessment. Cluster scores and person matches are determined using the activity preference scales. "Intercorrelations of the 10 scales range from -.27 to .06, with the bulk of the coefficients negative, as is typical of forced-choice responding. The median KR-20 for the scales was found to be .73 in a range from .64 to .80" in an online administration with 146 adults (Zytowski, 2007, p. 8). According to Zytowski, Ihle-Helledy administered the Kuder Career Interest Assessment to college students, reporting Cronbach alpha values ranging from .65 to .86 with a median of .77 and temporal reliability values ranging from .83 to .92 with a median of .87.

External and consequential validity of the Kuder Career Interest Assessment.

The career cluster scores are composed of a criterion group measure and are not homogeneous. Zytowski (2007) contends that the resulting person match possesses face validity because interest inventory takers having activity preference profiles that are identical or comparable to certain other persons are assumed to have real similarities. The predictive validity of the Kuder Career Interest Assessment does not apply since the purpose of the inventory is for career exploration and development rather than selecting an occupation (Zytowski, 2007).

New Manufacturing Curriculum

The new manufacturing curriculum provides students an opportunity to explore and learn about a variety of careers in manufacturing (Career Communications, Inc., 2006). The curriculum includes case studies and group projects to explore the six manufacturing career pathways: 1) production, 2) production process development, 3) maintenance, installation, and repair, 4) quality assurance, 5) logistics and inventory control, and 6) health, safety, and environmental assurance. The curriculum integrates academic competencies with industry standards to assist students in recognizing the relationship between schoolwork and the workforce. The curriculum also provides students with opportunities to explore occupationally specific skills, wages, postsecondary education/training needed, and awareness of job availability (Career Communications, Inc., 2006).

Data Collection

The informed consent letter and instruction forms were e-mailed to the respective teachers of each of the participating public schools. The quantitative study utilized the online Kuder Career Interest Assessment, located within the Kuder Career Planning System, as a pretest and posttest. Students completed the Kuder Career Interest Assessment by accessing the Arkansas Kuder website. The Kuder Administrative Database was used to accumulate the career interest results of the participants. The participants' career interest results were converted into raw scores by Kuder Inc., and transported into SPSS. Data collection and analysis excluded any incomplete or improperly completed career interest assessments.

Data Analysis

Descriptive statistics were used to arrange and summarize the data. Data from the Kuder Administrative Database were entered into SPSS to organize the variables: gender, ethnicity, and teacher by groups. SPSS was used to identify the means and standard deviations of the raw interest results. One-sample *t* tests, independent-samples *t* tests, and paired-samples *t* tests were used to compare the pretest and/or posttest means for the manufacturing cluster between groups.

Using convenience sampling of groups introduced the possibility that the groups were not matched equally. Accordingly, the data were analyzed to determine if there were posttest mean differences across groups. One-way ANCOVA tests were incorporated to measure the effect of gender on the manufacturing cluster posttest means, with the pretest as a covariate, to statistically equate the groups. Initial group equivalency must be determined to ensure that any statistically significant differences on the dependent variable are due to the treatment, the curriculum intervention, by making compensating adjustments to the posttest means of the two groups (Gall, Gall, & Borg, 2007). One-way ANOVA tests were used to measure the effect of teacher on students' interests in manufacturing by comparing posttest means across groups. If the ratio of between-group variance to within-groups variance is sufficiently high, this indicates that there is more difference among the groups in their scores on a particular variable than there is within each group (Gall, Gall, & Borg, 2007).

Informed Consent and Confidentiality

Arkansas career orientation teachers were invited to voluntarily participate in the study by means of an informed consent letter explaining the general purpose of the study, as presented in Appendix A. Each teacher signed an informed consent letter and submitted the necessary information regarding school, teacher, and student names in confidence. Although explaining the research study's purpose in determining the effect of the new manufacturing curriculum on students' career interests, the informed consent letter to teachers did not indicate specific hypothetical predictions, thus preventing unnecessary bias. The informed consent letter to teachers did not specifically mention the curriculum intervention to avoid response bias. The Arkansas State University Institutional Review Board for the protection of human subjects approved the research protocol.

CHAPTER IV

PRESENTATION OF DATA

The purpose of this study was to determine the extent to which the intervention, the new manufacturing curriculum, influenced Arkansas eighth grade students' interests in manufacturing careers as measured by the Kuder Career Interest Assessment (KCIA). Chapter IV presents the students' demographic data and the pretest and posttest Kuder raw interest scores in manufacturing by groups, gender, and teacher. One-sample *t* tests, independent-samples *t* tests, and paired-samples *t* tests were used to compare the pretest and/or posttest means for the manufacturing cluster between groups. One-way ANCOVA tests were used to measure the effect of gender on the manufacturing cluster posttest means with the pretest means as a covariate, to statistically equate the groups. One-way ANOVA tests were used to measure the effect of teacher on students' interests in manufacturing by comparing posttest means across groups.

The design instrument, KCIA, was used to measure the control group's interests in manufacturing before and after receiving instruction in the traditional manufacturing curriculum. The KCIA was used to measure the experimental group's interests in manufacturing before and after receiving instruction in the new manufacturing curriculum. The KCIA was used to assess all areas of interests for the 16 career clusters. The data presented in this study focuses on the KCIA pretest and posttest results for the manufacturing cluster. The emphasis was on the manufacturing cluster results because of the teacher training and curriculum intervention materials presented in Little Rock, Arkansas, at the manufacturing conference. The KCIA pretest and posttest interest scores were calculated in the Kuder Administrative Database, converted into raw scores by Kuder Inc., and transported into the SPSS statistical software.

The investigator attended the manufacturing conference in Little Rock, Arkansas, in November of 2007. A convenience sample of thirteen teachers was selected initially at the manufacturing conference to administer the KCIA as a pretest and posttest to their eighth grade career orientation students in the 2007 fall semester (control group) and 2008 spring semester (experimental group). The intent of teacher selection was to have a high number of teachers and a relatively even number of student participants for the control and experimental groups in case of teacher drop out or lack of participation. Of the thirteen teachers initially selected, a total of six signed the consent form and agreed to participate in the study.

Four of the six teachers taught a career orientation course in the 2007 fall semester representing the control group. All six teachers taught a career orientation course in the 2008 spring semester representing the experimental group. A survey distributed to the career orientation teachers in May 2008 provided a basis to evaluate their experiences with teaching the traditional manufacturing curriculum (control group) and or the new manufacturing curriculum (experimental group) and to help the investigator interpret the research results. Discussion of the teacher responses to the survey questions appear at the end of this chapter. The following research questions guided the study:

1. Is there a significant difference in participating students' interests in manufacturing in comparison to the national average?

2. Does the curriculum intervention have a significant effect on the experimental group's interests in manufacturing in comparison to the control group?
3. Are there significant gender differences in students' interests in manufacturing across experimental and control groups?
4. Is there a significant difference in students' interests in manufacturing based on individual teachers across experimental and control groups?

Study Participants

Six teachers from six different schools and counties agreed to participate in the study. Four teachers each representing one school from the west, southwest, northeast, and central regions of Arkansas participated in the control and experimental groups. The four teachers administered the Kuder Career Interest Assessment (KCIA) pretest and posttest and implemented the traditional manufacturing curriculum to the control group in the 2007 fall semester. These same four teachers and two additional teachers representing schools in the northeast region of Arkansas participated in the experimental group. All six teachers administered the KCIA pretest and posttest and implemented the new manufacturing curriculum to the experimental group in the 2008 spring semester.

The demographic data were collected using the Kuder Administrative Database and summarized in SPSS using descriptive statistics. The control group consisted of 145 students because only four of the six teachers taught career orientation in the 2007 fall semester. The experimental group consisted of 256 students because all six teachers taught career orientation in the 2008 spring semester. Therefore, a total sample of 401 students participated in this study.

Demographic characteristics of the students are presented in Tables 1, 2, and 3. The gender characteristics of the control and experimental groups appear in Table 1. There was a predominance of females in the control group, whereas a majority of males characterized the experimental group. The ethnic characteristics of the control and experimental groups appear in Table 2. There was a predominance of Caucasians in both the control and experimental groups. The number and percentage of students in the control and experimental groups by teacher appear in Table 3. Teachers 1 – 4 participated in both the control and experimental groups. Teachers 5 and 6 participated in the experimental group only.

Table 1

Frequencies and Percentages for Groups by Gender (N = 401)

	Control group (n = 145)		Experimental group (n = 256)	
Gender	n	%	n	%
Male	61	(42.1%)	137	(53.5%)
Female	84	(57.9%)	119	(46.5%)

Table 2

Frequencies and Percentages for Groups by Ethnicity (N = 401)

	Control group (n = 145)		Experimental group (n = 256)	
Ethnicity	n	%	n	%
Caucasian	77	(53.1%)	162	(63.3%)
African American	22	(15.2%)	20	(7.8%)
Asian	1	(0.7%)	1	(0.4%)
Hispanic	4	(2.8%)	7	(2.7%)
American Indian	4	(2.8%)	5	(2.0%)
Hawaiian	1	(0.7%)	0	(0.0%)
Other	1	(0.7%)	5	(2.0%)
N/A	35	(24.1%)	56	(21.9%)

Table 3

Frequencies and Percentages for Groups by Teacher (N = 401)

	Control group (n = 145)		Experimental group (n = 256)	
Teacher	n	%	n	%
1	29	(20.0%)	27	(10.5%)
2	27	(18.6%)	59	(23.0%)
3	63	(43.4%)	47	(18.4%)
4	26	(17.9%)	30	(11.7%)
5			28	(10.9%)
6			65	(25.4%)

Distribution of Data and Outliers

Posttest data for the manufacturing cluster were analyzed across groups, gender, and teacher to identify outliers by using a box plot statistical procedure. Outliers were identified for gender in both groups. Two male outliers were identified for the control group and one female outlier was identified for the experimental group.

Tabachnick and Fidell (1996) recommend changing the scores on the outlying cases to one unit smaller than the highest score in the distribution to reduce the impact of the outliers. The greatest posttest value in the lower boundary of the distribution for males was 34.62. The values for Case 11 and 54 were changed to 33.62. The outliers are illustrated in Figure 1.

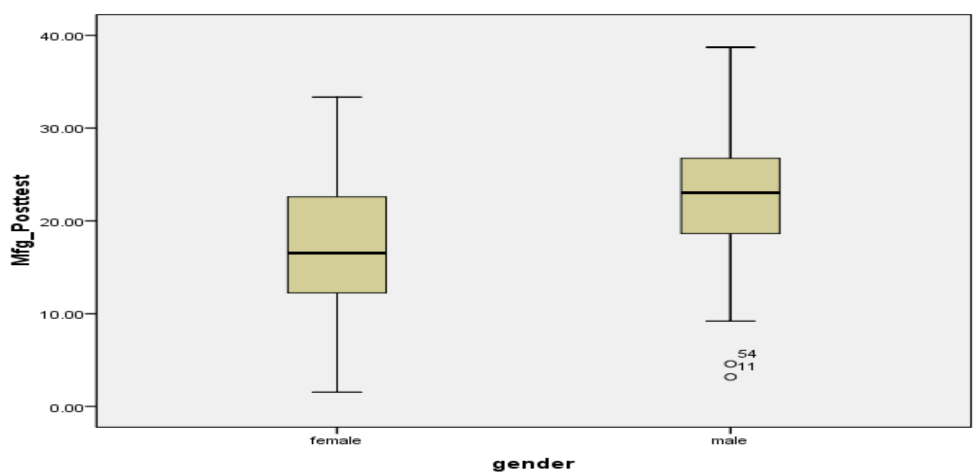

Figure 1. Distribution of the control group's posttest data for the manufacturing cluster across gender with identified outliers.

During the reexamination of the control group's posttest data for the manufacturing cluster, another outlier for gender was identified. The adjustments to Case 11 and 54 changed the higher range of the normal distribution exposing an outlier beyond the upper boundary as shown in Figure 2. When Case 132 was changed to (37.71), one unit smaller than the highest value, Case 132 was still identified as an outlier upon reexamination. Therefore, Case 132 was changed to one unit below the next highest posttest value (37.16) to adjust the outlier as shown in Figure 3. Reexamination identified no additional outliers.

Figure 2. Distribution of the control group's posttest data for the manufacturing cluster across gender with identified outlier.

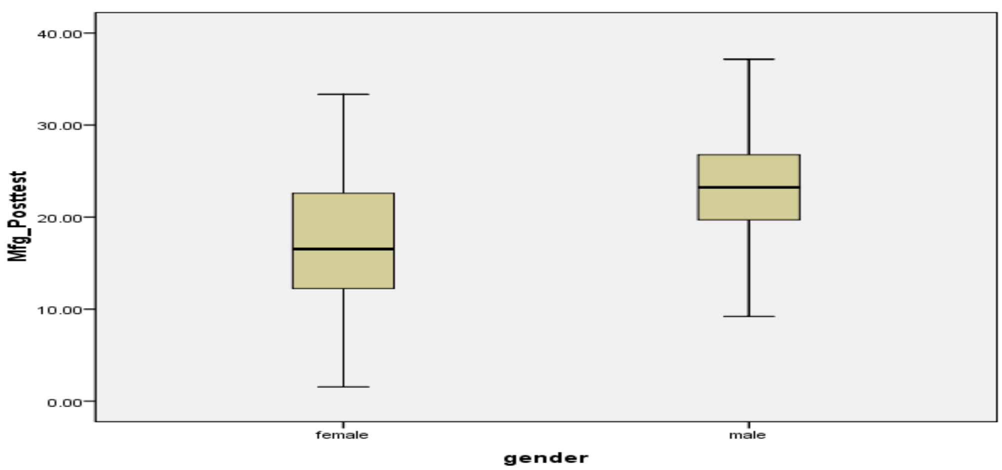

Figure 3. Distribution of the control group's posttest data for the manufacturing cluster across gender with adjusted outlier.

Upon examination of the experimental group's posttest data for the manufacturing cluster, an outlier for gender was identified. The highest posttest value for a female, Case 368 was identified as an outlier as shown in Figure 4.

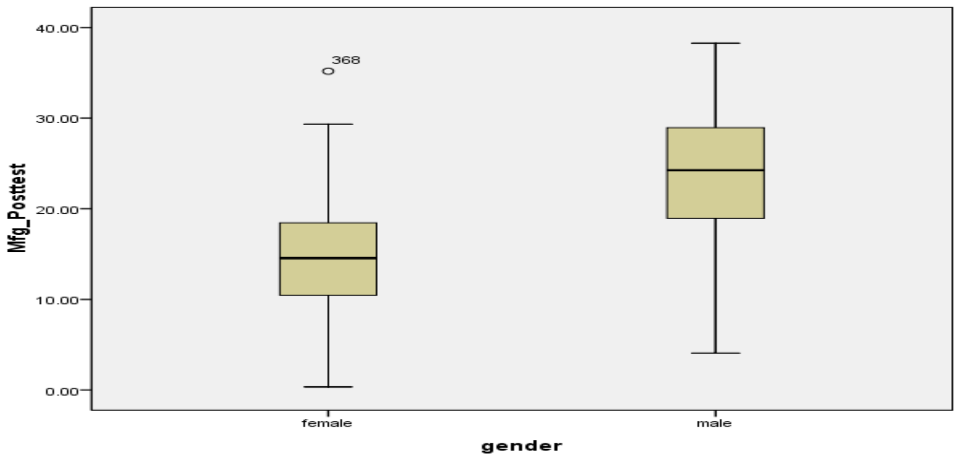

Figure 4. Distribution of the experimental group's posttest data for the manufacturing cluster across gender with identified outlier.

The next most extreme posttest value for the manufacturing cluster for females was 29.35. Therefore, Case 368 was changed to 28.35 to adjust for the outlier. The distribution of the experimental group posttest data for the manufacturing cluster with the adjusted outlier appears in Figure 5.

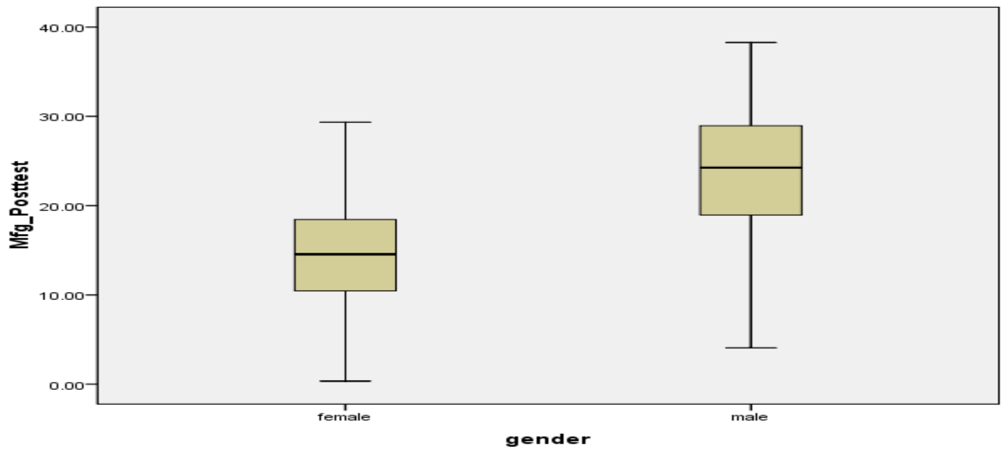

Figure 5. Distribution of the experimental group's posttest data for the manufacturing cluster across gender with adjusted outlier.

The remaining tables in this study are presented with adjusted outliers across groups, gender, and teacher. Table 4 displays the control and experimental groups' Kuder Career Interest Assessment (KCIA) posttest means and standard deviations for each career cluster compared to the 2007-2008 KCIA national average and standard deviation for each career cluster. The manufacturing posttest mean for the control group (19.63) was greater than the posttest mean for the experimental group (19.43). The national average (23.68) was greater than both the control and experimental groups' posttest mean for the manufacturing cluster.

Table 4

Control and Experimental Groups Posttest Means and Standard Deviations Compared to the National Average and Standard Deviation for each Career Cluster

Career cluster	Posttest mean	SD	National average	SD
Agriculture, Food, and Natural Resources				
Control	18.21	6.46	17.96	6.45
Experimental	19.11	6.55		
Architecture and Construction				
Control	18.61	6.87	18.59	7.32
Experimental	18.87	7.26		
Arts, Audio-Video, and Communication				
Control	17.79	7.21	18.46	6.86
Experimental	17.78	7.14		
Business Management and Administration				
Control	21.36	6.28	31.96	7.26
Experimental	20.97	6.84		
Education and Training				
Control	21.00	6.75	20.75	6.65
Experimental	20.69	7.06		
Finance				
Control	19.65	6.32	20.25	6.14
Experimental	19.03	6.20		

Career cluster	Posttest mean	SD	National average	SD
Government and Public Administration				
Control	19.87	6.34	26.82	6.42
Experimental	19.95	6.10		
Health Science				
Control	20.00	6.55	18.93	6.95
Experimental	19.89	6.96		
Hospitality and Tourism				
Control	19.35	6.36	20.42	6.40
Experimental	19.51	6.02		
Human Services				
Control	22.06	7.42	30.32	7.80
Experimental	21.53	8.02		
Information Technology				
Control	19.16	7.26	17.63	7.04
Experimental	19.19	7.33		
Law, Public Safety, and Security				
Control	16.68	6.77	31.58	7.49
Experimental	17.12	6.58		
Manufacturing				
Control	19.63	7.57	23.68	7.84
Experimental	19.43	8.02		

Career cluster	Posttest mean	SD	National average	SD
Marketing, Sales, and Service				
Control	21.76	7.30	24.15	8.46
Experimental	22.15	7.60		
Science, Technology, Engineering, and Math				
Control	18.23	6.30	17.72	6.36
Experimental	18.86	6.67		
Transportation, Distribution, and Logistics				
Control	20.92	7.82	21.19	8.01
Experimental	21.46	8.34		

Question 1: Is there a significant difference in participating students' interests in manufacturing in comparison to the national average?

A one-sample t test analysis was used to compare the manufacturing cluster national average (M = 23.68, SD = 7.84) to the manufacturing cluster posttest mean for the experimental group (M = 19.43, SD = 8.02). The t test produced a result of t (255) = -8.48 (p = .00), indicating a significant difference. The national average was significantly greater than the posttest mean for the manufacturing cluster in the experimental group.

A one-sample t test analysis was used to compare the manufacturing cluster national average (M = 23.68, SD = 7.84) to the manufacturing cluster posttest mean for the control group (M = 19.63, SD = 7.57). The t test produced a result of t (144) = -6.44 (p = .00), indicating a significant difference. The national average was significantly greater than the posttest mean for the manufacturing cluster in the control group. The results of the one-sample *t* tests comparing the manufacturing posttest means to the national average are displayed in Table 5.

Table 5

One-sample t Tests: National Average Compared to Posttest Means for the Manufacturing Cluster between Groups

Group	Mean Difference	df	*t*	*p* (2-tailed)
Experimental Group Posttest and National Average	-4.25	255	-8.48	.00*
Control Group Posttest and National Average	-4.05	144	-6.44	.00*

* $p < .05$

Table 6 displays the minimum, maximum, and mean with standard deviation for the control and experimental groups' pretest and posttest Kuder raw interest scores in manufacturing. The pretest mean (20.07) was greater than the posttest mean (19.63) for the control group. The pretest mean (19.45) was greater than the posttest mean (19.43) for the experimental group.

Table 6

Pre- and Posttest Values for the Manufacturing Cluster across Groups (N = 401)

Group	n	Min.	Max.	Mean	SD
Control					
Pretest	145	3.36	34.47	20.07	6.95
Posttest	145	1.55	37.16	19.63	7.57
Experimental					
Pretest	256	2.83	35.88	19.45	7.77
Posttest	256	.35	38.26	19.43	8.02

Question 2: Does the curriculum intervention have a significant effect on the experimental group's interests in manufacturing in comparison to the control group?

To determine if a significant difference existed between pretest means, an independent-samples *t* test was used to compare the pretest means of the control and experimental groups for the manufacturing cluster. There was a difference in pretest means for the control group (*M* = 20.07, *SD* = 6.95) and the experimental group (*M* = 19.45, *SD* = 7.77), but it was not statistically significant. The *t* test for equality of means produced a result of t (399) = .83 (p = .41) for the manufacturing cluster indicating that career interest in manufacturing was not significantly different between control and experimental groups at the outset of the curriculum intervention.

To determine if a significant difference existed between the posttest means, an independent-samples *t* test was used to compare the posttest means of the control and experimental groups for the manufacturing cluster. There was a difference in posttest means for the control group (*M* = 19.63, *SD* = 7.57) and the experimental group (*M* = 19.43, *SD* = 8.02), but it was not statistically significant. The *t* test for equality of means produced a result of *t* (399) = .25 (*p* = .81) for the manufacturing cluster indicating that career interest in manufacturing was not significantly different between control and experimental groups at the conclusion of the curriculum intervention. Table 7 displays the results of the independent-samples *t* tests for the manufacturing cluster pretest and posttest mean difference between the control and experimental groups.

Table 7

Independent-samples t Tests: Pretest and Posttest Mean Difference for the Manufacturing Cluster between Groups

Groups	Mean Difference	df	*t*	*p* (2-tailed)
Pretest				
Control and Experimental	.63	399	0.83	0.41
Posttest				
Control and Experimental	.20	399	0.25	0.81

A paired-samples *t* test analysis was used to compare the pretest mean of the experimental group (*M* = 19.45, *SD* = 7.77) to the posttest mean of the experimental group (*M* = 19.43, *SD* = 8.02) for the manufacturing cluster. The *t* test produced a result of *t* (255) = .039 (*p* = .97), indicating no significant difference between pretest to posttest for the experimental group as shown in Table 8.

A paired-samples *t* test analysis was used to compare the pretest mean of the control group (*M* = 20.07, *SD* = 6.95) to the posttest mean of the control group (*M* = 19.63, *SD* = 7.57) for the manufacturing cluster. The *t* test produced a result of *t* (144) = .910 (*p* = .36), indicating no significant difference between pretest to posttest for the control group as shown in Table 8.

Table 8

Paired-samples t Tests: Comparison of the Pretest and Posttest Mean Difference for the Manufacturing Cluster between Groups

Group	Mean Difference	df	*t*	*p* (2-tailed)
Experimental				
Mfg. Pretest and Posttest	.02	255	.039	.97
Control				
Mfg. Pretest and Posttest	.44	144	.910	.36

In Table 9, the minimum, maximum, and means with standard deviations by gender are listed for the KCIA pretest and posttest Kuder raw interest scores in manufacturing. The male pretest mean (24.76) was greater than the posttest mean (23.64) for the control group. The male pretest mean (23.58) was less than the posttest mean (23.61) for the experimental group. The female pretest mean (16.67) was less than the posttest mean (16.72) for the control group. The female pretest mean (14.70) was greater than the posttest mean (14.62) for the experimental group.

Table 9

Pre- and Posttest Values for the Manufacturing Cluster by Gender

Gender	n	Min.	Max.	Mean	SD
Male					
Control (pretest)	61	10.30	34.47	24.76	5.10
Control (posttest)	61	9.20	37.16	23.64	6.33
Experimental (pretest)	137	2.83	35.88	23.58	6.72
Experimental (posttest)	137	4.07	38.26	23.61	6.94
Female					
Control (pretest)	84	3.36	31.96	16.67	6.10
Control (posttest)	84	1.55	33.34	16.72	7.07
Experimental (pretest)	119	3.47	30.87	14.70	5.98
Experimental (posttest)	119	.35	29.35	14.62	6.30

Question 3: Are there significant gender differences in students' interests in manufacturing across experimental and control groups?

A one-way analysis of covariance (ANCOVA) was conducted with the control group to examine the effect of gender on the manufacturing cluster posttest means, using the pretest as a covariate to adjust for the potential effect of the pretest. ANCOVA results found that the main effect of gender was not significant (F (1, 142) = 1.56, p = .21). Males (M = 23.64, SD = 6.33) did not score significantly higher than females (M = 16.72, SD = 7.07) on the posttest for the manufacturing cluster.

A one-way ANCOVA was conducted with the experimental group to examine the effect of gender on the manufacturing cluster posttest means, using the pretest as a covariate to adjust for the potential effect of the pretest. ANCOVA results found that the main effect of gender was significant (F (1, 253) = 30.42, p = .00), with males scoring significantly higher (M = 23.61, SD = 6.94) than females (M = 14.62, SD = 6.30) on the posttest for the manufacturing cluster. Table 10 displays results for the ANCOVA tests for the control and experimental groups.

Table 10

One-way ANCOVA Tests: Effect of Gender on the Manufacturing Cluster Posttest Means across Groups

Group	Mean Square	F	df	*p*
Control				
Mean Pretest (Covariate)	2141.77	68.88	1	.00*
Gender (Fixed Factor)	48.37	1.56	1	.21
Experimental				
Mean Pretest (Covariate)	2005.04	54.94	1	.00*
Gender (Fixed Factor)	1110.20	30.42	1	.00*

* $p < .05$

Table 11 lists the minimum, maximum, and means with standard deviations for the control group and experimental group by teacher for the posttest raw interest scores in manufacturing on the Kuder Career Interest Assessment. The control group means were less than the experimental group means for Teachers 1 and 3. The control group means were greater than the experimental group means for Teachers 2 and 4. Teachers 5 and 6 did not teach a career orientation course in the 2007 fall semester, participating only in the experimental group.

Table 11

Posttest Values for the Manufacturing Cluster by Teacher

Teacher	n	Min.	Max.	Mean	SD
1 (control)	29	7.10	37.16	20.43	7.53
1 (experimental)	27	2.43	30.63	20.76	9.20
2 (control)	27	4.91	37.16	20.64	8.74
2 (experimental)	59	.35	38.26	17.32	8.04
3 (control)	63	1.55	33.62	18.15	7.64
3 (experimental)	47	3.43	34.69	19.22	8.02
4 (control)	26	9.56	33.34	21.27	5.66
4 (experimental)	30	6.42	35.96	20.73	7.35
5 (experimental)	28	7.71	35.36	20.50	7.96
6 (experimental)	65	2.61	37.80	19.89	7.71

Question 4: Is there a significant difference in students' interests in manufacturing based on individual teachers across experimental and control groups?

A one-way analysis of variance (ANOVA) test was conducted to compare the posttest means among the four control group teachers. The Tukey analysis (Gall, Gall, & Borg, 2007) revealed that Teacher 3 had the lowest posttest mean, indicating that students of Teacher 3 were the least interested in manufacturing (*M* = 18.15, *SD* = 7.64), compared to students who had Teacher 4 (*M* = 21.27, *SD* = 5.66), the teacher with the highest posttest mean. Students of Teacher 1 (*M* = 20.43, *SD* = 7.53) and Teacher 2 (*M* = 20.64, *SD* = 8.74) had means that fell in between the students of Teacher 3 and Teacher 4. The results for the posttest were F (3, 141) = 1.494 (p = .22), indicating no significant difference.

A one-way ANOVA test was conducted to compare the posttest means among the six experimental group teachers. The preliminary analysis revealed that Teacher 2 had the lowest posttest mean, indicating the students of Teacher 2 were the least interested in manufacturing (*M* = 17.32, *SD* = 8.04), compared to students who had Teacher 1 (*M* = 20.76, *SD* = 9.20), the teacher with the highest posttest mean. Students of Teacher 3 (*M* = 19.22, *SD* = 8.02), Teacher 4 (*M* = 20.73, *SD* = 7.35), Teacher 5 (*M* = 20.50, *SD* = 7.96), and Teacher 6 (*M* = 19.89, *SD* = 7.71) had means that fell in between the students of Teacher 2 and Teacher 1. The results for the posttest were F (5, 250) = 1.28 (p = .27), indicating no significant difference. Table 12 displays the effect of teacher on the manufacturing cluster posttest means by control and experimental group teacher.

Table 12

One-way ANOVA Tests: Effect of Teacher on the Manufacturing Cluster Posttest Means across Groups

Teacher	df	Sum of Squares	Mean Square	F	*p*
Control Group					
Between Groups	3	254.10	84.70	1.49	.22
Within Groups	141	7996.30	56.71		
Experimental Group					
Between Groups	5	409.44	81.89	1.28	.27
Within Groups	250	15982.80	63.93		

Career Orientation Teacher Survey Results

The teachers completed a survey distributed in May 2008 at the conclusion of the spring semester. The first part of the survey included questions about teaching the traditional manufacturing curriculum and the control group. The second part of the survey included questions about teaching the new manufacturing curriculum and the experimental group. Teachers 1, 2, 3, and 4 participated in both the control and experimental groups and received the two-part survey. Teachers 5 and 6 participated in the experimental group and only received the second part of the survey questions regarding the curriculum intervention.

Table 13 displays the preparation and instructional time teachers spent teaching the traditional manufacturing curriculum to the control group. Teacher 1 spent the most preparation time teaching the traditional manufacturing curriculum. Teacher 2 spent the most instructional time teaching the traditional manufacturing curriculum. Teacher 3 spent the same amount of preparation and instructional time on the traditional manufacturing curriculum. Teacher 4 spent the same amount of preparation time as Teachers 2 and 3, but spent the least amount of instructional time compared to all of the teachers.

Table 13

Planning and Teaching the Traditional Manufacturing Curriculum: Control Group

Teacher	Preparation	Instruction
1	3 hours	4 hours
2	2 hours	5 hours
3	2 hours	2 hours
4	2 hours	1 hour

Table 14 displays the preparation and instructional time teachers spent teaching the new manufacturing curriculum to the experimental group. Teacher 1 prepared three hours and instructed six hours on the curriculum intervention. Teacher 2 spent the most preparation and instructional time teaching the curriculum intervention. Teachers 3 and 4 each spent an equal amount of preparation and instructional time on the curriculum intervention. Teacher 5 spent the least amount of preparation and instructional time on the curriculum intervention. Teacher 6 did not answer this survey question.

Table 14

Planning and Teaching the New Manufacturing Curriculum: Experimental Group

Teacher	Preparation	Instruction
1	3 hours	6 hours
2	6 hours	15 hours
3	5 hours	5 hours
4	4 hours	4 hours
5	2 hours	1 hour
6	no response	no response

A survey question asked the teachers to describe the demographics of the school in which they taught. Table 15 shows the typical grade point average of students, the demographic location of the school, and the percentage of students that received reduced lunch costs for the control group. The grade point of students from each school was average. Each school had a rural location and 50 percent of students were on the reduced lunch program except for School 2, which 65 percent of students received a reduced lunch.

Table 15

Demographics: Control Group

School	Student GPA	Location	% on Reduced Lunch
1	average	rural	50 %
2	average	rural	65 %
3	average	rural	50 %
4	average	rural	50 %

Table 16 shows the typical grade point average of students, the demographic location of the school, and the percentage of students that received reduced lunch costs for the experimental group. The location of each school was rural. Students from School 1 had an average-to-high grade point and 40 percent of students were on the reduced lunch program, whereas School 2 had an average grade point and 65 percent of students were on the reduced lunch program. School 3 had a low-to-average grade point and 50 percent of students were on the reduced lunch program. School 4 had an average grade point and 50 percent of students were on the reduced lunch program. School 5 had an average grade point and 60 percent of students were on the reduced lunch program. School 6 indicated that students of all abilities were represented and 73 percent of students were on the reduced lunch program.

Table 16

Demographics: Experimental Group

School	Student GPA	Location	% on Reduced Lunch
1	average-high	rural	40 %
2	average	rural	65%
3	low-average	rural	50 %
4	average	rural	50 %
5	average	rural	60 %
6	"of all abilities"	rural	73 %

A survey item asked the teachers if they encountered any problems while teaching the traditional manufacturing curriculum to the control group. Teacher 1 indicated that she experienced no problems. Teacher 2 suggested that the manufacturing activities were obsolete and it was difficult to find new manufacturing activities to teach. Teacher 3 suggested that, initially, students' have a negative attitude about manufacturing careers until a teacher from the high school demonstrates to the class how to apply the engineering software. Teacher 4 indicated that students encountered problems during the group work activities. Table 17 displays the teachers' responses to the survey question regarding the problems they encountered while teaching the traditional manufacturing curriculum to the control group.

Table 17

Problems while Teaching the Traditional Manufacturing Curriculum: Control Group

Teacher	Survey Response
1	None.
2	It was hard to come up with activities to use teaching manufacturing. Some of the manufacturing jobs that I talked about probably do not even exist anymore.
3	Students' attitudes toward manufacturing jobs are usually pretty negative until the Project Lead the Way instructor brings students for a demonstration of the engineering software.
4	I do it as a group thing and sometimes the student groups do not get along.

A survey item asked the teachers if they encountered any problems while teaching the new manufacturing curriculum to the experimental group as shown in Table 18. Teacher 1 indicated that she experienced no problems. Teacher 2 suggested that the advanced content created problems for the students. Teacher 3 indicated that she did not receive some of the video materials presented at the manufacturing conference. Teacher 4 suggested that it was uncomfortable teaching the curriculum intervention since it was the first time to teach the material. Teacher 5 indicated that the textbook used was not current. Teacher 6 indicated that time and planning was a factor in teaching the curriculum intervention.

Table 18

Problems while Teaching the New Manufacturing Curriculum: Experimental Group

Teacher	Survey Response
1	None.
2	I believe that some of the content was over their head – but there were a lot of good ideas and activities that the students enjoyed.
3	I didn't find some of the videos I saw during the conference. I spent a lot of time researching different companies and looking for the great current video information to share.
4	I was not comfortable since it was the first time.
5	My textbook (1999) did not have current facts or statistics.
6	Enough time to do all the things I needed to cover but also try to do more on manufacturing. I need to do better planning and sneak in little manufacturing activities as we go through the semester.

A survey item asked the teachers which reference materials or curriculum resources they used to teach the traditional manufacturing curriculum to the control group as shown in Table 19. Teacher 1 indicated that she used the Internet, magazines, and ideas from the Arkansas Career Orientation Teacher Association (ArCOTA) to teach the traditional manufacturing curriculum. Teacher 2 used online resources and classroom materials. Teacher 3 used the Occupational Informational Network (O*NET) website, had students manufacture a product, and had the Project Lead the Way instructor and his students from the Advanced Manufacturing class speak to the control group. Teacher 4 used the ArCOTA website and textbook as a resource to teach the traditional manufacturing curriculum.

Table 19

Reference Materials/Resources Used to Teach the Traditional Manufacturing Curriculum:

Control Group

Teacher	Survey Response
1	Internet, magazines, and ArCOTA ideas.
2	Most of the resources I found on line or they were already in my classroom.
3	O*NET and have students do a fun activity manufacturing a product. I also use the Project Lead the Way instructor and students as resources.
4	ArCOTA website and textbook.

A survey item asked the teachers which reference materials or curriculum resources they used to teach the new manufacturing curriculum to the experimental group as shown in Table 20. Teacher 1 indicated that she used materials from the manufacturing conference in Little Rock, the Internet, and the Arkansas Manufacturing Career magazine to teach the curriculum intervention. Teacher 2 used books from the manufacturing conference in Little Rock. Teacher 3 used materials from the manufacturing conference, the Arkansas Manufacturing Career magazine, had the Project Lead the Way instructor and his students from the Advanced Manufacturing class speak to the experimental group. Teacher 4 used a magazine and worksheets as resources. Teacher 5 used current events, news articles, and workbook activities from the manufacturing conference. Teacher 6 used the Arkansas Manufacturing Career magazine as a resource to teach the curriculum intervention.

Table 20

Reference Materials/Resources Used to Teach the New Manufacturing Curriculum: Experimental Group

Teacher	Survey Response
1	Materials provided at the conference, Internet, Manufacturing magazines/inserts.
2	I used the books that I received at the Manufacturing meeting.
3	I used the materials provided during the conference as well as the magazine. I continued to use the Project Lead the Way instructor and students because it ties beautifully with Advanced Manufacturing.
4	Magazine, worksheets.
5	Current events/news articles. Some activities from the workbook that I received from the training in Little Rock.
6	Arkansas Manufacturing Career Magazine.

The teachers rated the materials and resources used to teach the traditional manufacturing curriculum on a scale of 1 to 5 with 5 being the highest as shown in Table 21. Teachers rated the ease of use of the materials, the readability of the materials, the user friendliness of the materials, how realistic the activities were, how students responded to the traditional manufacturing curriculum, and the level of teacher satisfaction with teaching the traditional manufacturing curriculum to the control group.

Table 21

Rate 1-5 the Manufacturing Materials/Resources Implemented: Control Group

Teacher	Ease of Use	Readability	User Friendly	Realistic Activities	Student Response	Satisfaction
1	4	4	4	3	3	3
2	3	3	2	2	3	2
3	5	4	4	3	3	3
4	5	4	4	4	4	4

The teachers rated the materials and resources used to teach the new manufacturing curriculum on a scale of 1 to 5 with 5 being the highest as shown in Table 22. Teachers rated the manufacturing conference in Little Rock, Arkansas, the ease of use of the materials, the readability of the materials, the user friendliness of the materials, how realistic the activities were, how students' responded to the curriculum intervention, and the level of teacher satisfaction with teaching the curriculum to the experimental group.

Table 22

Rate 1-5 the Manufacturing Materials/Resources Implemented: Experimental Group

Teacher	Training	Ease of Use	Read-ability	User Friendly	Realistic Activities	Student Response	Satisfaction
1	5	4	4	5	5	4	4
2	4	3	3	3	4	4	4
3	5	4	4	4	4	4	4
4	4	3	4	3	3	3	4
5	4	4	4	4	4	4	4
6	5	3	5	3	3	3	3

The teachers responded to a survey question about the curricular or instructional changes they would make after teaching the traditional manufacturing curriculum to the control group. The teachers' responses reported in Table 23 recommend implementing different activities or extending the manufacturing lessons taught.

Table 23

Traditional Manufacturing Curricular or Instructional Changes: Control Group

Teacher	Survey Response
1	More up-to-date activities.
2	I needed something that I could teach that would work in today's world.
3	Work on my activity to make it more realistic and indicative of the new manufacturing careers.
4	Maybe, extend lessons to 2 days.

Teachers responded to a survey question about the curricular or instructional changes they would make after teaching the new manufacturing curriculum to the experimental group. The teachers' responses reported in Table 24 recommend making the instruction easier to understand, implementing more of the manufacturing activities, and locating current manufacturing videos. Another suggested curricular change was to start the curriculum intervention earlier in the year, reserve money in the budget to implement hands-on activities, and better planning of the new manufacturing activities.

Table 24

New Manufacturing Curricular or Instructional Changes: Experimental Group

Teacher	Survey Response
1	None.
2	I would teach the curriculum again, but I would change some of the instruction for easier understanding. It did give me better insight to all the different careers in manufacturing.
3	Try some of the activities that I didn't use. Locate current videos showing the diversity and technological changes in manufacturing.
4	Do it earlier in the year.
5	Allow/reserve money in budget for supplies to implement hands-on activities.
6	Plan time to do some of the manufacturing activities.

A survey question asked the teachers about any problems they encountered while administering the Kuder Career Interest Assessment. The teachers that participated in the control and experimental groups responded "none" to this question. The teachers that participated in the experimental group were asked to list any recommendations about the new manufacturing curriculum that can be reported to the Arkansas Department of Career Education. Teacher 2 and Teacher 3 were the only ones to respond to this survey question. Teacher 2 stated that the students really enjoyed doing most of the activities.

Their favorite activity was making the CD. Teacher 3 recommended that the ADCE provide all career orientation teachers with the new manufacturing curriculum CD and workbook.

Summary

Research results produced no significant difference between pretests and posttests for either the control or experimental groups. The posttest means for the manufacturing cluster for both the control and experimental groups were lower than the pretest means for both groups, although the mean differences were not significant. Males in the experimental group scored significantly higher than did females on the posttest for the manufacturing cluster; no gender differences existed for the control group. The teacher effects across the control and experimental groups were not statistically significant.

The teacher survey responses revealed no substantive differences among the various control and experimental groups studied. Teacher differences in preparation time and instruction time for both the traditional and intervention curricula had no effect on students' resultant career interests in manufacturing. The teacher survey revealed that the experimental group teachers rated the curriculum intervention higher than the control group teachers rated the traditional manufacturing curriculum in terms of ease of use, readability, user friendly, realistic activities, student response, and satisfaction. The research analysis presented in Chapter V offers possible reasons for data results and explores alternative approaches for future consideration.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of the Arkansas Department of Career Education (ADCE) grant-sponsored new manufacturing curriculum was to inform eighth graders about career opportunities in manufacturing and the skills necessary to compete for high-skill, high-wage, and high-demand manufacturing careers in an effort to help alleviate the shortage of skilled manufacturing workers in Arkansas. The data presented represent the results of a control and experimental group study with a sample of Arkansas teachers. The control group received the traditional manufacturing curriculum, whereas the experimental group received the curriculum intervention. The teachers administered the Kuder Career Interest Assessment as a pretest and posttest to measure the effects of the curricula on students' interests in manufacturing careers. Chapter 5 presents the implications of data results with recommendations for future practice and research.

Research Question 1

Is there a significant difference in participating students' interests in manufacturing in comparison to the national average?

Summary and implications.

The one-sample *t* tests were significant indicating that the manufacturing cluster national average (23.68) was four points greater than the manufacturing cluster posttest mean for both the control (19.64) and experimental (19.43) groups. The posttest means revealed that, nationally, students are more interested in manufacturing than are the sample of Arkansas students in this study. The finding may explain partially why Arkansas is experiencing a shortage in manufacturing workers. The finding also implies that influencing Arkansas students' career interests may be a more formidable challenge as compared to states in which students already view manufacturing more favorably.

Recommendations.

The fact that Arkansas students' career interests in manufacturing lag behind the national average confirms the intent of the Arkansas Department of Career Education to try to influence student career interests toward manufacturing. Elevating Arkansas students' career interests in manufacturing represents a plausible strategy to help alleviate the shortage of skilled manufacturing workers in the state. The resultant question that one must subsequently address deals with the effectiveness of the new manufacturing curriculum initiated, which represents the subject of the current research study.

Research Question 2

Does the curriculum intervention have a significant effect on the experimental group's interests in manufacturing in comparison to the control group?

Summary and implications.

An independent samples *t* test was used to compare the control and experimental groups manufacturing cluster pretest means. The difference in pretest means between the groups was not statistically significant. An independent samples *t* test was used to compare the control and experimental groups manufacturing cluster posttest means. Like the pretest means, the difference in posttest means between the groups was not statistically significant. A paired samples *t* test showed that no statistically significant difference existed between the experimental group pretest and posttest means for the manufacturing cluster. Similarly, a paired samples *t* test showed that no statistically significant difference existed between the control group pretest and posttest means for the manufacturing cluster.

Results indicate that the curriculum intervention had no significant effect upon the manufacturing career interests of the Arkansas eighth grade students assessed. In fact, although not statistically significant, the experimental group showed a slight decrease in interest in manufacturing careers after receiving the curriculum intervention. Similarly, the control group showed a decrease in interests in manufacturing careers after receiving instruction in the traditional manufacturing curriculum, although, again, the difference was not statistically significant. Therefore, neither the traditional manufacturing curriculum nor the curriculum intervention significantly influenced students' career interests in manufacturing.

Question 2 on the teacher survey inquired as to differences among students grade point averages, home setting (rural versus urban), and reduced lunch status. Survey responses revealed no substantive differences among the various control and experimental groups studied. Therefore, the qualitative findings of the teacher survey indicate that grade point average, home setting, and reduced lunch status did not influence research results as potential confounding variables.

Recommendations.

Previous career development research and interventions primarily have focused upon adolescents and young adults (Porfeli, Hartung, & Vondracek, 2008). Correspondingly, a lack of research exists in terms of career interventions in stages preceding adolescence (Watson & McMahon, 2005). According to Hartung et al. (2005), vocational development begins in early childhood and what children learn about work influences career choices made in adolescence and the early adult years.

Gottfredson's (1981, 2002) stage development theory of circumscription and compromise examines children's thought processes about careers in four stages. During the first stage, ages 3-5, children's thoughts are concrete as their exposure to occupational information begins. In the second stage, children aged 6 to 8, gender role perceptions influence occupational preferences. During the third stage, ages 9-13, children gain awareness of the differentiation of social value and status existing among various careers, selecting occupations accordingly. During the fourth stage, ages 14 and older, individuals tend to select occupations that are compatible with their perceptions of interests and abilities, which influence their occupational decisions.

Gottfredson's model implies that eighth graders (fourth stage) already have formed gender, social value, and status differentiation impressions related to manufacturing, providing a potential explanation of the inability of the new manufacturing curriculum to significantly influence students' manufacturing career perceptions. An intervention occurring during the second stage of Gottfredson's model might influence children's gender role perceptions related to manufacturing and or math-science related careers. Similarly, an intervention occurring during the third stage might influence the social value and status differentiation impressions that children form.

Additionally, the model of vocational development beginning from childhood through adolescence advocated by Hartung et al., (2005) suggests that early experiences with work and career exploration, along with an emerging sense of self, affects the development of occupational identity, self-concept related to the vocation, and associated values and interests. Considering how children's ability self-concepts and values influence activity performance and choice (Wigfield & Eccles, 2000) and that career interests extend from self-efficacy (Lent, Brown, & Hackett, 1994, 2000), interventions that increase both interest and self-efficacy seem appropriate (Tracey & Sodano, 2008).

Palladino Schultheiss (2008) emphasized that career interventions should provide exploratory and experiential learning activities and an integration of interventions across all academic subjects, instead of an isolated subject. Applying this concept to future practice, an intervention taught in the early grades using exploratory and experiential activities may promote students' interests in manufacturing. An integrated intervention extending from childhood into adolescence might promote children's self-concepts, values, interests, and perceived ranges of occupational options in manufacturing and or math-science related careers.

Future research designed with a longitudinal approach could better inform how students' career development toward math and science develop from elementary grades through high school. The Expectancy Value Model of Eccles et al. (1994) suggests that adolescents' self-concepts of their abilities in math and science, as well as the value that they assign to this domain choice, determine their career choices, particularly in math-science fields. A mixed-method approach based on the Expectancy Value Model could be applied by using interview questions, math self-efficacy and value assessments, the Kuder interest assessment, and assessment results to determine if an integrated intervention implemented from grade school through high school influenced students' self-concepts, values, and interests toward math and science related careers.

The interview questions would be correlated with the assessment data to explain and determine to what extent students' self-concepts, values, and interests in math and science developed before and after the implementation of an integrated intervention program across all academic subjects throughout the early to high school grades. A longitudinal study might provide researchers with data on how to address and promote students' self-concepts, values, and interests in math and science at an earlier age in order to influence their gender role perceptions, social value and status differentiations, and, later, course selections and educational choices toward math-science related careers.

Research Question 3

Are there significant gender differences in students' interests in manufacturing across experimental and control groups?

Summary and implications.

One-way ANCOVA tests, with the pretest mean as the covariate, was conducted to analyze the effect of gender on the manufacturing cluster posttest means for the control and experimental groups. The main effect for gender was not significant for the control group. Males did not score significantly higher than females on the posttest for the manufacturing cluster. The main effect for gender was significant for the experimental group. Males scored significantly higher than females on the posttest for the manufacturing cluster.

Recommendations.

An individual perceives which gender roles and behaviors are most appropriate for his or her sex based on their socio-cultural learning environment. Gender role socialization is an important element influencing career interests and choices (Lent, Brown, & Hackett, 1994). By age nine, children perceive which gender roles and behaviors are most commonly associated with certain careers (Gottfredson, 1981, 2002). This perception of gender differences influences children to consider potential occupations most compatible with his or her gender self-concept (Gottfredson & Lapan, 1997). By early adolescence, their interests stabilize, thus narrowing the alternative occupations he or she will consider (Gottfredson, 1981, 2002).

Self-concept of ability in math and positive outcome expectancies in math predict individual interest in math and science careers (Fouad & Smith, 1996). Mau, Domnick, and Ellsworth (1995) found that eighth grade female students interested in pursuing science and engineering careers reported higher levels of academic achievement, self-esteem, internal locus of control, parental expectations, and socio-economic status in comparison to other eighth grade female students. Hyde, Fennema, and Ryan (1990) suggested that low levels of mathematics self-efficacy influence the low representation found among women and minority groups in science and engineering. Meece, Glienke, and Burg (2006) showed that boys reported greater self-efficacy in math and science, whereas girls reported greater self-efficacy in language arts. In another study, Turner and Lapan (2002) found that young women demonstrated more interest in traditionally female dominated careers in Holland's artisic or social areas, whereas boys were more interested in traditionally male dominated careers in the realistic or investigative areas.

Eccles (1994) explained that some women choose traditionally female oriented careers to better balance work and family roles as compared to traditionally male oriented occupations. Super's (1990) life-span, life-space theory hypothesizes that females place more emphasis on flexibility and the ability to balance work and family roles when choosing a career. Women possessing pessimistic self-efficacy beliefs eliminate non-traditional career options, thus limiting opportunities for finding satisfying, high-paying jobs (Coogan & Chen, 2007).

Social Cognitive Career Theory suggests that career role models can provide contextual support for females and influence their self-efficacy beliefs and occupational choices in non-traditional careers (Lent, Brown, & Hackett, 1994). Counselors, teachers, and parents can recognize and encourage discussions with students on how career gender typing and or a low self-efficacy may limit students' academic choices, career exploration, interests, planning, and decision-making (Coogan & Chen, 2007). Van Vianen, De Pater, and Preenen (2009) propose teaching women career adaptability or coping skills for balancing family or life roles, understanding gender role socialization, and dealing with socio-cultural barriers in the workplace.

Watson and McMahon (2005) maintained that a lack of research exists relating to how social and environmental factors influence children's career development. According to Watson and McMahon, few studies have examined *how* children learn and *what* children learn about potential roles in the working world. Previous research has focused on the development and assessment of career interest levels, instead of the thinking, organizing, and conceptualizing processes that children enact as part of career interest development (Tracey & Sodano, 2008).

Based on the results in this study, female students were less interested in manufacturing than the males. Future studies could examine how and what females learn about their interests toward non-traditional careers. In return, researchers can develop and implement recruitment interventions for engaging female students' interests in manufacturing careers in public schools. A mixed methods approach based on Social Cognitive Career Theory (1994, 2002) can be applied to future qualitative research by exploring *how* females become interested in manufacturing or non-traditional careers by structuring interview questions that address sociocultural influences, gender differences, ethnic background, social support, and barriers. Future quantitative research may focus on *what* females learn about manufacturing careers by assessing their self-efficacy beliefs, goals, values, and expectancies for success related to pursuing manufacturing or non-traditional occupations.

Based on a qualitative and quantitative comparison analysis, recruitment interventions can be created and implemented to address and disband females' gender typing notions, as well as negative influences or perceptions about manufacturing or non-traditional careers, and provide females with effective career adaptability strategies for pursuing non-traditional careers. In addition, conducting qualitative interviews with male and female students most interested in manufacturing may determine the reasons for their high interest in manufacturing and reveal the best practices for recruitment associated with a career intervention.

Research Question 4

Is there a significant difference in students' interests in manufacturing based on individual teachers across control and experimental groups?

Summary and implications.

A one-way ANOVA test was conducted to compare the posttest means among the four control group teachers. The results indicated no significant difference existed between the posttest means of the control group teachers. A one-way ANOVA test was conducted to compare the posttest means among the six experimental group teachers. Similarly, the results indicated no significant difference existed among the posttest means of the experimental group teachers.

Question 1 of the teacher survey inquired as to differences among teachers in preparation and instruction time. Although the qualitative survey results indicated that inconsistencies did exist in terms of the time that each control and experimental group teacher spent preparing for and delivering both the traditional and intervention curricula, quantitative research results found no statistical differences among the posttest means across teachers. The results imply that differences in preparation time and instruction time for both the traditional and intervention curricula had no effect on students' resultant career interests in manufacturing.

Qualitative survey questions invited the teachers to compare the differences in curriculum and instruction that they implemented with both groups. Question 3 on the teacher survey inquired as to problems or challenges the teachers faced with implementing the new curriculum intervention, as well as the traditional curriculum. Teachers reported that the traditional manufacturing curriculum lacked the recent and realistic activities that the curriculum intervention materials provided. The control group teachers reported challenges ranging from difficulty in finding activities for teaching the traditional manufacturing curriculum, students' negative attitudes toward manufacturing, and student conflict experienced while working in groups. Experimental group teachers reported difficulty with making the curriculum intervention easier for students to understand and planning the manufacturing activities. The experimental group teachers reported challenges relating to students ability to grasp the advanced content, lack of current materials and resources, discomfort in teaching the subject for the first time, and incorporating the new curriculum into their lesson plans.

Comparing the results of Question 5 of the teacher survey, experimental group teachers rated the curriculum intervention higher than the control group teachers rated the traditional curriculum in terms of ease of use, readability, user friendly, realistic activities, student response, and satisfaction. Question 6 of the teacher survey invited teachers to offer suggestions to improve both the traditional and intervention curricula. The curricular or instructional changes for teaching the traditional manufacturing curriculum recommended by the teachers were implementing up-to-date activities, realistic activities, and extending the lessons. The curricular or instructional changes for teaching the curriculum intervention recommended by the teachers were implementing current videos and hands-on activities, making the instruction easier to understand, and planning to do more of the manufacturing activities.

Recommendations.

Based on the survey data, teachers need to make improvements in the planning of activities. The curriculum intervention contained advanced math concepts and several group work activities that the teachers found difficult to implement and difficult for the students to learn. Based on the staff development model of Joyce and Showers (1982), schools should provide teachers with instructional material describing the implementation rationale, peer modeling for each strategy via multimedia, and feedback from the trainer or peer coach relating to teachers' understanding and application of the strategies by using a self-reflection form. Therefore, career orientation teachers may need extensive observation training and peer coaching to implement the curriculum intervention activities effectively and to improve the teachers' level of comfort with group work and teaching the advanced content.

In addition, teacher staff development on classroom self-efficacy strategies likely would improve students' math self-efficacy concepts and, consequently, student outcomes in the advanced group work activities. Bandura (1986) explained that both self-efficacy and imagined outcome consequences of a particular course of action help determine if a person will choose or avoid a specific activity. When individuals perceive self-competence at a particular activity, as well as positive outcomes yielded by the activity, people tend to develop interests for that activity. Conversely, people may develop dislike for an activity if they feel incompetent at the activity or expect to receive negative outcomes (Lent, 2005).

Some learning strategies for increasing students' self-efficacy include modifying instructional techniques, teacher feedback, student goal setting, and teacher and student role modeling (Bandura, 1986; Schunk, 1984). When students practice different activities and receive continuous feedback about their performances, their skills improve, performance standards develop, and self-efficacy and outcome expectations for particular activities form and their interests expand. The development of self-efficacy, positive outcome expectations, and interests stimulates students to set goals, persist, and exert extra effort in sustaining and increasing their skills and involvement in particular activities (Lent, 2005).

In addition, career orientation teachers can increase students' activity practice, math self-efficacy, and outcome expectations in math by collaborating with math teachers to integrate the advanced intervention activities with the students' mathematics curriulum.

Math teachers can incorporate the math concepts from the intervention into their curriculum to prepare and reinforce the math activities taught during the manufacturing cluster. Activity practice and subsequent practice efforts encourage performance achievements, in return, influencing self-efficacy and outcome expectations throughout the repetition of activities (Lent, 2005).

Based on the survey data, teachers need to make improvements in implementing the appropriate resources. Teachers can implement the appropriate resources by taking into account Bandura's (1997) four learning experiences: personal performance accomplishments, vicarious learning, social persuasion, and physiological and affective states. Teachers also can apply the critical ingredients for structuring intervention efforts advanced by Brown et al. (2003). Teachers can foster personal performance accomplishments by teaching students how to assess and interpret their own vocational interests, skills, and values (in the manufacturing cluster) using career exploration and decision-making models. Teachers can provide vicarious learning experiences by providing career role models as guest speakers to explain their personal experiences with the decision-making process and the high-wage, high-demand, and high-skill opportunities available in manufacturing. Teachers can use workbooks and written exercises requiring students to compose goals, plans, and career analyses in a cluster-specific field, such as manufacturing. Teachers can provide students with individualized interpretation and feedback on test results, goals, and plans (Brown et al., 2003). When students clarify their interests, skills, and values, this allows students to expand their options in a career field (Lent, 2005), such as manufacturing. Students can gather current data about specific career options during class sessions and outside of the classroom to explore accurate information about careers in manufacturing (Brown et al., 2003).

Teachers can address students' negative attitudes or preconceived notions about manufacturing careers by teaching them career adaptability skills and providing a social support network. Social Cognitive Career Theory's choice model contends that people are more likely to follow career preferences if they perceive few barriers to achievement and if they have a strong support system (Lent, 2005). Teachers can apply persuasion techniques to encourage students to perform new tasks, persist in challenging activities, and view performances as enhancing their skill development in manufacturing. As suggested by Brown et al. (2003), teachers can assist students in building a network of social support to help them sustain their career choices and plans (in manufacturing) by identifying possible mentors and facilitating the career decision-making process. Following Lent's recommended approach, teachers or counselors can demonstrate to students where and how to access social and financial resources, the steps to implement their preferred options, and involve family members to participate and assist the students in developing career adaptability and support strategies.

Teachers may need to implement the same curriculum intervention lessons and spend the same amount of instructional time on the curriculum intervention. Although no teacher differences across groups existed in the current study, greater consistency of instruction would lessen the possibility of teacher differences across groups introducing itself into future studies as a potential confounding variable.

Palladino Schultheiss (2008) recommends applying a collaborative intervention-based research approach to future studies in 21st century schools. For example, university faculty and graduate research students possess knowledge of conducting research, writing, and collecting and reporting data results. Teachers have access to students and the skills to deliver and implement instruction resulting from university-driven research design. Collaborative intervention efforts would involve university faculty working with K -12 educators to conceptualize, assess, and implement effective career interventions to promote students' interests in manufacturing, in return meeting the needs of the economic community.

Summary

Considering children's gender role socialization (Gottfredson, 1981; 2002) and the effect that personal and environmental factors have upon career development (Lent, Brown, & Hackett, 1994; 2000), few studies have examined how and what children learn about careers (Watson & McMahon, 2005). Therefore, future studies should consider qualitative research by using a grounded theory approach to understand *how* students develop career interests in manufacturing and *what* students learn about manufacturing careers over time from childhood through adolescence. Such an approach might allow researchers and policy makers to discover the best career interventions and recruitment practices to implement in the public schools for promoting students' interest in manufacturing careers in an effort to help alleviate the shortage of skilled manufacturing workers in Arkansas.

APPENDIX A

Informed Consent Letter to Teachers

Dear Career Orientation Teacher:

We are requesting that you participate in a research study conducted by doctoral student, Bridget Duncan, under the guidance of Dr. David Agnew, Associate Professor at Arkansas State University in cooperation with the Department of Career Education. The purpose of the research is to determine the effect of the new manufacturing curriculum on career orientation students' career interests as measured by the *Kuder Career Interest Assessment* administered before and after receiving instruction using this new curriculum. The interest of students in manufacturing careers has an impact on economic development and the ability to attract industry to Arkansas.

What we need from teachers:

1. A **list** of **students', teacher, and school names** for the Fall 2007 and Spring 2008 semester sent to Bridget Duncan by postal mail or email and the **signed copy** of the consent form faxed or mailed to the address below. *Please make a copy of the signed consent form for your records*.
2. We are asking teachers who administered the *Kuder* early in the Fall 2007 semester to **administer Kuder again at the end of the Fall semester.**
3. We ask that this same group of teachers administer the *Kuder* at the **beginning of the Spring 2008 semester,** implement the NEW manufacturing curriculum, and administer the **Kuder again at the end of the Spring semester**.
4. We ask that at the end of the Spring 2008 semester, the teachers implementing the manufacturing curriculum **complete a survey** related to their perceptions of the curriculum and its effectiveness.

Your willingness to participate will provide the Department of Career Education a wealth of information that will help guide decisions in the future. All schools, teachers, and student names **will be kept confidential.** Please read the informed consent form that is attached and if you are willing to participate then sign the attached form and return it to Bridget Duncan. We appreciate your time and effort in participating in this study.

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Informed Consent Information and Agreement

The Effects of a Manufacturing Curriculum on Arkansas Students' Career Interests

Your rights as a volunteer. Your participation in this study is completely voluntary, and you may choose not to participate. You are free to withdraw from this study at any time with no penalty to you. Your responses and those of your students will be kept confidential. If the results of this study were to be written in a report or for publication, no identifying information will be used. There are no foreseeable risks involved with your participation in this study. If you have questions or concerns regarding this study please contact the investigator or advisor at the address below. If you have any questions regarding your rights as a research subject, please contact **Sheri Walls** at 870-972-3032.

Persons agreeing to participate in this project should read the following statements and check both boxes, provide the information requested and sign below.

[ ] I have read this consent form, and all of my questions have been answered. I freely and voluntarily choose to participate in the research interview, and I understand that I will receive a signed copy of this form.

[ ] The information contained in this consent form has been adequately explained to me. All my questions have been answered and I freely and voluntarily choose to participate. I understand that I may withdraw my consent at any time.

Print your name: ____

Name of School:____

Email Address:______________________ Phone Number:_____-_____-_____

______________ ______________________________

Date *Your Signature*

Thank You ! ! !

Bridget Duncan **Arkansas State University** **Center for Excellence in Education** P.O. Box 1270 State University, AR 72467-1270 Phone: 870-972-3943 Fax: 870-972-3945 bridget.duncan@smail.astate.edu	Dr. David Agnew **Arkansas State University** **Agricultural Education and** **Career & Technical Ed.** P.O. Box 1080 State University, AR 72467 Phone: 870-972-2453 dagnew@astate.edu

APPENDIX B

Career Orientation Teacher Survey

<u>Traditional Manufacturing Curriculum Fall 2007 Survey</u>

Teacher Name: ____

School: ____

<u>Directions</u>: Please answer the following questions as you reflect on your experience with teaching the manufacturing cluster in the Fall 2007 semester.

1. How much time did you spend planning and teaching the manufacturing cluster in the fall? Preparation hours? _______ Instructional hours? _______

2. Overall, how would you describe the students you taught in the fall with respect to the following criteria?
   GPA: (low, average, high) ______________________
   Home setting/location: (rural/small town or urban/city) ______________________
   What percentage would you say is on reduced lunch? ______________________

3. What problem(s), if any, did you encounter while teaching the manufacturing cluster during the fall semester?

4. What reference materials or curriculum resource(s) did you use to teach the manufacturing cluster during the fall semester?

5. Rate the manufacturing cluster materials/resources that you used in the **Fall** on a scale of 1 to 5 with 5 being the highest by **bolding** and <u>underlining</u> your answer:

Ease of use	1	2	3	4	5
Readability	1	2	3	4	5
User friendly	1	2	3	4	5
Realistic activities	1	2	3	4	5
How students' responded to this curriculum	1	2	3	4	5
Your level of satisfaction with curriculum	1	2	3	4	5

6. After teaching the manufacturing cluster in the fall, what curricular or instructional changes would you make if you were to teach this cluster again?

7. What problem(s), if any, did you encounter with the Kuder Career Interest Assessment in the fall?

Continue on next page

New Manufacturing Curriculum Spring 2008 Survey

Teacher Name: ____

School: ____

Directions: Please answer the following questions as you reflect on your experience with teaching the new manufacturing curriculum in the Spring 2008 semester.

1. How much time did you spend planning and teaching the **new manufacturing curriculum** in the spring? Preparation hours? ______ Instructional hours? _____

2. Overall, how would you describe the students you taught in the spring with respect to the following criteria?
   GPA: (low, average, high) ____________________
   Home setting/location: (rural/small town or urban/city) ______________
   What percentage would you say is on reduced lunch? _______________

3. What problem(s), if any, did you encounter while teaching the **new manufacturing curriculum** during the spring semester?

4 What reference materials or curriculum resource(s) did you use to teach the **new manufacturing curriculum** during the spring semester?

5. Rate the **new manufacturing curriculum** that you used in the spring on a scale of 1 to 5 with 5 being the highest by **bolding** and underlining your answer:

Effectiveness of Little Rock training	1	2	3	4	5
Ease of use	1	2	3	4	5
Readability	1	2	3	4	5
User friendly	1	2	3	4	5
Realistic activities	1	2	3	4	5
How students' responded to the curriculum	1	2	3	4	5
Your level of satisfaction with curriculum	1	2	3	4	5

6. After teaching the **new manufacturing curriculum** in the **spring**, what curricular or instructional changes would you make if you were to teach this curriculum again?

Continue on next page

7. What problems, if any, did you encounter with the Kuder Career Interest Assessment in the spring?

8. Please list any recommendations about the **new manufacturing curriculum** that can be passed on to the Department of Career Education:

REFERENCES

Ali, S. R., & Saunders, J. L. (2006). College expectations of rural Appalachian youth: An exploration of social cognitive career theory factors. *Career Development Quarterly, 55*(1), 38.

Amir, T., & Gati, I. (2006). Facets of career decision-making difficulties. *British Journal of Guidance & Counseling*, *34*(4), 483.

Arkansas Department of Economic Development. (2006). *ACE workbook for the Arkansas community of excellence program*. Retrieved November 14, 2007, from http://www.1800arkansas.com/business_development/community_development/files/ACE%20Manual%202006.pdf

Arkansas Department of Career Education. (2004). *Program policies and procedures for career and technical education: Secondary programs and adult skill training*. Retrieved August 1, 2007, from http://dwe.arkansas.gov/CTESCTEProgramPoliciesandProcedures.htm

Arkansas Department of Career Education. (2006). *Career orientation: Curriculum content frameworks*. Retrieved August 1, 2007, from http://ace.arkansas.gov/CurriculumFrameworks/CareerOrientation/carerorientation2006.pdf

Arkansas Department of Career Education. (2007a). *Arkansas state transition plan for the Carl D. Perkins Career and Technical Education Act – July 1, 2007, through June 30, 2008*. Retrieved August 1, 2007, from http://dwe.arkansas.gov/CareerandTechEducation/StateTransitionPlanFINAL.doc

Arkansas Department of Career Education. (2007b). *Career action plan*. Retrieved August 1, 2007 from http://dwe.arkansas.gov/CareerOrientation/CareerActionPlan-LettertoCOTeachers.doc

Arkansas Department of Career Education. (2007c). *Career orientation philosophy*. Retrieved August 1, 2007, from http://dwe.arkansas.gov/CareerOrientation/OBJECTIV.CO.doc

Arkansas Department of Career Education. (2007d). *National career clusters*. Retrieved August 1, 2007, from http://dwe.arkansas.gov/CareerandTechEducation/2004Policiesapproved10-04.pdf

Bandura, A. (1986). *Social foundations of thought and action: A social cognition theory*. New Jersey: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bandura, A. (2000). Exercise of human agency through collective efficacy. *Current Directions in Psychological Science*, *9*(3), 75.

Bauman, S. (2006). Using comparison groups in school counseling research: A primer. *Professional School Counseling*, *9*(5), 357.

Betz, N., & Hackett, G. (1983). The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behavior*, *23*(3), 329.

Betz, N. (1994). Self-concept theory in career development and counseling. *Career Development Quarterly, 43*(1), 32.

Betz, N. E. (2004). Contributions of self-efficacy theory to career counseling: A personal perspective. *Career Development Quarterly, 52*(4), 340.

Brown, S. D., & Lent, R. W. (1996). A social cognitive framework for career choice counseling. *Career Development Quarterly, 44*(4), 354.

Brown, S. D., Krane, N. E. R., Brecheisen, J., Castelino, P., Budisin, I., Miller, M., & Edens, L. (2003). Critical ingredients of career choice interventions: More analyses and new hypotheses. *Journal of Vocational Behavior*, *62*(3), 411.

Career Communications, Inc. (2006). *Manufacturing: The new generation*. Overland Park, KS: Author.

Collin, A. (2006). Conceptualizing the family-friendly career: The contribution of career theories and a systems approach. *British Journal of Guidance & Counseling*, *34*(3), 295.

Collins, J. T. (2005). An Arkansas outlook: Prospects for growth. *Business Perspectives*, *16*(4), 18.

Coogan, P. A., & Chen, C. P. (2007). Career development and counselling for women: Connecting theories to practice. *Counselling Psychology Quarterly, 20*(2*)*, 191.

Creed, P. A., Prideaux, L., & Patton, W. (2005). Antecedents and consequences of career decisional states in adolescence. *Journal of Vocational Behavior, 67*(3), 397.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, NJ: Pearson.

Crites, J. O. (1978). *Theory and research handbook for the Career Maturity Inventory* (2nd ed.). Monterey, CA: McGraw-Hill/CTB.

Crites, J. O. (1997). *The revised Career Maturity Inventory.* Paper presented at the National Career Development Association Conference, Daytona Beach, FL.

Dahir, C.A., & Stone, C. (2003). *Leaving no school counselor behind. Retrieved March 22, 2008, from http://www.counselingoutfitters.com/vistas/vistas04/18.pdf*

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Delano, R. K. & Hutton, K. C. (2007). Economic and workforce development – K through 12 education issue. *Economic Development Journal*, *6*(2), 47.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation*. (pp. 75-146). San Francisco, CA: W. H. Freeman.

Eccles, J. S. (1994). Understanding women's educational and occupational choices: Applying the Eccles et al. model of achievement-related choices. *Psychology of Women Quarterly, 18(4)*, 585.

Eccles, J. S. (2005). Studying gender and ethnic differences in participation in math, physical science, and information technology. *New Directions for Child & Adolescent Development*, *2005*(*110*), 7.

Feller, R. (1996). Preparation for the changing workplace. *Vocational Education Journal, 71*(4), 27.

Ferry, T. R., Fouad, N. A., & Smith, P. L. (2000). The role of family context in a social-cognitive model for career-related choice behavior: A math and science perspective. *Journal of Vocational Behavior*, *57*(3), 348.

Fouad, N. A., & Spreda, S. L. (1996). Transition and use of a career decision-making self-efficacy assessment for Hispanic middle school students. *Journal of Vocational Education Research, 21*(4), 67.

Fouad, N. A., & Smith, P. L. (1996). A test of a social cognitive model for middle school students: Math and science. *Journal of Counseling Psychology*, *43*(3), 338.

Friedman, T. L. (2005). The world is flat: A brief history of the twenty-first century. (1st ed.). NY: Farrar, Straus and Giroux.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston, MA: Pearson.

Gardner, D. (2007). Average age of manufacturing workers: 50 years old. *Northeast Pennsylvania Business Journal*, *22*(1), 53.

Gati, I., Krausz, M., & Osipow, S. H. (1996). A taxonomy of difficulties in career decision making. *Journal of Counseling Psychology, 43*(4)*,* 510.

Gelatt, H. B. (1989). Positive uncertainty: A new decision-making framework for counseling. *Journal of Counseling Psychology, 36*(2)*,* 252.

Goodman, J., & Hansen, S. (2005). Career development and guidance programs across cultures: The gap between policies and practices. *Career Development Quarterly*, *54*(1), 57.

Gottfredson, L. S. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology*, *28*(6), 545.

Gottfredson, L. S. (2002). Gottfredson's theory of circumscription, compromise, and self-creation. In D. Brown & Associates (Eds.), *Career choice and development* (4th ed., pp. 85 – 148). San Francisco: Jossey-Bass.

Gottfredson, L. S., & Lapan, R. T. (1997). Assessing gender-based circumscription of occupational aspirations. *Journal of Career Assessment*, *5*(4), 419.

Gysbers, N. C. (2001). School guidance and counseling in the 21st century: Remember the past into the future. *Professional School Counseling*, *5*(2), 96.

Gysbers, N. C., & Henderson, P. (2001). Comprehensive guidance and counseling programs: A rich history and a bright future. *Professional School Counseling*, *4*(4), 246.

Hackett, G., & Campbell, N. K. (1987). Task self-efficacy and task interest as a function of performance on a gender-neutral task. *Journal of Vocational Behavior*, *30*(2), 203.

Hackett, G., Espositio, D., & O'Halloran, M. S. (1989). The relationship of role model influences to the career salience and education and career plans of college women. *Journal of Vocational Behavior*, *35*(2), 164.

Hartung, P. J., & Blustein, D. L. (2002). Reason, intuition, and social justice: Elaborating on Parsons' career decision-making model. *Journal of Counseling & Development*, *80*(1), 41.

Hartung, P. J., Porfeli, E. J., & Vondracek, F. W. (2008). Career adaptability in childhood. *The Career Development Quarterly*, *57*(1), 63.

Herr, E. L. (1997). Super's life-span, life-space approach and its outlook for refinement. *Career Development Quarterly*, *45*(3), 238.

Herr, E. L. (2001a). Career development and its practice: A historical perspective. *Career Development Quarterly*, *49*(3), 196.

Herr, E. L. (2001b). The impact of national policies, economics, and school reform on comprehensive guidance programs. *Professional School Counseling*, *4*(4), 236.

Herr, E. L. (2002). School reform and perspectives on the role of school counselors: A century of proposals for change. *Professional School Counseling*, *5*(4), 220.

Herr, E. L., & Shahnasarian, M. (2001). Selected milestones in the evolution of career development practices in the twentieth century. *Career Development Quarterly*, *49*(3), 225.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist*, *41*(2), 111.

Hirschi, A., & Lage, D. (2008). Increasing the career choice readiness of young adolescents: An evaluation study. *International Journal for Educational and Vocational Guidance*, *8*(2), 95.

Holland, J. L. (1985). Making vocational choices: A theory of vocational possibilities and work environments (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Holland, J. L. (1996). Exploring careers with a typology: What we have learned and some new directions. *American Psychologist*, *51*(4), 397.

Holland, J. L. (1997). Making vocational choices: A theory of vocational personalities and work environments (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Hughey, K. F., & Hughey, J. K. (1999). Preparing students for the future: Making career development a priority. *Journal of Career Development, 25*(3), 203.

Hyde, J. S., Fennema, E., & Ryan, M. (1990). Gender comparisons of mathematics attitudes and affect: A meta-analysis. *Psychology of Women Quarterly*, *14*(3), 299.

Jacobs, J. E. (2005). Twenty-five years of research on gender and ethnic differences in math and science career choices: What have we learned? *New Directions for Child & Adolescent Development*, *2005*(*110*), 85.

Jenkins, D. (2006). *Career pathways: Aligning public resources to support individual and regional economic advancement in the knowledge economy*. http://www.workforcestrategy.org/publications/WSC_pathways8.17.06.pdf

Ji, P. Y., Lapan, R. T., & Tate, K. (2004). Vocational interests and career efficacy expectations in relation to occupational sex-typing beliefs for eighth grade students. *Journal of Career Development, 31*(2), 143.

Joyce, B., & Showers, B. (1982). The coaching of teaching. *Educational Leadership, 40*(1), 4.

Kazdin, A. E. (2003). Psychotherapy for children and adolescents. *Annual Review of Psychology*, *54*(*1*), 253.

Ketterson, T. U., & Blustein, D. L. (1997). Attachment relationships and the career exploration process. *Career Development Quarterly*, *46*(2), 167.

Koszalka, T. A., Grabowski, B. L., & Darling, N. (2005). Predictive relationships between web and human resource use and middle school students' interest in science careers: An exploratory analysis. *Journal of Career Development*, *31*(3), 171.

Kuder, F. (1980). Person matching. *Educational and Psychological Measurement*, *40*(1), 1.

Kuder, Inc. (2007). *About Kuder*. Retrieved August 5, 2007, from http://www.kuder.com/PublicWeb/kcs.aspx

Lambie, G. W., & Williamson, L. L. (2004). The challenge to change from guidance counseling to professional school counseling: A historical proposition. *Professional School Counseling*, *8*(2), 124.

Lane, J. (2000). A scientific approach for developing and testing a students' job-career plan before 11th grade. *Education, 120*(4), 605.

Lapan, R. T., Gysbers, N. C., Multon, K. D., & Pike, G. R. (1997). Developing guidance competency self-efficacy scales for high school and middle school students. *Measurement and Evaluation in Counseling and Development*, *30*(1), 4.

Lapan, R. T., Adams, A., Turner, S., & Hinkelman, J. M. (2000). Seventh graders' vocational interest and efficacy expectation patterns. *Journal of Career Development*, *26*(3), 215.

Lapan, R. T., & Turner, S. (2002). Career self-efficacy and perceptions of parent support in adolescent career development. *Career Development Quarterly*, *51*(1) 44.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, *45*(1), 79.

Lent, R. W., Hackett, G., & Brown, S. D. (1999). A social cognitive view of school-to-work transition. *Career Development Quarterly, 47*(4), 297.

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47*(1), 47.

Lent, R. W. (2005). A social cognitive view of career development and counseling. In Brown, S. D., & Lent, R. W. *Career development and counseling: Putting theory and research to work.* (pp.101-127). Hoboken, NJ: Wiley.

Levinson, E. M., Ohler, D. L., Caswell, S., & Kiewra, K. (1998). Six approaches to the assessment of career maturity. *Journal of Counseling and Development, 76*(4), 475.

Magnuson, C. S., & Starr, M. F. (2000). How early is too early to begin life career planning? The importance of the elementary school years. *Journal of Career Development, 27*(2), 89.

Mau,W. C., Domnick, M., & Ellsworth, R. A. (1995). Characteristics of female students who aspire to science and engineering or homemaking occupations. *Career Development Quarterly, 43(4)*, 323.

Mazzeo, C., Roberts, B., Spence, C., & Strawn, J. (2006). *Working together: Aligning state systems and policies for individual and regional prosperity*. Brooklyn, NY: Workforce Strategy Center.

McWhirther, E. H., Hackett, G., & Bandalos, D. L. (1998). A causal model of the educational plans and career expectations of Mexican American high school girls. *Journal of Counseling Psychology*, *45*(2), 166.

Meece, J. L., Glienke, B. B., & Burg, S. (2006). Gender and motivation. *Journal of School Psychology, 44(5)*, 351.

Meltzoff, J. (2003). *Critical thinking about research*. Washington, DC: American Psychological Association.

Miller, M. J., & Miller, T. A. (2005). Theoretical application of Holland's theory to individual decision-making styles: Implications for career counselors. *Journal of Employment Counseling*, *42*(1), 20.

National Association of Manufacturers. (2005). *2005 skills gap report: A survey of the American manufacturing workforce*. Retrieved August 14, 2007, from http://www.nam.org/s_nam/bin.asp?CID=202426&DID=235731&DOC=FILE.PDF

National Association of Manufacturers. (2006). *The facts about modern manufacturing*. Retrieved August 14, 2007, from http://www.nam.org/s_nam/bin.asp?CID=202612&DID=237708&DOC=FILE.PDF

National Career Development Association. (2003). Career development: A policy statement of the national career development association board of directors. Retrieved August 14, 2007, from www.ncda.org/pdf/Policy.pdf

Niijhof, W. J. (1998). Qualifications for the future. In W. J. & J. N. Streumer (Eds.), *Key qualifications in work and education* (19-35). Boston, MA: Kluwer Academic Publishers.

North Central Regional Educational Laboratory. (2003). enGauge 21st century skills: Helping students thrive in the digital age. Retrieved January 22, 2009, from www.bcps.org/offices/lis/staging/activesci/images/litskillsbrochure.pdf

O'Brien, K. M., Dukstein, R. D., Jackson, S. L., Tomlinson, M. J., & Kamatuka, N. A. (1999). Broadening career horizons for students in at-risk environments. *Career Development Quarterly*, *47*(3), 215.

O'Brien, K. M. (2001). The legacy of Parsons: Career counselors and vocational psychologists as agents of social change. *Career Development Quarterly*, *50*(1), 66.

Ochs, L. A., & Roessler, R. T. (2004). Predictors of career exploration intentions: A social cognitive career theory perspective. *Rehabilitation Counseling Bulletin, 47*(4), 224.

Osborn D. S., & Reardon, R. C. (2006). Using the self-directed search: Career explorer with high-risk middle school students. *Career Development Quarterly*, *54*(3), 269.

Paisley, P. O., & McMahon, G. H. (2001). School counseling for the 21st century: Challenges and opportunities. *Professional School Counseling*, *5*(2), 106.

Palladino Schultheiss, D.E. (2008). Current status and future agenda for the theory, research, and practice of childhood career development. *Career Development Quarterly, 57(1)*, 7.

Parsons, F. (1909). *Choosing a vocation*. Boston, MA: Houghton Mifflin.

Pitz, G. F., & Harren, V. A. (1980). An analysis of career decision making from the point of view of information processing and decision theory. *Journal of Vocational Behavior, 16*(4), 320.

Pope, M. (2000). A brief history of career counseling in the United States. *Career Development Quarterly, 48*(3), 194.

Porfeli, E. J., Hartung, P. J., & Vondracek, F. W. (2008). Children's vocational development: A research rationale. *Career Development Quarterly, 57(1)*, 25.

Powell, D. F., & Luzzo, D. A. (1998). Evaluating factors associated with the career maturity of high school students. *Career Development Quarterly, 47*(2), 145.

Quimby, J. L., & DeSantis, A. M. (2006). The influence of role models on women's career choices. *Career Development Quarterly*, *54*(4), 297.

Reardon, R. C., Bullock, E. E., & Meyer, K. E. (2007). A Holland perspective on the U.S. workforce from 1960 to 2000. *Career Development Quarterly*, *55*(3), 262.

Rojewski, J. W., & Yang, B. (1997). Longitudinal analysis of select influences on adolescents' occupational aspirations. *Journal of Vocational Behavior*, *51*(3), 375.

Sampson, J. P., Jr., Reardon, R. C., Peterson, G. W., & Lenz, J. G. (2004). *Career counseling and services: A cognitive information processing approach.* Pacific Grove, CA: Brookes/Cole.

Savickas, M. L. (1997). Career adaptability: An integrative construct for life-span, life-space theory. *Career Development Quarterly*, *45*(3), 247.

Savickas, M. L. (2002). Reinvigorating the study of careers. *Journal of Vocational Behavior*, *61*(3), 381.

Savickas, M. L. (2005). The theory and practice of career construction. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 42 – 70). New York: Wiley.

Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement*, *55*(5), 818.

Secretary's Commission on Achieving Necessary Skills. (1991). *What work requires of schools: A SCANS report for America 2000.* Washington, DC: U.S. Department of Labor.

Secretary's Commission on Achieving Necessary Skills. (1993). *Teaching the SCANS Competencies,* US Department of Labor, Washington, DC.

Schunk, D. H. (1984). Sequential attributional feedback and children's achievement behaviors. *Journal of Educational Psychology, 76*(6), 1159.

Smith, W., & Erb, T. O. (1986). Effect of women science career role models on early adolescents' attitudes toward scientists and women in science. *Journal of Research in Science Teaching*, *23*(8), 667.

States' Career Clusters Initiative. (2008). *More about Career Clusters*. Retrieved November 16, 2008, from http://www.careerclusters.org

State Scholars Initiative. (2008). *A Scholar Today…A Success Tomorrow!* Retrieved November 16, 2008, from http://www.wiche.edu/statescholars

Stephens, W. R. (1970). *Social reform and the origins of vocational guidance*. Washington, DC: National Vocational Guidance Association.

Super, D. E. (1984). Career and life development. In D. Brown, L. Brooks, & Associates (Eds.), *Career choice and development: Applying contemporary theories to practice* (pp. 192 – 234). San Francisco: Jossey-Bass.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown & L. Brooks (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed., pp. 197 – 261). San Francisco: Jossey-Bass.

Super, D. E., Savickas, M., & Super, C. (1996). The life-span, life-space approach to careers. In D. Brown, L. Brooks, & Associates (Eds.), *Career choice and development* (3rd ed., pp. 121 – 178). San Francisco: Jossey-Bass.

Tabachnick, B. G., & Fidell, L. S. (1996). Using multivariate statistics (3rd ed.). New York, NY: HarperCollins College Publishers.

Thomas, J. H., & McDaniel, C. R. (2004). Effectiveness of a required course in career planning for psychology majors. *Teaching of Psychology*, *31*(1), 22.

Tracey, T. (2001). The development of structure of interests in children: Setting the stage. *Journal of Vocational Behavior*, 59, 89.

Tracey, T., & Sodano, S. M. (2008). Issues of stability and change in interest development. *Career Development Quarterly, 57(1),* 51.

Trusty, J., & Niles, S. G. (2004). *A practical approach to career assessment in schools*. In B. Erford (Ed.), Professional school counseling: A handbook of theories, programs, & practices. (pp. 431-441). Austin, TX: Pro-Ed.

Trusty, J., Niles, S., & Carney, J. (2005). Education-career planning and middle school counselors. *Professional School Counseling*, *9*(2), 136.

Turner, S. L., & Lapan, R. T. (2002). Career self-efficacy and perceptions of parent support in adolescent career development. *Career Development Quarterly, 51(1)*, 44.

Turner, S. L., Steward, J. C., & Lapan, R. T. (2004). Family factors associated with sixth-grade adolescents' math and science career interests. *Career Development Quarterly*, *53*(1), 41.

Turner, S. L., & Lapan, R. T. (2005). Evaluation of an intervention to increase non-traditional career interests and career-related self-efficacy among middle-school adolescents. *Journal of Vocational Behavior*, *66*(3), 516.

U.S. Department of Education. (2007). *Carl D. Perkins Career and Technical Education Act of 2006*. Retrieved November 14, 2007, from http://www.ed.gov/policy/sectech/leg/perkins/index.html

Van Vianen, A. E. M., De Pater, I. E., Preenen, P. T. Y. (2009). Adaptable careers: Maximizing less and exploring more. *The Career Development Quarterly*, *57*(4), 298.

Watson, M., & McMahon, M. (2005). Children's career development: A research review from a learning perspective. *Journal of Vocational Behavior, 67*(2), 119.

Watt, H. (2005). Explaining gendered math enrollments for NSW Australian secondary school students. *New Directions for Child & Adolescent Development*, *2005*(*110*), 15.

Whiston, S. C. (2003). Career counseling: 90 years old yet still healthy and vital. *Career Development Quarterly*, *52*(1), 35.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68.

Wirth, A. G. (1992). *Education and work for the Year 2000*. *Choices we face*. San Francisco: Jossey-Bass Publishers.

Zunker, V. G. (1994). *Career counseling: Applied concepts of life planning* (4^{th} ed.). Pacific Grove, CA: Brooks/Cole.

Zytowski, D. G., & Kuder, F. (1999). *Kuder Career Search with Person Match*. Adel, IA: National Career Assessment Services.

Zytowski, D. G. (2007). *Kuder Career Search with Person Match*: *Technical manual version 1.1*. Retrieved November 14, 2007, from https://www.visions-unltd.com/PublicWeb/kcs_manual.aspx