Career and Technical Education Research (*CTER*) is published three times a year and is an official publication of the Association for Career and Technical Education Research (*ACTER*). *ACTER* was organized in 1966 and strives to: (a) stimulate research and development activities related to career and technical education, (b) stimulate the development of training programs designed to prepare persons for responsibilities in career and technical education research, (c) foster a cooperative effort in research, (d) foster a cooperative effort in research and development activities with the total program of career and technical education and other disciplines, and (e) facilitate the dissemination of research findings and diffusion of knowledge.

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Editor's Note

James P. Greenan
Purdue University

The Association for Career and Technical Education Research (*ACTER*) was founded in 1966 under the original name, the American Vocational Education Research Association (*AVERA*). The Association began publishing its Journal, *Career and Technical Education Research* (*CTER*) in 1976 under the name, the *Journal of Vocational Education Research* (*JVER*). Since the genesis of the Association and its Journal, the field has experienced tremendous growth and expansion of its research and conceptual knowledge base. Further, the field has been led (and continues to be led) by numerous dedicated professionals who are committed to the conduct, promotion, and dissemination of research in Career and Technical Education (CTE). It is not possible to name all of these individuals within the current space limitations. However, early in my career, I was fortunate to have worked with and been mentored by some of the founders and pioneers of the *ACTER*, namely George H. Copa, Jerome Moss, Brandon B. Smith, and Gordon I. Swanson. They were outstanding teachers, researchers, and role models. They also conveyed the importance of professionalism, commitment, dedication, and excellence. Accordingly, when colleagues asked me to consider accepting the nomination as Editor of *CTER*, I felt a responsibility to serve and contribute to the tradition of excellence that is characteristic of the *ACTER* and *CTER*. Similarly, I call on our colleagues to serve and contribute to excellence in the Association and Journal in a variety of capacities.

I am honored to serve as Editor of *CTER* for Volumes 32 and 33. I am also pleased to introduce Lisa A. Neuenschwander as Assistant to Editor from Purdue University. James M. Brown at the University of Minnesota will serve as Associate Editor, and Curtis R. Friedel from Louisiana State University, will serve as Managing Editor. Additionally, I will be working with an Editorial Board and field reviewers that represent colleagues with excellent dedication and talents. I wish to thank Steven R. Aragon (former *CTER* Editor) and David Ortner (former Assistant to Editor) for helping to ensure a smooth and successful transition between Editors and institutions. On behalf of the Editorial staff and Editorial Board, I welcome you to Volume 32, Issue 1.

Jack Elliot's 2006 *ACTER* Presidential Address builds a strong argument that CTE is the premier educational delivery system in the world. He makes several historical, sociological, economic, political, and legislative points to make his case. Elliot stresses the impact CTE can and does make in teaching academics using integrative methodologies and, thereby, enhancing learner achievement. Elliot's

argument resonates well with contemporary curricular and instructional issues confronting CTE.

Sang Hoon Bae, Kenneth Gray, and Georgia Yeager focus on a study that compares CTE participants and non-CTE participants on state-mandated math and reading proficiency tests. Specifically, the questions posited include: (a) Is there a statistically significant difference between CTE students' performance on state-mandated 11th-grade math and reading proficiency tests and a comparison group of non-CTE students with similar math proficiency scores in the 8th-grade, and (b) Is student performance on an 11th-grade state-mandated proficiency test associated with math course-taking patterns prior to enrollment in CTE? A strong conceptual framework that is well supported by theory and previous research guided the study.

Bradley Greiman, Robert Torres, Scott Burris, and Tracy Kitchel compared two different formal mentoring relationships based on the perceptions of beginning teachers regarding their dyadic interactions. The study was predicated on a theoretical framework of Kram's mentor role theory and Byrne's similarity-attraction paradigm. The problem focused on the interaction that two cohorts of beginning teachers had either with formal mentors located in their school, or teachers who served as formal mentors and were located in neighboring schools. The study contributes to the knowledge base regarding the success and retention of beginning CTE teachers.

Travis Park and Ed Osborne examined effective classroom strategies to improve reading comprehension skills. The major research question for the study was, "How can career and technical education teachers use their instruction to improve students' comprehension of subject matter and motivation to read, in order to contribute to students' overall academic achievement?" The conceptual framework was based on a sound sociocultural theory of reading. The study has strong implications for reading achievement and improvement in CTE.

Finally, in Volume 31, Issue 3, the lead article was entitled, "Inside the Black Box: Exploring the Value Added by Career and Technical Student Organizations to Students' High School Experience." Please note that the following references were omitted from the article:

Hansen, D. M., & Larson, R. (2002). *The Youth Experience Survey (YES) 1.0: Instrument development and testing*. Unpublished Manuscript, University of Illinois at Urbana-Champaign.

Perry, N. E., Turner, J. C., & Meyer, D. K. (2006). Classrooms as contexts for motivating learning. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 327-348). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

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Career and Technical Education Research, 32(1), pp. 3-7

The 2006 ACTER Presidential Address: The Premier Educational Delivery System

Jack Elliot
University of Arizona
ACTER President, 2006

The public's perception of No Child Left Behind (NCLB) is one of confusion. Most people, including educators, expect that public schools should be accountable and should have high standards. Yet, when thoroughly investigated, NCLB goals are statistically impossible to achieve and actually punish schools with high percentages of minorities and underrepresented populations. In addition, school systems in low socioeconomic status (SES) areas are destined for failure as well. Students attracted to Career and Technical Education (CTE) programs generally favor hands-on learning methods called kinesthetic learning style, which is not easily or usually tested on high stakes tests that are required by NCLB. Therefore, across the country, school districts are narrowing their educational delivery methods and replacing CTE classes with remedial education classes. Interestingly though, not one positive effect on learning and retention was found in 144 studies that evaluated remedial education efforts. Further, by limiting course offerings (that is replacing CTE which can address all learning styles with remediation courses), schools are inadvertently destining their students for more failures because students who learn kinesthetically will become even more disenfranchised with school. There is hope. A historical look at the educational process embedded within CTE, versus only focusing on CTE outcomes, is the answer for American education.

Figure 1 illustrates "Determinates of Excellence in Vocational Education" since the 1900s (Rosenfeld, 1987). Specifically, the chart highlights over time what attributes (i.e., basic competencies or academics, job-specific skills, or economic development) were associated with good and effective vocational education programs. At the turn of the last century, education in the public schools was boring, entailing mostly memorization of facts and regurgitation of those facts on tests. However, most young people did not complete grade school education, much less high school. Regardless, education was becoming more important in the United States and there were numerous outcries for educational reform from all sectors of society.

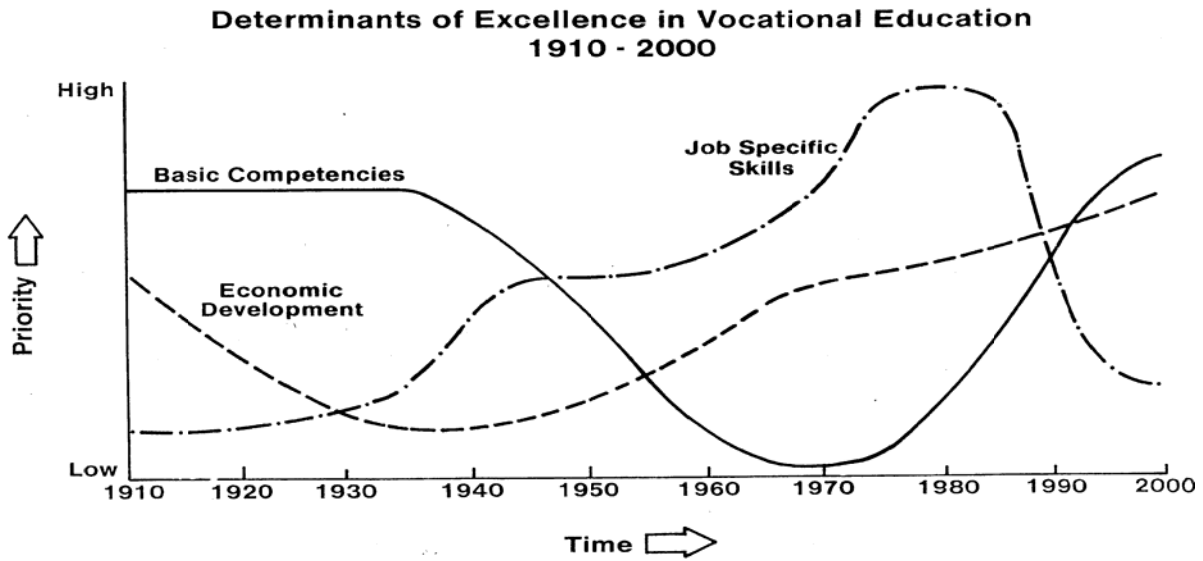

Figure 1. Determinants of Excellence in Vocational Education: 1910-2000 [1]

[1] From "Determinants of excellence in vocational education," by S. Rosenfeld, 1987. In *Design Papers for the National Assessment of Vocational Education*. Washington, DC: U.S. Department of Education.

Rufus Stimson, President of the Connecticut Agricultural College (now the University of Connecticut), quit his job to become a high school teacher. He did so to test his theory of education which was to see if academics could learn better in an applied setting. His high school students in Northampton, Massachusetts came from the agrarian countryside with hundreds of unanswered questions about their farms. Professor Stimson used this natural curiosity in his classes and fine-tuned the problem solving approach to teaching, which became the beginnings of vocational education and was the impetus for including experiential education activities within vocational legislation. The important point of this era was that good and effective vocational education programs were reinforcing academics through applied and relevant activities.

This interesting and usually forgotten CTE origin is the essence of being a premier educational delivery system. Figure 2 identifies from research, various educational and developmental delivery systems and their relationship with effective education. Effective education is defined as a delivery system that focuses on retention of content and skills by addressing the learning styles of all students, in every class everyday. As clearly shown in Figure 2, Career and Technical Education is poised to be the best or premier educational delivery system in the country. The chart emphasizes the relationships among CTE and other well-known educational and developmental efforts. What went wrong? Why is CTE often left out of discussions about improving our educational situation? Looking back at Figure 1 and the era that began in the 1930s gives us that answer.

Because of the World Wars and the country coming out of the depression, funds were tight and early vocational education leaders marketed "Voc Ed" as the answer to improving economic development by training people for specific jobs in the workplace. As the chart shows, "job-specific skills" became the dominant attribute of the time and slowly academics became non-existent in our delivery system. In fact, the non-emphasis on academics became so pervasive that during the time when most of our current legislators, administrators, and voters came through high school in the 1960s, 1970s, and early 1980s vocational education was, in many cases, viewed as the dumping ground and oftentimes regarded as the equivalent of special education. This phenomena is why many people today still view CTE as a place for other people's children. Many vocational education articles of that era centered on training-related placement. The irony was that business and industry quit looking to vocational education graduates as a first choice for new employees because many of them lacked the basic competencies that were needed in the workplace. It was also during these three decades that many university vocational teacher education departments were downsized and eliminated because the tie to academics and scholarship was forgotten. Our emphasis on our product, a trained student, and not on our original comprehensive educational process evolved into an educational delivery system that was not even mentioned in "A Nation At Risk."

Delivery Efforts	Content	Application	Motivation
Career & Technical Education	Technical Instruction (Classroom)	Experiential Development (Laboratory & Work-Based Learning including educational home visits)	Personal & Leadership Development [Intra-curricular] (CTE Student Organization)
Domains of Learning	Cognitive	Psychomotor	Affective
7-Habits of Highly Effective People (Covey, 1989)	Knowledge	Skill	Desire
Center for Occupational Research & Development (CORD)	Academics	Skill Building Hands-on	Character Building
National Governor's Association Educational Plan	Rigor	Relevance	Relationship
Academic Class	Content Delivered	Not Applicable Usually	Not Applicable Usually

Figure 2. Educational and Developmental Delivery System

The vocational education world was in an uproar in the 1980s because of the educational reform movements that were spawned by the emergency situation within our public schools and emphasized in "A Nation At Risk." The crossing of lines in Figure 1 in the 1990s shows that vocational educators received the message that unless we change, we will not even be considered as a viable component in today's educational world. A return to the past was prominent throughout the country. Research began documenting the positive academic effects of vocational education graduates. Workshops centered on integrating academics within vocational programs. A dual emphasis on graduates emerged, one that touted entering the workforce and continuing education. The more the educational community questioned the value of vocational education, the more it became apparent that the new "Voc Ed," now called Career and Technical Education was actually more relevant today then ever. In the turbulent educational reform world, other educational delivery systems have mirrored CTE, focusing on rigor, relevance, and relationships. The ultimate irony is that we have had the best and most effective teaching strategies since our beginnings. However, because of what we emphasized as "Determinants of Excellence" throughout our history, we have a ways to go to get others to believe that CTE has a place in today's educational settings for all students.

Career and Technical Education is the premier educational delivery system in the world. It addresses all learning styles by employing pedagogical strategies that embrace all of the multiple intelligence areas and incorporate the current knowledge in brain-based research. In fact, CTE educational strategies are utilized in the top 30 academic schools in America. In summary, Career and Technical Education employs the best teaching strategies to reach all students, in all classes, everyday, if learning and retention are the outcomes.

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Career and Technical Education Research, 32(1), pp. 9-22

A Retrospective Cohort Comparison of Career and Technical Education Participants and Non-Participants on a State-Mandated Proficiency Test

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Abstract

The sometimes poor performance of Career and Technical Education (CTE) concentrators on a state-mandated proficiency test is a major concern of CTE educators. This study examined whether (a) there are performance differences on state-mandated 11th-grade math and reading tests between CTE and non-CTE students with similar proficiency scores in the 8th-grade; and (b) 11th-grade math test scores are related to 8th-grade math proficiency and high school math course-taking patterns. This exploratory study was conducted using two different cohorts of students from the high school classes of 2004 and 2005, from two CTE schools and their sending schools in Pennsylvania. The study found no statistically significant differences in reading proficiency on the state-mandated 11th-grade math test. In one of the two cohort groups, a statistically significant difference was found in math performance between CTE students and their counterparts, with the CTE students scoring lower. CTE students as a group had taken fewer college-prep math courses than their non-CTE peers. Such differences were associated with CTE students' lower achievement on a state-mandated math test. When math course-taking was controlled, CTE participation was found not to be associated with math test scores.

Background

With the increasingly popular public notion that higher academic performance is vital to promoting individual opportunity and national economic growth, improving students' academic achievement is becoming the norm for educators and policymakers (Cohen, 1996; Gray, 2004; Levin, 2001). Educational systems and programs considered to hamper student learning outcomes become a target for reform. A case in point is career and technical education (CTE), which has long been stigmatized as a second-class education for low-achieving and non-college-bound

students. Despite the compelling evidence that CTE programs help students' high school completion and postsecondary success in the labor market, more often than not, CTE students are viewed as the ones left behind, CTE schools are blamed for the allegedly lower academic performance of their students, and ultimately the viability of CTE as a differentiated school curriculum is questioned (Gray, 2004; Harvey, 2002; Harvey & Koch, 2004). For instance, the 2004 National Assessment of Vocational Education (NAVE) reported that "vocational courses and programs do not themselves add value to academic achievement" (U.S. Department of Education, 2004, p. 7).

Of particular importance in the debates regarding academic achievement of CTE students is their performance on state-mandated tests required by the federal No Child Left Behind (NCLB) legislation. The Carl Perkins Act of 2006, for example, again stipulated that academic achievement data collected by states in compliance with NCLB will be the metric used to evaluate academic performance of CTE students. The dilemma of course is that in many cases, CTE concentrators do not perform as well as their peers who do not take CTE. Such comparisons are problematic, however, if in fact CTE students as a group were less academically proficient when they entered high school than the population (Stone, 2004). If this is the case, then a valid assessment of CTE on academic achievement requires a comparison of CTE students with students who did not take CTE courses but had similar math skills when they entered high school. Such a comparison was the purpose of this research.

Another problem with comparing the academic test score performances of those taking and not taking CTE is the possibility of differential course-taking patterns while in high school. It could be, for example, that CTE students as a group take less advanced math in the 9^{th}- and 10^{th}-grade than non-CTE students. While the national trend data show that CTE students have considerably increased their academic course-taking over the past decade, large gaps remain in the completion rate of the college-prep courses between CTE and non-CTE students (Stone, 2004; U.S. Department of Education, 2004). Given that participation in the advanced college-prep courses is advantageous in improving test scores (Plank, 2001), it is of interest to examine how CTE students' academic course-taking patterns are related to their performance on a state-mandated academic proficiency test – specifically, math course-taking patterns and math achievement. An examination of this issue was a second purpose of this research.

Review of the Related Literature

Academic Performance of CTE Students

There seems to be a common belief among policymakers and the public that CTE students in general do not perform as well as the general non-CTE students in academic courses such as math and reading. One example is the 2004 NAVE report,

a national report about CTE and non-CTE students' academic achievement. Using the recent 12th-grade National Assessment for Educational Progress (NAEP) test scores, the report revealed that while CTE students have made substantial progress on math and reading achievement along with a significant increase in participation in more rigorous math and reading classes, they were still far less likely to be proficient in math and reading as compared to the general students. More strikingly, the report indicated that such improvement by CTE students in academic achievement was mostly due to "higher graduation requirements and emphasis on upgrading academic courses" (p. 18), not their CTE enrollment.

Similarly, at the state level, a policy paper prepared by Jobs for the Future (2005), a Boston-based education consulting firm, reported that CTE regional school students tended to lag behind their sending schools on the "percentage of their completers who have passed advanced academic courses" and that CTE students' academic skills are "unacceptably low" (p. 12). According to the report, two main reasons for CTE students' underachievement were: less participation in the advanced math courses and the low expectations for CTE students' academic performance. The authors pointed out, however, that given the lower academic performance status of CTE students upon entering CTE programs, the effectiveness of CTE programs should be evaluated "based on the gain in performance during a student's tenure there" (p. 14).

Elliot, Foster, and Franklin (2005), in comparing the high stakes test scores between CTE students and other general students in Arizona, found that the academic performance of CTE students was lower than their counterpart students. However, they found that the extraneous factors, including limited English proficiency, special needs, and socioeconomic status, had a statistically significant influence on the high stakes test scores. When these variables were controlled, CTE enrollment was not related to students' academic achievement. However, most previous policy papers and studies had compared CTE students with all other students in the academic track, which include academically advanced college-bound students. From a policy perspective, such a comparison may not be valid in evaluating the effectiveness of high school CTE programs (Jobs for the Future, 2005).

Math Achievement and Math Course-Taking Patterns

Using the data from the National Education Longitudinal Study of 1988, Plank (2001) revealed that high school course-taking patterns are highly associated with test scores. He particularly pointed out that academic concentrators' achievement advantage is partly due to their greater participation in advanced academic subjects. Likewise, Levesque (2003), as cited in Stone (2004), suggested that the completion of advanced academic courses is a critical determinant of academic achievement. With regard to the high school math course-taking patterns of CTE students, Stone

(2004) reported evidence that CTE reforms over the last decade had significantly promoted CTE students' participation in higher-level math courses. However, he noted that the effects of such an increase on math performance are uncertain.

Research Questions

This study investigated two research questions:

1. Is there a statistically significant difference between CTE students' performance on state-mandated 11th-grade math and reading proficiency tests and a comparison group of non-CTE students with similar math proficiency scores in the 8th-grade?
2. Is student performance on an 11th-grade state-mandated proficiency test associated with math course-taking patterns prior to enrollment in CTE?

Conceptual Framework

This research was guided by the concept that prior math achievement and high school math-taking patterns—particularly the level of difficulty of math course completed—were associated with math achievement by students (Jobs for the Future, 2005; Plank, 2001; Stone, 2004**).** Based on this framework, the underlying assumption of this study was that when academic abilities, as measured by 8th-grade test scores taken before entering high school, and the level of difficulty of math courses taken while in high school, were controlled, the academic achievement of CTE students would not differ from that for the general population of students who took the academic program, only.

Method

Research Design

The current study employed a retrospective cohort study method extensively used in clinical research to compare outcomes between those who receive a particular treatment and another group not influenced by the treatment under investigation (Kazdin, 2003)—in this study, CTE enrollment. This method was used because it provided a better research context for comparisons between CTE and non-CTE students. To be specific, a cohort was defined as students with similar academic performance in the 8th-grade. Among the cohort, CTE students were defined as those who take 3.0 or more credits in occupational courses in CTE.

Sample and Data

The study was conducted using two different cohorts of students from two different CTE area vocational schools and their respective sending schools in Pennsylvania. Specifically, for one CTE school and its sending schools, the class of

2005 was the population from which a cohort was selected (hereafter referred to as Cohort 04-05); for the other CTE school and its sending schools, the class of 2004 was examined (hereafter, Cohort 03-04).

Data used in this study were collected from two sources: (a) the Pennsylvania System of School Assessment (PSSA) database for student performance data; and (b) high school transcripts to ascertain students' math course participation. The PSSA is a statewide mandatory test designed to assess academic performance of students, schools, and districts in Pennsylvania. The reading and math PSSA has been administered to students in the 5^{th}-, 8^{th}-, and 11^{th}-grades since 1996.

The dependent variable was a student's 11^{th}-grade math and reading performance on the PSSA test. For Cohort 04-05, student performance was measured by *scaled scores*; for Cohort 03-04, it was measured by *percentile ranks*, a student's relative standing in comparison with other students taking the PSSA test statewide. The independent variables were as follows: (a) 8^{th}-grade math and reading performance on the PSSA test, (b) CTE enrollment, which was coded into two dummy variables (1 = CTE students, 0 = non-CTE students), (c) years of math (algebra I or higher level) taken by the 11^{th}-grade, and (d) taking Algebra I before the 10^{th}-grade—this variable indicates whether a student took Algebra I before the 10^{th}-grade and was coded into two dummy variables (1 = Yes, 0 = No) .

Sample Selection

Since the target population and scale of measurement for the variables were not consistent across two cohorts, sample selection and data analysis were conducted separately for each cohort. However, the procedures for sample selection and data analysis techniques were the same for both cohorts. The sample selection procedures for the two cohorts are explained below:

Cohort 04-05. Among students from the class of 2005 from one CTE school and its sending school, 25 CTE students and 49 non-CTE students were randomly selected. All had both 8^{th}- and 11^{th}-grade math and reading performance scores. Next, 8^{th}-grade math and reading achievement scores of CTE students were averaged to find a mean (*M*) and standard deviation (*SD*). Then, a cohort was identified as students whose 8^{th}-grade math and reading scores were within the range of $M \pm 1SD$. As a result, 18 CTE students and 43 non-CTE students were identified as an *8^{th}-grade math performance cohort* (n = 61). Likewise, 17 CTE and 34 non-CTE students were identified as an *8^{th}-grade reading performance cohort* (n = 51). It should be noted that CTE students in this cohort were taking math at the CTE area school the year they took the 11^{th}-grade state-mandated test.

Cohort 03-04. Fifty-one CTE students and 102 non-CTE students were first drawn from graduates of the class of 2004 of the other CTE area school and its sending schools. To identify a cohort among them, the same procedure used for

Cohort 1 was employed except that the range of $M \pm 0.75SD$ was used because the range of $M \pm 1SD$ had failed to find the cohort students who had similar 8th-grade math and reading performance scores. Finally, 24 CTE students and 31 non-CTE students were selected as an *8th-grade math performance cohort* ($n = 55$). Similarly, 24 CTE and 29 non-CTE students were identified as an *8th-grade reading performance cohort* ($n = 53$). CTE students in this cohort were not taking math at the area CTE school. Thus, some CTE students were not taking math in the year they took the 11th-grade state-mandated test.

Data Analysis

To examine whether there was a statistically significant difference between the 11th-grade math and reading performance of CTE and non-CTE students, an independent samples t-test was conducted. An independent t-test *conventional* comparison was also conducted between CTE students and "all" non-CTE students to provide a contrast between the traditional NCLB comparison method and the cohort group comparison method. The purpose was to demonstrate the value of cohort over conventional comparison methods.

To determine the relationship between math achievement and math course-taking patterns, multiple regression analysis was employed. Since the data on students' math course-taking patterns were not available for Cohort 04-05, this analysis was done only for Cohort 03-04. The data were analyzed using SPSS statistical software. All statistical assumptions required for independent t-test and multivariate analyses were checked.

Findings

Academic Performance of CTE Students

The results of independent samples t-tests are presented in Table 1. For Cohort 04-05, no statistically significant differences on the state-mandated 11th-grade math exam were found for either the cohort or conventional comparison. In the case of reading, the conventional comparison of CTE students with all other non-CTE students revealed that CTE student scores were significantly lower with an alpha level of .05.

The math test results for the conventional comparisons are important. As mentioned above, CTE students in this cohort were taking math at the CTE area school during the year they took the test. Thus, it is important to note that there was no statistically significant difference between CTE and all non-CTE students (meaning those in the college and general programs of study) from the sending schools.

For Cohort 03-04, there was no statistically significant difference in reading performance between the two cohort groups; a statistically significant difference was

found for math performance ($p < .05$). However, compared with results for the conventional comparison, the cohort analysis found a considerably smaller mean difference (*MD*) between the two groups in math performance. As in the case of Cohort 04-05, while a conventional comparison found a statistically significant difference in reading performance between the two groups, the cohort comparison showed no statistically significant difference. These results suggest that the commonly used comparison method is more likely to magnify the achievement gap between CTE students and non-CTE students.

Table 1
Summary of Independent Samples T-test Results

	Conventional Comparison				**Cohort Comparison**			
	M	**SD**	**MD**	**P**	**M**	**SD**	**MD**	**P**
Cohort 04-05								
Math								
CTE	1233.80	165.55	27.61	.43	1246.17	96.55	12.76	.62
Non-CTE	1261.41	66.25			1258.84	66.31		
Reading								
CTE	1268.56	240.06	125.79	.02*	1260.36	161.62	86.56	.06
Non-CTE	1394.35	162.06			1346.00	145.83		
Cohort 03-04								
Math								
CTE	26.37	22.00	26.68	.00***	25.67	15.41	12.53	.00**
Non-CTE	53.05	17.78			38.19	15.07		
Reading								
CTE	28.67	15.10	27.59	.00***	32.71	12.49	6.89	.13
Non-CTE		56.25	23.83		39.69	18.76		

Note: Cohort 04-05 CTE $N = 25$, Non-CTE $N = 49$; *Cohort 03-04* CTE $N = 51$, Non-CTE $N = 102$. Conventional comparison is a comparison between CTE students and all other students on the academic track. Cohort comparison is a comparison between CTE students and students who had similar proficiency scores in the 8th-grade but did not take CTE.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Math Achievement and Math Course-taking Patterns: 03-04 Cohort

Table 2 presents descriptive statistics for students' math course-taking patterns for the two groups (CTE & non-CTE) in the cohort. The non-CTE students as a group had taken 0.81 more years of advanced math courses in the 9th- and 10th-grades than had CTE students. Whereas 70.0% of non-CTE students had taken Algebra I before the 10th-grade, only 33.3 % of the CTE students had completed Algebra I before the 10th-grade.

Table 2
Average Years of Math Taken by Grade 11 and Percentage of Students Who Had Taken Algebra 1 before Grade 10 by Groups (n = 55): 03-04 Cohort

	CTE (*n* = 24)	Non-CTE (*n* = 24)
Years of math (algebra I or higher level) taken by grade 11	1.67 (.64)	2.48 (1.03)
Percentage of students who had taken algebra I before grade 10	33.3%	70.0%

Note: Standard deviation in parentheses.

Given the differences in the math course-taking patterns between the two groups, multiple regression analysis was conducted to examine the relationship between 11th-grade math achievement on PSSA and math course-taking patterns. Since the variable *Taking algebra I before grade* 10 was found to be highly correlated with the variable *Years of math taken by grade 11* (r =.67), the regression analysis included only the variable *Years of math taken by grade 11* as an independent variable, taking into account the multicollinearity problem (see Tabachnick & Fidell, 2001).

Table 3 presents a summary of the regression analysis. First, the regression analysis revealed that 8th-grade math achievement was statistically significant and positively associated with 11th-grade math achievement ($p < .05$). Second, *Years of math (algebra I or higher level) taken by grade 11* was statistically significant and positively related to 11th-grade math test scores ($p < .05$). That is, the higher the math achievement prior to entering high school and more years of advanced math courses taken in high school, the higher the performance on the 11th-grade mandated math test. Finally, when controlling for the differences in course-taking patterns and 8th-grade math performance, CTE enrollment was not found to be a statistically significant predictor of 11th-grade math achievement on the PSSA. In other words, math performance on the 11th-grade test was found to have no statistically significant relationship to taking CTE, but in fact was related to math proficiency upon entering high school and especially to the number of math courses completed in high school.

Table 3
Summary of Multiple Regression Analysis for Variables Predicting the 11th-Grade Math Achievement on the PSSA (n = 55)

	B	*SE B*	*β*	*p*
(Constant)	2.96	7.75		.70
CTER Enrollment	-5.92	3.79	.44	.12
8th-Grade Achievement	.47	.21	.25	.03
Years of Math (Algebra 1 or Above) taken by grade 11	7.48	2.10	-.18	.00

Note: $R^2 = .44$

Discussion and Implications

This study examined (a) whether performance differences exist on state-mandated 11th-grade math and reading tests between CTE and non-CTE students who had similar proficiency scores in the 8th-grade; and (b) whether 11th-grade math test scores are related to 8th-grade math proficiency and high school math course-taking patterns. The study was conducted using two different cohorts of students from two CTE regional schools and their respective sending schools in Pennsylvania. Independent samples t-tests and multiple regression analyses were employed.

The key findings are summarized as follows. First, for the 04-05 conventional comparison, no statistically significant differences were found in math for the conventional and cohort comparison; a statistically significant difference was found for reading performance in the conventional comparison but not in the cohort comparisons. For the 03-04 cohort comparisons, no statistically significant difference was found in reading scores but was found in the conventional comparison. A statistically significant difference was found in math performance in both comparisons. It should be noted that for both cohorts, while the conventional comparison of CTE students with all other non-CTE students revealed a statistically significant difference in reading performance, the cohort analysis found no statistically significant difference between the two groups, therefore, illustrating the value of the cohort comparison method.

Second, CTE students in the 03-04 group had taken fewer advanced math courses in the 9th- and 10th-grades, and fewer had taken Algebra 1 before grade 10, compared with non-CTE students in the cohort. Consistent with previous studies (Levesque, 2003; Plank, 2001), the differences in math course-taking patterns were

related to a math achievement gap between the two groups. Finally, when controlling for differences in course-taking patterns between the two groups, CTE enrollment was not associated with 11th-grade math performance outcomes.

Given that this was an exploratory study with small samples, the results should be interpreted with caution. Nevertheless, the implications are worth further investigation. First, the overall findings suggest that when compared with students who are like them in terms of previous math ability entering high school, and when differences in math courses taken in high school are controlled for, CTE student test scores were not meaningfully different than for their counterparts who did not take CTE. Of course, it can be argued that both groups should have performed better, and it was hoped that CTE students would have performed better; therefore, suggesting that CTE curriculum does improve math and science as suggested by previous research (Conroy & Walker, 2000; Grubb, 1995; Hernandez & Brendefur, 2003; U.S. Department of Education, 2004). Nonetheless, these findings are important in those situations where districts, looking for some excuse for their poor performance, choose to blame student involvement in CTE. In fact, they should be looking at math instruction in the pre-high school years and why students of similar math skills enroll in different courses. Furthermore, this research illustrated that the cohort comparison is a more accurate and reliable way to assess CTE students' academic performance. Therefore, conventional comparison methods should be avoided when assessing the academic skills of CTE students.

The study found that in the 03-04 cohort, CTE students had different math course-taking patterns in high school. Of note, very few CTE students had taken algebra in the 9th-grade compared to the non-CTE students in the cohort. Considering that both groups in the cohort entered high school with the same math ability, the question is—why? This research only allows speculation. What the research did reveal was that lack of higher-level math among CTE students was associated with lower 11th-grade math test scores. Federal and state policymakers appear to believe that CTE students' lack of advanced-level math courses is an obstacle to math achievement, postsecondary education, and success (Jobs for the Future, 2005; U.S. Department of Education, 2004). This study suggests that, at least in the case of math skills, this point of view has validity; it is important for as many students to take algebra in the 9th-grade as is possible. It would seem appropriate to suggest an investigation of differential math-taking patterns in general, especially among students who, when entering high school, have similar math skills.

Interestingly, the 04-05 conventional comparisons of CTE students showed that they did as well in math as the entire student body. This is important in that the 04-05 CTE students were taking math at the regional school during the 11th-grade when the test was given. These results suggest that the poor performance of CTE students, especially in regional school settings, may be due to the fact that they are not taking any math instruction in the year they take the test.

Regardless, students who choose the CTE path generally belong to the "academic middle" and seek "other ways to win" by pursuing both CTE and academic courses (Gray & Herr, 2005). Therefore, if CTE requires students to make a trade-off between participation in math courses beyond algebra and geometry and occupational training courses, such a tradeoff is justifiable for these students. Students who intend to work and/or pursue pre-baccalaureate technical education after high school should take CTE programs that offer both occupational and integrated academic skills (Harvey & Koch, 2004). The finding by Plank (2001) that 80% of CTE concentrators take virtually the same academic courses as the population at large suggests that most CTE students are in fact taking both. Furthermore, as economists Becker (1993) and Sicherman (1991) maintain, individual human capital consists of various components, including academic abilities and occupational skills. Thus, CTE students' decision to acquire occupational skills rather than take higher-level academic courses or both academics and CTE in preparation for one- and two-year technical education, is logical and should be both respected and valued by adults.

Finally, at the high school level, one curriculum will never meet the needs of all students. Those whose needs are not met all too often drop out of high school. Considering that the national dropout rate is now a staggering 33% and that in virtually every state the dropout rate has increased since the advent of mandatory testing (Gray, 2004), the importance of CTE cannot be overstated. For example, Plank (2001) found that a combination of academic and CTE courses had the highest probability of preventing students at risk from dropping out. CTE is to some students what advanced placement and honors courses are to others, namely, a curriculum alternative to the standard academic program. The rationale for the two programs is the same (Gray, 2004)—if advanced placement is needed, so too is CTE. Therefore, it may be necessary to address the unfairness and inappropriateness of the policy recommendation to insist on the same academic standards, the same tests, and the same curriculum for all high school students. Academic standards designed for students who are preparing for college may not best serve students who decide to go to work. Meanwhile, academic standards and CTE combined best serve those who aspire to post-secondary, pre-baccalaureate technical education. In both of these cases, CTE is necessary.

Recommendations for Further Research

The first and obvious recommendation is that this type of research should be duplicated with larger samples and in other states. Findings from the cohort design used in this study demonstrate the value of comparing CTE students with those who entered high school with similar math ability but did not take CTE. It demonstrated, for example, that when CTE students are compared to their peers, participation in CTE is not related to test performance on 11th-grade state-mandated tests. It also

revealed troubling differences in early math course-taking patterns among students who entered high school with similar math skills. A large study in each state might well prove very interesting.

Second, the current study examined CTE students' math course-taking patterns as factors in determining math achievement and found that in the 03-04 cohort, CTE students took less math. Given the fact that students with special needs are at an economic disadvantage, they are also typically overrepresented in CTE (Elliot, Foster, & Franklin, 2005). Since these students often do not take high-level math, subsequent studies should be conducted with independent variables representing such demographic characteristics of CTE students using the cohort study concept.

Third, this study found differences in course-taking patterns that began in the 9th-grade. When compared to non-CTE students in the cohort, few CTE students took Algebra I in the 9th-grade. Considering that all students in the cohort had similar math skills when they entered high school, differing math course-taking patterns cannot be explained by differing math ability. Of course, this could be an isolated phenomenon with a logical explanation such as a large number of special needs students. However, one wonders and the issue of tracking based on socioeconomic background comes to mind. Further investigation in other locales might prove interesting.

Last, this study used both "reading" and math scores. The CTE students' readings scores were significantly lower in both conventional comparisons. While the differences in the cohort comparisons were not statistically different at the .05 level, they were lower than those for non-CTE students. This is cause for concern if this is the case generally, not just in this study. It is a reminder that at present, research (Stone, 2004) has focused primarily on math. One could argue, however, that in light of the need to be lifelong learners, and since technology as a whole tends to deskill work, diminishing the level of math required, not increasing it, reading may become a more important skill than math for most workers in the future. Therefore, it is recommended that CTE researchers conduct studies in reading skills as well.

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Beginning Teachers' Perceptions of In-School and In-Profession Mentoring Relationships

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Abstract

The purpose of this study was to compare two different formal mentoring relationships based on the perceptions of beginning teachers regarding their dyadic interactions. Kram's mentor role theory and Byrne's similarity-attraction paradigm served as the theoretical foundation for the study. The specific variables of interest included psychosocial mentoring, dyad similarity, and dyad satisfaction. The time and place sample consisted of beginning agricultural education teachers (n = 40) paired with a mentor in the school where they taught (i.e., in-school), and beginning agricultural education teachers (n = 40) paired with an agricultural education mentor located in a neighboring school (i.e., in-profession). Data for this study were collected by using the Mentoring Relationship Questionnaire (MRQ). No statistically significant differences were found between the two mentoring relationships. Recommendations for further investigation are suggested, including the need to expand the understanding of relationship dynamics and predictors of quality mentoring.

Introduction

It has been reported that teacher mentoring programs have become the dominant form of teacher induction during the past two decades (Fideler & Haselkorn, 1999). Over 60% of states have legislation pertaining to mentoring programs (Educational Commission of the States, 1999), and approximately two-thirds of beginning teachers said they worked closely with a mentor (Smith & Ingersoll, 2004). Even more importantly, the positive outcomes of mentoring have been documented and reported by researchers. Huling-Austin (1990) conducted a

literature review of teacher induction programs and concluded that "the most consistent finding across studies is the importance of the support (mentor) teacher" (p. 542). A mentor assists beginning teachers during their transition into the teaching profession, and contributes to the increased retention of beginning teachers (McCormick, 2001; Odell & Ferraro, 1992). With the exodus of young teachers ranking as one of the most significant issues facing education, it is important that an effective mentoring relationship be developed to assist in combating the challenges presented by the first year of teaching. Previous research has concluded that an effective mentoring relationship helps reduce the stress level of beginning teachers (Galvez-Hjornevik, 1985), improves teacher efficacy (Strong & St. John, 2001), increases job satisfaction (Holloway, 2001), and assists the professional growth of novice teachers (Darwin, 2000).

Only recently have researchers begun to concentrate on the dyad to determine the variables that are necessary for a satisfying and quality relationship between mentor and protégé. Drawing on relationship dynamics, mentoring research has examined attitudinal similarity (Ensher, Grant-Vallone, & Marelich, 2002), cognitive style similarity (Armstrong, Allison, & Hayes, 2002), leader-member exchange (LMX) theory (Somech, 2003), personality similarity (Waters, 2004), and relational demography (Sagas, Paetzold, & Ashley, 2005) to better understand the mentoring phenomenon. However, the majority of this line of research has been in a business and organizational context, and a lesser amount of research has been conducted on the mentoring relationship in education. Extending mentoring theory based on relationship dynamics to the context of career and technical education served as one of the motivators to conduct this study. Further support for this impetus was provided by Young, Cady, and Foxon (2006) who noted that "theoretical foundations for mentoring have not been developed to keep pace with empirical investigation" (p.149).

While many induction issues for beginning teachers are similar across disciplines, it can be debated that there are unique elements associated with being a career and technical education teacher that may require different mentoring strategies. For example, Greiman, Walker, and Birkenholz (2005) found that novice teachers of agricultural education were challenged by complex program management responsibilities across a broad range of areas, such as technology, laboratory management, completing paper work in the form of reports and applications, and managing FFA (student organization) activities. Relationship dynamics suggest that the extent of mentoring received by the beginning teacher may differ between those dyads that share a common teaching assignment, and those who do not. Further, the perceived similarity between the beginning teacher and their formal mentor is likely a contributing factor to the level of satisfaction experienced in the mentoring relationship. As a result, this study focused on the interaction that two cohorts of beginning agricultural education teachers had either with: (a) formal mentors located in their school, or (b) agricultural education teachers who served as formal mentors and who were located in neighboring schools. Such a study is needed to better understand the dynamics of the

mentoring relationship, and has implications for the retention of beginning teachers and their success during the induction year of teaching.

Theoretical Framework

The researchers framed this study based on the conceptual understanding that mentors have two distinct functions that revolve around providing *professional* assistance and *psychosocial* assistance to protégés. Professional assistance refers to mentoring that supports novice teachers in the development of skills associated with career responsibilities, while psychosocial assistance is designed to enhance novice teachers' sense of competence and effectiveness through encouraging interactions. Support for this conceptual framework is drawn from Kram's (1985) mentor role theory, and this theoretical foundation was utilized to explain the functions that mentors play in a dyad relationship. As a result of her seminal work, Kram concluded that mentoring is a type of developmental relationship in which mentors provide two types of functions: (a) career functions, which focus on skill development of the protégé; and (b) psychosocial functions, which are centered on providing support and encouragement to the protégé. Career functions "are those aspects of a relationship that enhance learning the ropes and preparing for advancement in an organization" (Kram, p. 22). These functions increase the likelihood of the protégé becoming successful, and include sponsorship, exposure and visibility, coaching, protection, and challenging assignments. Psychosocial functions enhance an individual's "sense of competence, identity, and effectiveness in a professional role" (Kram, p. 23). Psychosocial functions include acceptance, counseling, friendship, and role modeling. Researchers (Brown, Davis, & McClendon, 1999; Kram, 1985; Noe, 1988; Ragins & McFarlin, 1990) found that two issues may influence perceptions of the psychosocial functions in cross-gender mentoring relationships: sexual concerns and restriction of identification. The potential for sexual involvement, gossip, and public scrutiny (Cunningham, 1984) in cross-gender mentoring relationships may restrict the friendship role. Further, protégés may view cross-gender mentors as restricted in their ability to relate and provide acceptance, counseling, and role modeling (Clawson & Kram, 1984; Noe, 1988). As a result, Ragins and McFarlin (1990) extended Kram's work by including a *social* function in their instrument to measure psychosocial mentoring, and Greiman (2002) added social as a fifth psychosocial function in Kram's mentor role theory. Kram suggested that the greater the number of functions provided by the mentor, the more beneficial the relationship will be to the protégé.

The second theoretical framework that underpins this study is the similarity-attraction paradigm (Byrne, 1971). This theory is anchored in relationship dynamics, and suggests that human beings have a natural tendency to be attracted to others perceived to be similar in such factors as attitude, behaviors, personality, and physical characteristics (Young, et al., 2006). Within the context of a mentoring relationship, dyad members must work together, communicate with one another, and

possibly interact on a social level. Successful dyad interactions depend on a compatible relationship that develops between the mentor and the protégé, and similarity helps to increase the quality of this interaction. As such, dyad interactions may be easier and more comfortable with individuals who have similar beliefs and attitudes. In contrast, dissimilarity leads to differences in attitudes, values, and beliefs, and to a lower communication level between dyad members (Somech, 2003).

Literature Review

Professional and Psychosocial Mentoring

Most of the studies regarding the mentoring phenomenon in education are overwhelmingly positive (Hansford, Tennent, & Ehrich, 2003), and professional support has been identified in the literature as an important aspect of mentoring. For example, Simon and Wardlow (1989) utilized an experimental design to compare two groups of beginning agricultural education teachers in Minnesota. Beginning teachers in the control group were not assigned mentors, while the experimental group received the benefit of both an in-school mentor, and a subject matter mentor from a neighboring school district. Mentored teachers exhibited more effective teaching behaviors, were better equipped to handle classroom management issues, exhibited a higher level of teacher efficacy, and expressed more positive attitudes than did teachers without a formal mentor. The researchers concluded that beginning teachers were strongly satisfied with the nature and quality of both their in-school mentor and their subject matter mentor. Beginning teachers were generally more satisfied with the psychosocial assistance they received from their in-school mentor, and generally relied on their subject matter mentor for professional assistance related to teaching materials, instructional resources, laboratory exercises, FFA, and Supervised Agricultural Experience (SAE) (work-based learning). A similar finding was reported by Simon (1989) who conducted an interpretive study and concluded that mentors of beginning agricultural education teachers provided professional support. Mentors helped beginning teachers by providing professional assistance with such areas as classroom management, teaching materials, FFA, curriculum and program development, and reflective thinking. Greiman (2006) found that novice agricultural education teachers and their formal mentors were somewhat satisfied with the extent of professional mentoring received. His study organized professional mentoring around four major areas related to student relationships, teaching and learning, school and parental relationships, and program management.

In addition to professional mentoring, the literature has consistently identified psychosocial support as a second function provided by mentors in a dyad relationship (Greiman, 2002). In their literature review of 159 studies involving formal mentoring programs in the context of education, Ehrich, Hansford, and Tennent (2004) concluded that the most frequent positive outcome for beginning teachers was related to psychosocial assistance. Beginning teachers reported that they received support,

empathy, encouragement, counseling, and friendship from their formal mentors. In another study, Barrera and Finley (1992) reported that beginning agricultural education teachers received guidance from a mentor committee composed of a classroom teacher, an administrator, and a teacher educator. Their study determined that beginning teachers received psychosocial assistance in the form of moral support, guidance, and a feeling of security by participating in the formal mentoring relationship. Further, Simon (1989) determined that mentors of beginning agricultural education teachers perceived their role to be one of psychological support. The researchers found that mentors served as a sounding board for beginning teachers, listened sympathetically to their problems and frustrations, and provided beginning teachers with advice, counseling, friendship, and positive reinforcement. As one mentor noted, "I gave him re-assurance, lifted him up, encouraged him and tried to get him to overcome his own insecurities" (Simon, p. 219).

The literature suggests that the induction needs of beginning agricultural education teachers might be best satisfied by a mentor who is a professional colleague and who teaches in the same subject field. For example, Greiman, Walker, and Birkenholz (2002) concluded that most beginning agricultural education teachers in Missouri were utilizing formal and informal mentors to assist them during the induction process. Although formal mentors were assigned by the school district to provide professional assistance, it appeared that informal mentors were more helpful. The majority of the respondents in the study indicated that a teacher in the school district and an agricultural education teacher located outside the school district were more helpful in providing professional assistance than the formal mentor. In another study, Peiter, Terry, and Cartmell (2003) examined Oklahoma's formal mentoring program and also found that an agricultural education teacher provided more mentoring to the beginning teacher than did the formal mentor assigned by the school district. Both Greiman et al. (2002) and Peiter et al. (2003) found that beginning agricultural education teachers were receiving little assistance from formal mentors regarding time management and organization of work, balancing personal and professional responsibilities, and in areas that were unique to an agricultural education program (i.e., FFA, SAE, student recruitment, and extended learning opportunities afforded by the summer program).

Dyad Similarity and Dyad Satisfaction

The effect that similarity of dyad partners has on developing a satisfying mentoring relationship has been examined by researchers. Factors associated with the construct of dyad similarity have been identified, and include such items as communication behaviors (Michinov & Monteil, 2002), gender (Turban, Dougherty, & Lee, 2002), race (Turban, et. al., 2002), values (Ensher & Murphy, 1997), and work behaviors (Michinov & Monteil, 2002). Further, Ehrich et al. (2004) identified the major problems associated with formal mentoring programs for beginning

teachers, and personality mismatch was one of the most commonly cited problems. This mismatch between mentors and beginning teachers was the result of differences involving personality, ideology, or expertise. Simon (1989) reported that a satisfying mentoring relationship depended on personal characteristics, compatibility, and professional abilities of the dyad members. One mentor commented, "A friendship did not develop because we were too different individuals" (Simon, p. 223). Previous studies have indicated that protégés' perceived similarity was related to mentoring received (Ensher & Murphy, 1997; Greiman, 2002; Turban, et. al., 2002), and to satisfaction with the mentoring relationship (Allen, Russell, & Maetzke, 1997; Ensher & Murphy, 1997; Young & Perrewé, 2000). It has also been found that the attitudinal similarity of dyad partners is a significant predictor of protégés' satisfaction with the mentoring relationship (Ensher, et al., 2002; Nielson & Eisenbach, 2003).

Researchers have examined dyads composed of teachers who taught similar and dissimilar subjects to determine the impact this measure of similarity has on the retention of beginning teachers. For example, Smith and Ingersoll (2004) utilized data from the nationally representative Schools and Staffing Survey and concluded that beginning teachers who were provided a mentor from the same subject field were less likely to leave the teaching profession after their first year of teaching. Specifically, Smith and Ingersoll found that having a mentor in the same subject field reduced the risk of leaving teaching at the end of the first year by about 30%, while having a mentor outside one's subject field reduced the risk of leaving by 18%.

The current research study was conducted in a Midwestern state that has legislation requiring school districts to provide a formal mentor for each beginning teacher (Department of Elementary and Secondary Education, 1988). Prior to 2003, the formal mentor was a teacher located in the same school as the beginning teacher. However, state legislation enacted in 2003 provided for other mentoring arrangements, which resulted in beginning agricultural education teachers being mentored by an agricultural education teacher located in a neighboring school district. This change in the dyad structure provided the researchers with an opportunity to compare the results of the two formal mentoring relationships, and to examine whether Kram's (1985) mentor role theory applied to beginning agricultural education teachers. Further, Byrne's (1971) similarity-attraction paradigm suggests that beginning teachers who have a mentor from within their profession rather than paired with a mentor outside their profession, may perceive themselves as more similar, and perhaps they will have a higher-level of satisfaction with the relationship.

Purpose and Objectives

The purpose of this study was to compare two different formal mentoring relationships based on the perceptions of beginning agricultural education teachers

regarding their dyadic interactions. The specific variables of interest included psychosocial mentoring, dyad similarity, and dyad satisfaction. The following research objectives were, therefore, addressed in the study: (a) determine and compare beginning teachers' perception of the extent of psychosocial mentoring received by mentoring relationship, (b) determine and compare beginning teachers' perception of dyad similarity by mentoring relationship, (c) determine and compare beginning teachers' perception of dyad satisfaction by mentoring relationship, and (d) determine the relationship among psychosocial mentoring received, dyad similarity, and dyad satisfaction. Based on the literature review, the following hypotheses were formulated to determine whether there were statistically significant findings in the study:

H_1: There is a statistically significant difference between in-school and in-profession mentoring relationships on psychosocial mentoring.

H_2: There is a statistically significant difference between in-school and in-profession mentoring relationships on dyad similarity.

H_3: There is a statistically significant difference between in-school and in-profession mentoring relationships on dyad satisfaction.

H_4: There is a statistically significant relationship among psychosocial mentoring, dyad similarity, and dyad satisfaction.

Methods and Procedures

This study was descriptive-correlational in design (Gall, Borg, & Gall, 1996), and the target population was agricultural education teachers in their first year of teaching in a Midwestern state. The names of the beginning teachers were obtained from the Department of Elementary and Secondary Education located in the Midwestern state, and served as the population for the study. After comparing beginning teacher demographics in the Midwestern state over an extended number of years, the researchers found Oliver and Hinkle's (1982) argument to be reasonable that a sample in any given year could be representative of the population over time. As such, the time and place sample consisted of beginning agricultural education teachers (n = 40) paired with a mentor in the school where they taught during 2001-2002 (i.e., in-school), and beginning agricultural education teachers (n = 40) paired with an agricultural education mentor located in a neighboring school during 2003-2004 (i.e., in-profession). Both cohorts represented the entire number of beginning agricultural education teachers who were in their first year of teaching in the Midwestern state. There was one additional beginning teacher during the 2001-2002 school year, however, the school district had not assigned a formal mentor, and there was an additional beginning teacher during the 2003-2004 school year who did not participate in the induction program. A total of 70 beginning teachers ($n_{\text{in-school}}$ = 39, $n_{\text{in-profession}}$ = 31) participated in the study, which resulted in an overall response rate of 87.5%.

For the cohort of beginning teachers who had in-school mentors, the mentoring program was coordinated by each individual school district. Therefore, mentoring activities varied from teacher to teacher. Because some mentors were not agricultural education teachers, the amount and type of mentoring related to specific agricultural education responsibilities also varied. In contrast, the programming for the cohort of beginning teachers who had in-profession mentors was more structured, and consisted of several common activities (i.e., instructional planning and creating a professional development plan). Further, the dyad met formally at least three times throughout the school year.

For both cohorts of beginning teachers, data were collected at the end of their first year of teaching using the Mentoring Relationship Questionnaire (MRQ). The MRQ was developed by Greiman (2002). He adapted and modified highly reliable scales from data collection instruments utilized in previous research studies involving mentoring (Ragins & McFarlin, 1990; Turban, Daugherty, & Lee, 2002). A panel of experts (n = 8) who had an identifiable research focus involving mentoring and/or induction of teachers reviewed the MRQ for content and face validity (Greiman, 2002). Appropriate changes to the questionnaire were made based on the recommendations of expert panel members. The MRQ consists of scales that measure psychosocial mentoring, dyad similarity, and dyad satisfaction, and the details of each scale follow.

Psychosocial Mentoring

The development of this part of the MRQ was based on Kram's (1985) mentor role theory, and participants were asked to identify the extent of psychosocial mentoring provided by their formal mentors. Beginning teachers responded to 15 items representing each of the five psychosocial functions (three questions each for acceptance, counseling, friendship, role modeling, and social). The function of acceptance was represented by an item such as, "To what extent has your formal mentor accepted you as a competent colleague." An example of an item expressing the function of counseling was, "To what extent has your formal mentor been willing to discuss your questions and concerns." An example of an item that denoted the friendship function was, "To what extent has your formal mentor been someone you could confide in." The role modeling function was represented by items such as, "To what extent has your formal mentor been someone you wanted to emulate." Finally, the social function was denoted by such statements as, "To what extent has your formal mentor got together with you informally after work." Beginning teachers were asked to identify the extent that their mentors performed each of the 15 items using a 7-point Likert-type scale ranging from 1 = *not at all* to 7 = *very large extent*. Ragins and McFarlin (1990) reported Cronbach's coefficient alphas that ranged from .82 to .93 for each of the psychosocial functions, while Greiman (2002) reported a reliability coefficient of .97 for the psychosocial mentoring construct.

Dyad Similarity

Five items (e.g., "My formal mentor and I have similar values and attitudes," "My formal mentor and I see things much the same way," "My formal mentor and I have similar teaching philosophies") were designed to measure the perceived similarity of the dyad relationship. Turban, et al. (2002) conceptualized this global scale based on the extent that one person believes the other person has similar underlying attitudes, values, and beliefs, and they suggested that this construct is at a deeper level than gender or race similarity. Beginning teachers provided their perceptions using a 7-point Likert-type scale with 1 representing *strongly disagree* and 7 representing *strongly agree*. The reliability for this measure of dyad similarity has ranged from .87 (Turban, et al., 2002) to .98 (Greiman, 2002).

Dyad Satisfaction

Five items (e.g., "In regard to the interaction with my formal mentor, the relationship has been a positive experience," "In regard to the interaction with my formal mentor, the relationship has been successful," "In regard to the interaction with my formal mentor, I was satisfied with the interaction") were intended to gain a global measure of the perceived satisfaction with formal mentoring. Participants provided their perceptions using a 7-point Likert-type scale with 1 representing *strongly disagree* and 7 representing *strongly agree*. The scale was developed by Ragins and McFarlin (1990) ($\alpha = .83$), and utilized in subsequent research conducted by Greiman (2002) ($\alpha = .99$).

Data collection was conducted using an adaptation of Dillman's (2000) tailored design method. For both cohorts of beginning teachers, the data collection process began by sending participants a pre-notice message announcing the intent of the study and the estimated arrival date of the survey packet. The survey packet was mailed to the beginning teachers five days later, and consisted of a personalized and signed cover letter, a questionnaire, and a self-addressed, stamped envelope. Ten days after the first mailing, an e-mail reminder notice was sent to nonrespondents to further encourage their participation. A week later, nonrespondents were sent a second packet containing a revised cover letter, a second questionnaire, and a self-addressed, stamped envelope as a reminder to participate in the study. The final contact with nonrespondents was approximately 25 days after the first mailing, and consisted of a telephone call that encouraged the return of the questionnaire.

Data were coded and entered into SPSS for the analyses. For objectives 1, 2, and 3, mean scores and standard deviations were calculated to summarize the data for interval or ratio-level data. Independent sample *t*-tests were conducted to test hypotheses 1, 2, and 3 by comparing the groups on psychosocial mentoring, dyad similarity, and dyad satisfaction. For objective 4 and hypothesis 4, Pearson Product-Moment correlations were calculated to determine the relationships among psychosocial mentoring, dyad similarity, and dyad satisfaction. To interpret the

magnitude of relationships based on the correlation coefficients, Davis' (1971) conventions were adopted: very strong relationship (r = .70), substantial relationship (r = .50), moderate relationship (r = .30), low relationship (r = .10), and negligible relationship (r = .01). Effect sizes were calculated and interpreted using Cohen's (1988) d and r coefficients and indices: small effect size (d = .20, r = .10), medium effect size (d = .50, r = .30), and large effect size (d = .80, r = .50). Finally, an alpha level of .05 was established a priori for tests of significance.

Findings

Selected characteristics of beginning agricultural education teachers and the schools where they taught are reported in Table 1. Each cohort was composed of nearly an equal percentage of male and female teachers (male $_{in\text{-school}}$ = 51.3%, male $_{in\text{-profession}}$ = 51.6%), and the average age was nearly the same ($M_{in\text{-school}}$ = 26, $M_{in\text{-profession}}$ = 25). A permanent teaching certificate was held by 31 (81.6%) beginning teachers with an in-school mentoring relationship, and by 28 (90.3%) beginning teachers with an in-profession mentoring relationship. Twenty-two (56.4%) beginning teachers with an in-school mentor taught in a single teacher program with a mean enrollment of 80 students. Seventeen (56.7%) beginning teachers with an in-profession mentor taught in a single teacher program with a mean enrollment of 91 students.

The first objective of the study sought to determine and compare beginning teachers' perceptions of the extent of psychosocial mentoring received by mentoring relationships. As shown in Table 2, both respondent groups perceived they were receiving psychosocial mentoring to a *large extent* ($M_{in\text{-school}}$ = 4.65, $M_{in\text{-profession}}$ = 5.01). Among the psychosocial mentoring functions, both cohorts of teachers indicated they received acceptance ($M_{in\text{-school}}$ = 5.14, $M_{in\text{-profession}}$ = 5.54) the most often, while social ($M_{in\text{-school}}$ = 3.66, $M_{in\text{-profession}}$ = 3.83) was received the least often. The mean values for psychosocial mentoring and each of the five functions were higher among teachers with an in-profession mentoring relationship than among teachers with an in-school mentoring relationship. The effect size of the difference in perception between in-school and in-profession teachers regarding psychosocial mentoring was small for psychosocial mentoring (d = .22), acceptance (d = .29), counseling (d = .31), and friendship (d = .26). Negligible effect sizes were found for role modeling (d = .19) and social (d = .09).

Independent sample t-tests were conducted to test hypothesis one, and to determine if statistically significant differences existed between mentoring relationships on psychosocial mentoring. In each case, the calculated p-value (see Table 2) was greater than the .05 alpha level and the hypothesis was rejected. There were no statistically significant differences be1tween in-school and in-profession mentoring relationships on psychosocial mentoring, and on each of the psychosocial functions of acceptance, counseling, friendship, role modeling, and social.

Table 1
Selected Characteristics of Beginning Teachers and Schools by Mentoring Relationship

	In-school (n = 39)				In-profession (n = 31)			
Characteristic	*f*	%	M	SD	*f*	%	*M*	*SD*
Gender								
Male	20	51.3			16	51.6		
Female	19	48.7			15	48.4		
Certificate type								
Permanent	31	81.6			28	90.3		
Temporary	7	18.4			3	9.7		
Program type								
Single teacher	22	56.4			17	56.7		
Multiple teacher	17	43.6			13	43.3		
Age			26	6.3			25	4.0
Student enrollment			80	61.8			91	65.0

Objective two sought to determine and compare beginning teachers' perceptions of dyad similarity by mentoring relationship (see Table 3). Teachers with an in-school relationship reported a mean of 4.56 (SD = 1.76) for dyad similarity compared to a mean of 4.90 (SD = 1.41) for teachers with an in-profession relationship. The effect size of the difference in perception between in-school and in-profession teachers regarding dyad similarity was small (d = .21). An independent sample t-test was conducted to test hypothesis two, and to determine if statistically significant differences existed between mentoring relationships on dyad similarity. As shown in Table 3, the calculated p-value was greater than the alpha level and, therefore, the hypothesis was rejected. There was no statistically significant

difference between in-school and in-profession mentoring relationships on dyad similarity.

Table 2
Beginning Teachers' Perception of Psychosocial Mentoring Received by Mentoring Relationship

	In-school (n = 39)		In-profession (n = 31)			
Mentoring function	*M*	*SD*	*M*	*SD*	*t*	*p*
Psychosocial mentoring	4.65	1.68	5.01	1.58	-.91	.36
Acceptance	5.14	1.59	5.54	1.32	-1.14	.26
Counseling	4.97	1.76	5.45	1.69	-1.12	.27
Friendship	4.90	1.98	5.37	1.76	-1.02	.31
Role modeling	4.59	1.96	4.94	1.85	-.76	.45
Social	3.66	2.06	3.83	2.23	-.34	.74

Note. 7-point scale (1 = *not at all*, 3 = *some extent*, 5 = *large extent*, 7 = *very large extent*)

Objective three sought to determine and compare beginning teachers' perceptions of dyad satisfaction by mentoring relationship (see Table 3). Teachers with an in-school relationship reported a mean of 5.17 (*SD* = 1.91) for dyad satisfaction compared to a mean of 5.46 (*SD* = 1.68) for teachers with an in-profession relationship. The effect size of the difference in perception between in-school and in-profession teachers regarding dyad satisfaction was negligible (d = .16). An independent sample t-test was conducted to test hypothesis three, and to determine if statistically significant differences existed between mentoring relationships on dyad satisfaction. As shown in Table 3, the calculated p-value was greater than the alpha level and, therefore, the hypothesis was rejected. There was no statistically significant difference between in-school and in-profession mentoring relationships on dyad satisfaction.

Table 3
Beginning Teachers' Perceived Dyad Similarity and Dyad Satisfaction by Mentoring Relationship

	In-school (n = 39)		In-profession (n = 31)			
Construct	*M*	*SD*	*M*	*SD*	*t*	*p*
Dyad similarity	4.56	1.76	4.90	1.41	-.87	.39
Dyad satisfaction	5.17	1.91	5.46	1.68	-.65	.52

Note. 7-point scale (1 = *strongly disagree*, 3 = *disagree*, 5 = *agree*, 7 = *strongly agree*)

The fourth objective sought to determine the relationship among psychosocial mentoring, dyad similarity, and dyad satisfaction. As shown in Table 4, Pearson Product-Moment correlations were calculated to test hypothesis four. From the perceptions of beginning teachers who had an in-school mentoring relationship, *very strong* (Davis, 1971) statistically significant correlations were found between dyad similarity and dyad satisfaction (r = .93, large effect size), between psychosocial mentoring and dyad satisfaction (r = .91, large effect size), and between psychosocial mentoring and dyad similarity (r = .82, large effect size). From the perception of beginning teachers who had an in-profession mentoring relationship, *very strong* (Davis, 1971) statistically significant correlations were found between dyad similarity and dyad satisfaction (r = .82, large effect size), between psychosocial mentoring and dyad satisfaction (r = .81, large effect size), and between psychosocial mentoring and dyad similarity (r = .74, large effect size). It was determined that the Pearson Product-Moment correlations were significant at the .05 alpha level, and hypothesis four was accepted. A statistically significant relationship among psychosocial mentoring, dyad similarity, and dyad satisfaction was found for both groups of beginning teachers.

Table 4
Intercorrelations Among Psychosocial Mentoring, Dyad Similarity, and Dyad Satisfaction by Mentoring Relationship

Variable	1	2	3
	In-school (n = 39)		
1. Psychosocial mentoring	—	.82*	.91*
2. Dyad similarity	—	—	.93*
3. Dyad satisfaction	—	—	—
	In-profession (n = 31)		
1. Psychosocial mentoring	—	.74*	.81*
2. Dyad similarity	—	—	.82*
3. Dyad satisfaction	—	—	—

*p < .01.

Conclusions, Discussion, and Recommendations

The purpose of this study was to compare two different formal mentoring relationships (i.e., in-school and in-profession), based on the perceptions of beginning agricultural education teachers regarding their dyadic interactions. Supported by Kram's (1985) mentor role theory and Byrne's (1971) similarity-attraction paradigm, the researchers hypothesized that teachers with an in-school mentoring relationship would differ from those with an in-profession mentoring relationship on the variables of psychosocial mentoring, dyad similarity, and dyad satisfaction. The literature suggests that beginning teachers in agricultural education are faced with unique challenges, will benefit from a mentor who has familiarity with the characteristics of this specific teaching assignment, and this similarity will likely result in a more satisfying dyad relationship (Ehrich et al., 2004; Simon, 1989; Smith & Ingersoll, 2004). A crucial component of evaluating the effectiveness of the dyad relationship, therefore, is whether or not an individual perceives the interaction to have been satisfying (Young & Perrewé, 2000). Previous research has found that dyad satisfaction is important for both short-term and long-term benefits. Short-term, a satisfying mentoring relationship can positively impact the retention of beginning teachers (McCormick, 2001), has been associated with increased job satisfaction

(Holloway, 2001), and helps reduce the stress level of beginning teachers (Galvez-Hjornevik, 1985). Research also suggests that the long-term benefits of mentoring experiences will affect future interactions, expectations, and attitudes toward mentoring (Fagenson-Eland, Marks, & Amendola, 1997). Establishing a better understanding regarding how to assist dyad members in building effective relationships will potentially reduce the "likelihood that a harmful relationship will form and lead to damaging outcomes for participants and potential liabilities to organizations" (Young & Perrewé, p. 626).

Although beginning teachers with an in-profession mentoring relationship perceived they received more psychosocial assistance, were more similar, and were more satisfied with their dyad relationship compared to beginning teachers with an in-school mentoring relationship, the differences were not statistically significant. Therefore, this study concluded that there was no significant difference in psychosocial mentoring, dyad similarity, and dyad satisfaction between in-school and in-profession mentoring relationships. There are several possible explanations for the lack of significance between the two mentoring relationships. First, it is possible that the results may be attributable to mentoring variables that were not part of the research project's inquiry. For example, accessibility of the in-school mentor may have been an important variable in providing psychosocial assistance to the beginning teacher. While the in-school mentor was in the same building as the beginning teacher, the in-profession mentor was located in a neighboring school. It seems likely that due to proximity, an in-school relationship might be better suited to assisting beginning teachers with their needs in a proactive and timely manner. In contrast, the in-profession relationship might develop into a reactive and reflective approach to dealing with beginning teacher challenges. Thus, it is plausible that due to proximity, the in-school dyad may have spent more time interacting. Research (Ehrich, et al., 2004; Greiman, 2002; Long, 1997; Noe, 1988) continues to identify time limitations, incompatible work schedules, and physical distance as some of the most frequent reasons for lack of interaction by dyad partners. This study did not report this information, and as a result, it is recommended that research should investigate the frequency and scope of formal mentoring activities in relationship to psychosocial mentoring, dyad similarity, and dyad satisfaction. In addition, further investigation should examine the form of communication that dyads utilize in scenarios where mentoring might be at a distance; for example, as the in-profession mentors who were located at a neighboring school. In the past several years, there has been a dramatic increase in the number of on-line mentoring websites and computer-mediated communication (CMC) mentoring programs, but very few scholarly articles have addressed this phenomenon (Ensher, Heun, & Blanchard, 2003).

A second possible explanation for the lack of significance between the two mentoring relationships revolves around the willingness of dyad members to participate in the relationship (Hale, 2000). Wildman, Niles, Magliaro, and

McLaughlin (1989) assessed mentor traits that contributed to the success of the dyad relationship, and found *willingness to be a mentor* as an important variable. Therefore, the attitude of beginning teachers and mentors towards the mentoring relationship may have an important impact on the success of the dyad. For example, protégés who begin the mentoring relationship with a recognition of mentoring benefits, who are comfortable asking for help, and who are willing to be transparent about their abilities and needs are most likely to benefit from the experience. Accordingly, future research is needed to develop a *readiness* measure to assist dyad members in evaluating their attitudes and willingness toward participating in a mentoring relationship (Noe, 1988).

This study did find a significant relationship among psychosocial mentoring, dyad similarity, and dyad satisfaction for both cohorts of beginning teachers. This finding aligns with previous research (Allen, Russell, & Maetzke, 1997; Ensher et al., 2002; Ensher & Murphy, 1997; Greiman, 2002; Nielson & Eisenbach, 2003; Turban et al., 2002; Young & Perrewé, 2000), and lends support for Byrne's (1971) similarity-attraction paradigm. Therefore, the more a beginning teacher perceives the dyad as being similar, it is more likely the teacher will be satisfied with the dyad relationship, and it is more likely that the beginning teacher will perceive that psychosocial mentoring has been received. The implication is that administrators of teacher induction programs should consider matching dyad members based on similarity. In this study, similarity was defined as the extent that one person believes the other person has similar underlying attitudes, values, and beliefs, and this construct is at a deeper level than gender or race similarity (Turban et al., 2002). Ideally, an assessment of similarity characteristics should be conducted prior to matching so that the chances of obtaining a successful dyad are improved. The mismatch of dyad members has been identified as a major problem associated with formal mentoring programs (Ehrich, et al., 2004; Greiman, 2002; Hale, 2000; Ruhland & Bremer, 2002); therefore, additional research is needed to inform the matching process. For example, research should be conducted that inquires into the criteria employed to match dyad partners, and the identification of variables that result in an effective match.

Based on the findings of this study, it was concluded that beginning teachers were generally receiving psychosocial mentoring to a large extent regardless of the type of mentoring relationship. What is unique about the findings of this study is that Kram's (1985) mentor role theory was found to apply in the context of agricultural education. These results reveal empirical evidence to support Kram's assertion that mentors provide psychosocial assistance to their dyad partner through the acceptance, counsel, friendship, role modeling, and social functions. As a result, beginning teachers can anticipate that their sense of competence, identity, and effectiveness will be enhanced by the dyadic interactions with their formal mentors. This finding has implications for the retention of beginning teachers since lack of support is one of the major reasons that beginning teachers leave the profession

(Brighton, 1999; Darling-Hammond, 1997). Further, this study concluded that both cohorts of beginning teachers generally agreed that they were similar to their dyad partners and that they were satisfied with their dyadic interactions. This conclusion could imply that beginning teachers, regardless of the formal mentoring relationship, value the mentoring process.

There are some limitations associated with this research study. First, there is the issue of beginning agricultural education teachers who had an in-school mentor and taught in a multiple teacher program. It is possible that this scenario could have resulted in an agricultural education teacher serving as the beginning teacher's in-school mentor. Therefore, a limitation of this study is that the teaching assignment of the in-school mentor was not controlled for, and this potentially minimized the differences in psychosocial assistance, dyad similarity, and dyad satisfaction found between the two mentoring relationships. Secondly, the researchers could not control for dyad relationships involving beginning teachers who taught in multiple teacher programs. The 43.6% of beginning teachers with an in-school mentor, and 43.3% of beginning teachers with an in-profession mentor taught in multiple teacher programs. It seems likely that these on-site departmental colleagues provided informal mentoring, and this assistance may have had an effect on the beginning teacher's perceptions of mentoring received. While the questions in the MRQ specifically pertained to the beginning teachers' formal mentors, it is possible that respondents might not have easily made this distinction. Finally, readers are cautioned to limit the generalizability of the results to beginning agricultural education teachers in the Midwestern state. As such, further research with a larger population of teachers throughout the United States is desirable so that generalizability could be improved.

While this study did not find significant differences between in-school and in-profession mentoring relationships on psychosocial mentoring, dyad similarity, and dyad satisfaction, significant relationships were discovered among psychosocial mentoring, dyad similarity, and dyad satisfaction for both dyad relationships. Additionally, the study did find support for Kram's (1985) mentor role theory and Byrne's (1971) similarity-attraction paradigm as indicated by the extent of psychosocial mentoring, dyad similarity, and dyad satisfaction perceived by both cohorts of beginning teachers. This study provides an examination of mentoring relationships in the context of agricultural education, and it is recommended that this line of mentoring research be replicated with other beginning career and technical education teachers. This recommendation aligns with Ruhland and Bremer (2002) who called for research to examine the quality of the mentor relationship and its helpfulness to the beginning career and technical education teacher. Limited research has been conducted pertaining to the retention of beginning career and technical education teachers, and yet the National Commission on Teaching and America's Future (2003) identified beginning teacher retention as a "national crisis" (p. 21). The increased retention of beginning teachers is one of the most significant issues facing education (Smith & Ingersoll, 2004); therefore, research should be conducted to

better understand how mentoring impacts retention. While this study examined the psychosocial assistance provided by a mentoring relationship, further study is needed regarding the professional mentoring afforded beginning teachers through a dyadic relationship. Finally, it is recommended that additional research be conducted in regard to the understanding of relationship dynamics and predictors of effective dyad relationships. Investigating predictors of dyad satisfaction and psychosocial functions could provide insightful information regarding the dyad relationship, and could provide guidance for matching dyad partners.

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Reading Strategy Instruction in Secondary Agricultural Science Courses: An Initial Perspective

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Abstract

Students must be able to create meaning from career and technical education texts. Reading and comprehension of texts are skills that develop through practice with a variety of texts, including those in career and technical education. A quasi-experimental nonequivalent control group design was used to determine the effect of implementing content area reading strategies (CARS) on comprehension and reading behaviors of a purposively selected sample (n = 95) of secondary agricultural science students. Instruction with CARS was compared to the teacher's normal instructional routine. Pretest score, grade level, grade point average, gender, ethnicity, and standardized reading level predicted 65% of variance in agriculture posttest scores. Students in the treatment group generally improved their reading behaviors, while students in the comparison group regressed. Students in the treatment group read significantly more hours per week for school and had increased the hours reading for pleasure significantly more than the comparison group.

Introduction

Adolescents need strong reading skills to excel in academics, create meaning from text, and function in society (Forget & Bottoms, 2000; Meltzer, 2001). These reading skills are vital for productive careers, democratic citizenship, and successful personal lives (D'Arcangelo, 2002; Guthrie, Schafer, Wang, & Afflerbach, 1995; National Reading Panel [NRP], 2000; Vacca, 2002b). High school graduates must possess skills necessary for understanding, creating, and applying meaning from text (Snow, 2002); therefore, reading must occur in not just the core academic areas, but in secondary agricultural sciences and career and technical education areas as well. Yet, agricultural science teachers and other career and technical education teachers implement few content area reading strategies in their courses (O'Brien & Stewart, 1990; Park & Osborne, 2006). Further, little research of an experimental nature has been conducted regarding the development of reading skills in secondary agricultural sciences or other career and technical education areas.

While little explicit literacy instruction occurs in many career and technical education courses, the need for such instruction may be more applicable than in any other course. When students do not comprehend a literary work in English class, the consequence is failure on an assignment or assessment. However, when a student does not comprehend text in agricultural science, such as a chemical label, a technical manual, or a nutritional label, the consequences may include failure on an assignment or test, but may also actually endanger the student or his/her peers. Misunderstanding a chemical label or even a simple ruler, at the least will cause economic loss of plant life in a greenhouse or wastage of construction materials. Thus, the consequences of students' reading failures in career and technical education are real and may have dire impacts.

The problem associated with the use of literacy strategies in career and technical education is the lack of evidence supporting the impact of such strategies on students' academic performance and motivation. While the literature would suggest that the use of reading strategies will assist students in learning about concepts and enhance motivation to read, little research supports these conclusions in career and technical education. The purpose of this research, therefore, was to address the need for empirical research that identifies the impact of content area reading strategies on students' reading comprehension and motivation to read.

Problems and Challenges of Reading Deficiencies

Literacy improvement is seldom a solitary event. In order to improve reading skills, students must be exposed to texts and thinking in all educational contexts. This includes the application of texts and reading as tools for learning and thinking in agricultural science education and other career and technical education areas. Improving reading and literacy skills is the job of every teacher, not just those in the language arts. In order for students to succeed in making decisions within the complex, information-based world, it is vitally important that they possess the ability to create knowledge from text, analyze arguments, propose solutions, and make decisions about real-world issues (Alvermann, 2006; National Governors Association [NGA], 2005). Yet, again, agricultural science teachers do not explicitly instruct students with reading strategies (Park & Osborne, 2006).

The problems of reading skill deficiency are prevalent at the secondary level. In the 8th-grade, 32% of boys and 19% of girls cannot read at the basic level (National Center for Educational Statistics [NCES], 2001), meaning that these students cannot understand texts, make interpretations, or relate concepts from the text to the classroom or real life. At the 12th-grade, 26% of all students fail to read at the basic level, including 30% of boys and 17% of girls (NCES, 2001; Wirt et al., 2004). Educators are making little advancement in teaching students how to comprehend and apply text, especially for struggling readers (Cappella & Weinstein, 2001; NCES, 2001). In 2004, Florida students showed improvement at every grade

level, except grades eight and 10, where the number of students reading below grade level increased from 62% in 2001 to 66% in 2004, the highest level in four years (Florida Department of Education [FDOE], 2004b, 2004c).

Eight percent of career and technical education concentrators improved their reading scores on the National Assessment of Educational Progress (NAEP) between 1994 and 1998 (NCES, 2001). Yet, only 29.3% of these students who completed three or more years of secondary career and technical education read at or above the *proficient* level (Silverberg, Warner, Fong, & Goodwin, 2004). The improvement in reading scores amounted to eight points, or just less than one standard deviation. A similar study of vocational completers within *High Schools That Work* schools found nearly a six-point improvement in reading achievement from 1996 to 1998 (Kaufman, Bradby, & Teitelbaum, 2000). However, the unknown variable is whether the completion of additional career and technical education courses or additional academic courses affected the improvement in reading achievement. At the same time, 44.8% of non-concentrators read at or above the proficiency level. Further, the report suggested, "There is little evidence that vocational courses contribute to improving academic outcomes" (Silverberg et al., p. 7).

Reading in secondary schools and content areas, such as career and technical education, is vital to students' development of comprehension skills. However, many students lack the requisite skills to understand and apply meaning from texts. Therefore, they disengage with reading in content areas and for pleasure. Students' reading difficulties are compounded by the diversity and complexity of reading material encountered in career and technical education courses (Alexander & Kulikowich, 1991; Cresson, 1999; Digisi, 1993; Kim, Vaughn, Wanzek, & Wei, 2004; Menke & Davey, 1994; Vacca, 2002a). Content area texts often contain complex and difficult vocabulary, structure, and concepts (Kim et al, 2004), which is especially true for career and technical education texts. The reading activities are also demanding and involve problem solving and critical thinking. Teachers are often unprepared to teach reading strategies and do not employ reading on a regular basis (Bintz, 1997; Cresson, 1999; Digisi, 1993; Menke & Davey, 1994). As the context of reading in secondary schools shifts with each passing period, students are required to shift knowledge, thinking skills, and contexts in order to comprehend coursework. Additionally, students often fail to realize the connection between reading in content areas and applications in their personal lives.

Good instruction is the most effective means of increasing student comprehension and developing skilled readers (Snow, 2002; Tomlinson, 1995). Because many career and technical education areas use difficult and complex text, the responsibility for teaching or at least reinforcing reading strategies belongs to all teachers in all subjects, including career and technical education (Alexander & Kulikowich, 1991; Florida Department of Education [FDOE], 2004a; Vacca, 2002a). However, few teachers employ reading strategies in their classrooms (Barry, 2002; Bean, 1997; Durkin, 1978; Ivey, 2002; Menke & Davey, 1994; Morawski &

Brunhuber, 1995). While researchers have cited various reasons, including lack of preparation, lack of time, and denial of responsibility (Bean, 1997; Bintz, 1997; Durkin, 1978; Forget & Bottoms, 2000; Stewart, 1990; Stewart & O'Brien, 1989; Vaughn, Klinger, & Bryant, 2001), perhaps part of the lack of content area reading strategies (CARS) implementation stems from teachers not being convinced of the efficacy of CARS with actual data from their own classrooms.

Theoretical and Conceptual Framework

Sociocultural Theory of Reading

Comprehension is more than just individual students and their reading; it is socially constructed through reading, writing, and speaking. Contextualized within the individual's social networks and their learning communities (Moje, 1996), reading is a social activity among students as they collectively construct content and learning procedures (Rex, 2001). Reading occurs socially as students "discuss their personal relationships to reading in the discipline, the cognitive strategies they use to solve comprehension problems, the structure and language of particular types of texts, and the kinds of knowledge required to make sense of reading material" (Schoenbach, Braunger, Greenleaf, & Litman, 2003, p. 136).

Reading occurs within personal, sociocultural, and political contexts (Mann, 2000). These contexts include agricultural science and other career and technical education areas. Students are social beings with aspirations who contextualize and make particular pieces of information significant while reading. Social patterns in the classroom shape the volume and breadth of student reading (Guthrie et al., 1995). Reading activities are highly associated with social interactions among friends and family, strategies for comprehension and learning, classroom instruction, and teachers' emphasis on reading (Guthrie et al.). Moje (1996) posited that teachers and students construct meaning through interactions with each other, the text, and reading strategies, and these interactions are based on past experiences, current situations, and future implications.

The RAND Reading Study Group's (Snow, 2002) research agenda for comprehension provided the conceptual framework for this study. The group defined comprehension as, "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (p. xiii). It is composed of the reader, text, and activity, or purpose for reading, which occur in a larger sociocultural context, including the teacher (see Figure 1). The teacher influences, or can influence, the reading activity by teaching CARS to readers and by encouraging students' use of CARS within classroom reading.

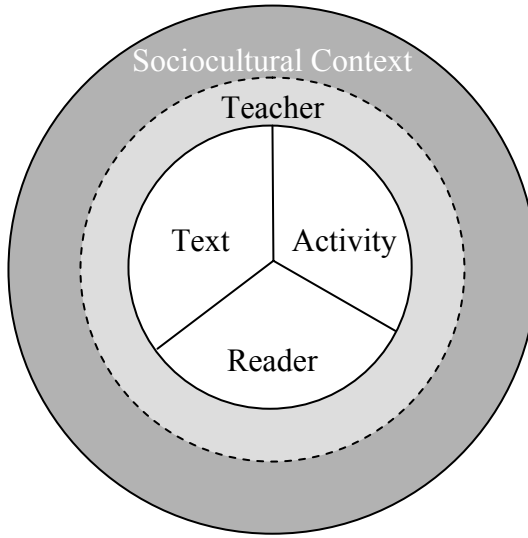

Figure 1. A Heuristic for Thinking about Reading Comprehension[1].

The reader in career and technical education brings his or her cognitive capabilities, motivation, knowledge, and experiences to the reading processes (Snow, 2002). Reader characteristics include gender, ethnicity, socioeconomic status, prior grade point average, grade level in school, and reading comprehension ability. These characteristics vary from reader to reader and significantly impact the understanding of written material. For many career and technical education students, especially those who are alienated from other academic areas, reading may present challenges that are difficult to overcome. Further, career and technical education students approach these classes with a negative attitude towards reading, often believing that reading has no place in career and technical education courses. Teachers reinforce this notion by professing the *hands-on* approach to instruction in career and technical education (O'Brien & Stewart, 1990).

The text includes the representation of information, including the surface code, text base, and mental models (Snow, 2002). Each different text varies in readability, vocabulary, structure, and content, thereby, impacting comprehension. Texts within career and technical education may include traditional textbooks, trade magazines, the Internet, technical manuals, business forms, chemical labels, and machinery.

[1] Snow, C. (2002). *Reading for understanding: Toward an R&D program in reading comprehension*. Santa Monica, CA: The RAND Corporation.

Each of these different genres in career and technical education presents specific challenges for students' comprehension.

The activity of reading involves the purposes, operations of reading, and outcomes of the reading comprehension processes (Snow, 2002). The activity of reading in career and technical education and agricultural science can be especially problematic for students. Within the context of career and technical education and agricultural science education, students must not only read with enough comprehension to score well on pencil-and-paper tests, but also create meaning from multiple text genres and *apply* that information to solve problems. The multiplicity of genres and application of comprehension present unique problems for those who cannot comprehend well. Outcomes of reading in career and technical education can consist of solving problems, increasing knowledge, or engaging the reader.

The context of reading comprehension is comprised of the larger sociocultural environment the student encounters and navigates while reading (Snow, 2002). This sociocultural context includes the teacher, but also extends beyond the classroom to encompass the community and world of the student. It involves social aspects of constructing meaning and the development of power within society.

Within the *activity* of reading, three points occur where students metacognitively think about the reading processes and, therefore, can initiate reading strategies: before reading, during reading, and after reading (see Figure 2, Ryder & Graves, 1994). The three micro-periods of pre-reading, reading, and post-reading constitute microdevelopmental processes (International Reading Association, 1988; Snider, 1989; Snow, 2002), where the reader develops and is developed by his or her application of previous knowledge, reading skills, and comprehension. Prior to reading, students can circumvent habits that inhibit comprehension and teachers can provide scaffolding to assist learning with text, such as establishing a purpose for reading, activating prior knowledge, and developing guiding questions for reading. Strategic learning during reading involves monitoring reading and making sense of the passages. During reading, readers should question the author's meaning of the passage, his or her intent, and challenge the author's point of view. After reading, students can extend and elaborate on the author's ideas. At this stage, students share their ideas about the reading through discussion, writing, or other means of expression.

Empirical Research on Reading Strategy Instruction

Instruction of reading strategies has been shown to have a positive effect on reading comprehension and motivation (Autrey, 1999; Choochom, 1995; Cooper, 1998; Druitt, 2002; Ferguson, 2001; Guthrie, 2001; Guthrie & Alao, 1997; Hurst, 2004; Knoll, 2000; Kuehl, 2002; Laflamme, 1998; Little, 1999; Lynch, 2002; Mastropieri, Scruggs, & Graetz, 2003; Rush, 2000; Sanchez, 2003; Ward-Washington, 2002). Teaching reading strategies improves awareness and use of

strategies, as well as motivation to read (NRP, 2000). However, students seldom expend the time and effort to implement strategies and do so only when directed by teachers (Cuevas, 2003). Teachers in agricultural science education seldom direct students to implement CARS (Park & Osborne, 2006).

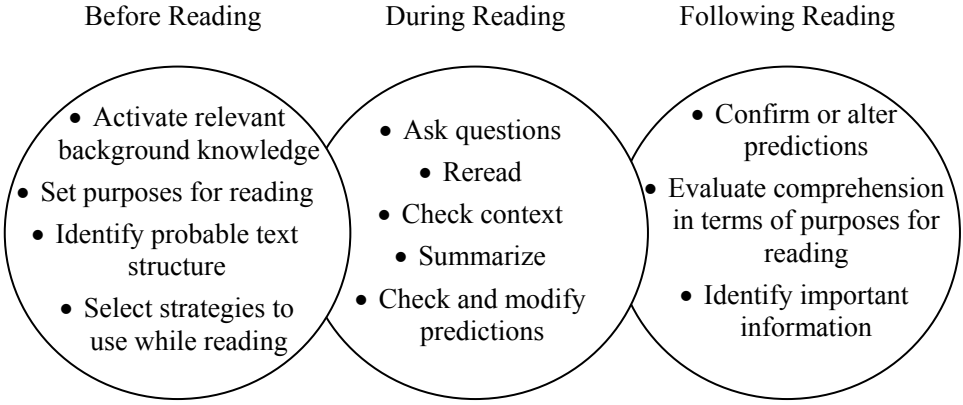

Figure 2. Strategies that Proficient Readers Use in the *Activity* of Reading[2].

CARS must be explicit, multiple, and accountable for motivation. Reading strategy instruction provides significant gains, even for higher reading level students. Evaluating strategy intervention with 98 8th-grade students, Mothus (2004) found that students participating in the intervention had a significant increase in comprehension achievement scores of more than one grade level. Simmonds (1992) determined that reading strategy instruction improved comprehension by nearly two standard deviations among 240 resource room students in grades one through nine. While these studies have focused on the use of CARS with younger students, few experimental studies have been conducted in secondary classrooms or in career and technical education.

Effective reading relies not upon a single strategy, but incorporates the coordination of several strategies (Bulgren & Scanlon, 1997-98; Pressley & Wharton-McDonald, 1997; Taraban, Rynearson, & Kerr, 2000; Vaughn, Klinger, & Bryant, 2001). Morgan and Hosay (1991) determined that teaching a package of reading strategies improved comprehension, led Virginia high school students to read more, enhanced critical reading, increased the variety of texts read, and improved standardized test scores. Weedman (2003) determined that higher comprehension

[2] Ryder, R. J., & Graves, M. F. (1994). *Reading and learning in content areas*. New York, NY: Macmillan College Publishing Company, Inc.

scores were generated when teaching 9th-grade students to use a package of strategies.

Motivation also impacts whether and how students use comprehension strategies (Dole, Brown, & Trathen, 1996; Guthrie et al., 1995), and may have an impact on whether and to what extent a student reads. Exploring the relationship between motivation and reading comprehension in 55 10th-graders, Knoll (2000) found a strong relationship (r = .73) between motivation and reading comprehension. Studying 90 7th-, 8th-, and 9th-grade students, Choochom (1995) concluded that intrinsically motivated students employed more strategies, exhibited greater self-regulation, and comprehended more text. In qualitative interviews of 14 college students, Van Zile-Tamsen (1996) found that content interest motivated students to self-regulate and use strategies. Still, little research exists about the impact of CARS instruction on students' actual reading behaviors.

Problem Statement and Research Question

With the potential to impact over 1.2 million agricultural science students possessing a wide range of comprehension abilities, the goal of this research was to develop effective classroom strategies to improve reading comprehension skills. Agricultural science is an especially compelling context for reading because of the global nature of concepts, the complexity of those concepts, and the difficulty and diversity of textual sources of information. As the world's population continues to increase, providing safe, abundant, and ethical supplies of food, fiber, and renewable energy to *all* people, while also maintaining the sustainability of the planet, is the nexus for all of agriculture. Students enrolled in agricultural science are the future decision-makers and problem solvers of agriculture. Students must evaluate information and decisions emerging from that information from many perspectives.

The overarching research question for career and technical education addressed in this study was "How can career and technical education teachers use their instruction to improve students' comprehension of subject matter and motivation to read, in order to contribute to students' overall academic achievement?" Currently, little to no research exists in career and technical education research; whereby, a study compares the implementation of CARS in a planned, systematic, and thoughtful manner versus a teacher's own intuition about when and where to implement learning strategies in the lesson. The specific research question is, therefore, "What is the effect of instruction with CARS on students' content comprehension and motivation to read?"

Purpose and Hypotheses

The purpose of this study was to explore the effects of CARS instruction on student comprehension of agricultural science content and motivation to read in

career and technical education, specifically agricultural science. The hypotheses of this study were:

H_1: Agricultural content posttest scores will be higher for students instructed with CARS than those students instructed with the teachers' normal routine of instruction.

H_2: Students' motivation to read, as measured by their reading behaviors, will be greater for students for students instructed with CARS than those students instructed with the teachers' normal routine of instruction.

Methods and Procedures

Research Design

A variation of the nonequivalent-control-group-design (Campbell & Stanley, 1963; Gall, Gall, & Borg, 2003) was used in this study. Independent variables were implicit instruction using CARS versus the teachers' normal instructional routine. CARS included reading strategies within each of the three micro-periods of reading, such as using K-W-L, graphic organizers, discussion webs, and summarization strategies. The teachers' normal routine of instruction was determined to be the comparison because of ethical reasons surrounding the idea of withholding instruction that could benefit students. Ethically, the researchers determined that withholding instructional methods beneficial to students' learning would be unethical and could inhibit the learning of those students in the comparison group. Therefore, teachers in the comparison group taught their lessons without the aid of professional development about learning strategies and without lessons with embedded CARS or any other learning strategy. They taught the lessons based upon how they normally would approach teaching these lessons.

The independent variable in the experiment was the activity associated with reading, namely the implementation of CARS. The dependent variables were the outcomes of the reading activity, specifically the students' agriculture content posttest scores and reading behaviors. Antecedent variables were the reader characteristics that included gender, grade level, ethnicity, socioeconomic status, and grade point average. FCAT reading level and agriculture content pretest score were also treated as covariates.

Gall et al. (2003) asserted that nonequivalent-control-group-designs could involve groups that all receive a treatment. This study used a variation of the design:

Treatment	O_1	X_{CARS}	O_2
- -			
Comparison	O_1	X_{normal}	O_2

The first observation (O_1) was an agricultural science content area pretest conducted during the week prior to initiating the study. CARS instruction served as the

experimental treatment (X_{CARS}), while the teacher's normal routine served as the instruction for the "comparison" group (X_{normal}). The second observation (O_2) occurred at the end of the study 23 class days later, and consisted of the agriculture content posttest.

Population and Sample

The target population was all students enrolled in the introductory agricultural science course, who were primarily, but not exclusively 9th-grade students. Because of uniformity of the curriculum in this course, the introductory agricultural science course was selected as the context. The nature of this study was not to examine career and technical education concentrators, those students who identify themselves as career and technical education students, but rather the impact of implementing the CARS intervention within a career and technical education course. The study used a sample from four Florida high schools. Teachers were selected purposively for their ability to deliver the treatment, gather data, and teach the prescribed content. Teachers, and their classes, were assigned randomly to either the treatment or comparison group. To ensure adequate significance level, statistical power, and analytic procedure, 47 subjects were required in each the experimental and control groups (Hays, 1973; Olejnik, 1984).

Description of the Participants

Of the 95 students in the study, the majority (n=58) were male. Fifty-five students (57.9%) were 9th-graders, 27 (28.4%) were 10th-graders, seven (7.4%) were 11th-graders, and six (6.3%) were 12th-graders (see Table 1). The treatment group included 8 minority students (17%), while the comparison group included 18 minority students (37.5%). In Florida, minority students comprise 48% of the student population. Minority students were those who self-classified into any of the non-White Caucasian categories as used by the University of Florida admissions criteria and those included American Indian/Alaska native, Black/African American, Hispanic/Latino(a), Asian, Hawaiian/Pacific Islander, and Other. Socioeconomic status was determined using a proxy—free and reduced lunch counts. If a student qualified for the school's free or reduced lunch program, then it was assumed that the student was of a lower socioeconomic status (Hauser, 1994; Malecki & Demaray, 2006). This information was provided by the school's guidance department. In the treatment group, 15 students (31.9%) qualified for free or reduced lunches, while in the comparison group, 19 students (40.4%) did so. The state average for free or reduced lunch counts is 45.2% (Edweek, 2006).

The mean grade point average was 2.62 on a 4-point scale. Overall, a majority of students (n=58, 61.1%) had a cumulative *A* or a *B* average in all classes (see Table 1). The mean state standard reading score was 1773.5 and the mean corresponding

FCAT Achievement Level was 2. Sixty students (69%) read at the lowest two FCAT levels, indicating they were reading below grade level.

Table 1
Descriptive Statistics about Students' Gender, Minority Status, Free or Reduced Lunch Count, Grade Level, Cumulative Letter Grade, and Florida Comprehensive Assessment Test (FCAT) Reading Level

	Treatment		Comparison		Total	
	n	%	*n*	%	*n*	%
	Gender					
Female	14	29.8	23	47.9	37	38.9
Male	33	70.2	25	52.1	58	61.1
	Minority Status					
White	39	83.0	30	62.5	69	72.6
Other ethnicity	8	17.0	18	37.5	26	27.4
	Qualified for Free or Reduced Lunch					
Not qualified	32	68.1	28	59.6	60	63.8
Qualified	15	31.9	19	40.4	34	36.2
	Grade Level					
9	33	70.2	22	45.8	55	57.9
10	10	21.3	17	35.4	27	28.4
11	1	2.1	6	12.5	7	7.4
12	3	6.4	3	6.3	6	6.3
Total	47	100.0	48	100.0	95	100.0
	Cumulative Grade Point Average					
A (3.3 – 4.0)	5	10.6	6	12.5	11	11.6
B (2.3 – 3.29)	20	42.6	27	56.2	47	49.5
C (1.3 – 2.29)	13	27.7	12	25.0	25	26.2
D (.3 – 1.29)	8	17.0	3	6.3	11	11.6
F (< .3)	1	2.1	0	---	1	1.1
Total	47	100.0	48	100.0	95	100.0
	FCAT Reading Level					
5	0	---	2	4.3	2	2.3
4	5	12.5	4	8.5	9	10.3
3	7	17.5	9	19.1	16	18.4
2	8	20.0	12	25.5	20	23.0
1	20	50.0	20	42.6	40	46.0
Total	40	100.0	47	100.0	87	100.0

Florida Comprehensive Assessment Test

The Florida Comprehensive Assessment Test (FCAT) is part of Florida's initiative on educational accountability and raising overall educational achievement. Scores on the FCAT are reported for each student showing "achievement levels, scale scores, and developmental scale scores…as well as performance on specific content strands; each student 's norm-referenced scores indicate the student's ranking against national norms" (FDOE, 2004d, p. 8). Students must pass the reading and writing portions of the test before they graduate. The reading portion of the FCAT is presented at the reading level of the grade and determines students' achievement in reading comprehension (FDOE, 2001). The 8th-grade FCAT reading test consists of 40% narrative text and 60% informational, or expository text. The 8th-grade FCAT reading assessment contains multiple-choice, short-response, and extended-response items. The 9th-grade FCAT reading assessment contains multiple-choice items, only. Questions on the reading portion of the test are drawn from "social studies, science, math, reading, health/physical education, the arts, and the workplace" (FDOE, 2004d, p. 10). The FCAT reporting scale is set to a mean of 300 with a standard deviation of 50, which spreads student scores along a scale from 100 to 500.

For reading, students are assigned to one of five reading levels. The definition of the FCAT reading levels are

1. Reading level 5 was the level that "indicates that the student has success with the most challenging content of the Sunshine State Standards" (FDOE, 2004e, p. 4).
2. Reading level 4 was the level that "indicates that the student has success with the challenging content of the Sunshine State Standards" (FDOE, 2004e, p. 4). This is the first level of reading above grade level.
3. Reading level 3 was the level that "indicates that the student has partial success with the challenging content of the Sunshine State Standards, but performance is not consistent" (FDOE, 2004e, p. 4). This is generally considered reading at grade level.
4. Reading level 2 was the level that "indicates that the student has limited success with the challenging content of the Sunshine State Standards" (FDOE, 2004e, p. 4). This is generally considered reading below grade level.
5. Reading level 1 was "indicates that the student has little success with the challenging content of the Sunshine State Standards" (FDOE, 2004e, p. 4).

Intervention

Students were taught three animal science lessons from the state approved curriculum and included anatomy and physiology, nutrition, and reproduction. The lessons were taught over the course of 23 school days, or nearly 1600 minutes of instruction. The text used was *Agriscience: Fundamentals & Application* (Cooper & Burton, 2002). Text readability was ascertained using the Fry method (Fry, 1977), which yielded a grade level 13. Chapters and reading passages were selected to coincide with the individual lessons about anatomy and physiology, nutrition, and reproduction.

Treatment group teachers were instructed where and how to use CARS within their lessons, so that CARS were implemented in a systematic, planned, and thoughtful manner. Teachers in the treatment group participated in two hours of professional development at the state agriculture teachers' conference during the summer prior to the intervention. Further, their lessons were designed specifically with CARS embedded within the lesson. For each objective in the lesson, treatment group teachers were instructed to choose between two or more complementary strategies when instructing students to read. The lessons contained actual references to reading passages in the text, directions for specific CARS, and examples of the CARS in use for the objective. Further, the researchers followed up with each teacher prior to initiation of the treatment, as well as during the treatment, to provide support for implementation of CARS. CARS used by the treatment group included pre-reading strategies, including K-W-L^{+}, *Making Predictions A→Z,* anticipation guides; during reading strategies, including think-aloud protocols and graphic organizers; and post-reading strategies, including summaries, discussion webs, and the *Cube It!* strategy. Each lesson contained one or more strategies for use during each of the micro-periods of reading. Teachers in the treatment group used an average of 16.5 CARS and taught for 1,570 minutes.

With no prompting from the researchers or the curriculum, teachers in the comparison group implemented learning strategies based upon their knowledge of and preference for using them. Additionally, no support from the researchers was provided to these teachers for implementation of any learning strategies. The teachers used an average of 29.5 different learning strategies and taught for 1,110 minutes. Learning strategies used by teachers in the comparison group most often included notes, organizers, Kagen structures, cooperative activities, concept mapping, prediction guides, Internet searches, demonstrations, discussions, chunking reading assignments, think-pair-shares, and summaries of reading. Much of the impetus for professional development about using learning strategies was developed through local school in-service and professional development workshops. Specific CARS, such as the K-W-L+, anticipation guides, discussion webs, graphic organizers, *Cube It!* strategy, and specific summary strategies were not used by the comparison group teachers.

Instruments

Agriculture Content Knowledge. In order to control for preexisting agricultural content knowledge, an agricultural content knowledge pretest was adapted from existing assessments found in the Florida Agriscience Foundations Lesson Plan Library (FDOE, 2003). This test also served as the posttest at the conclusion of the treatment period. A panel of experts, consisting of teachers, faculty, and graduate students in agricultural education, evaluated the pretest and posttest to ensure face and content validity.

Comprehension of agricultural science concepts was measured using the pretests and posttests for each of the three lessons in the unit on introductory animal science. The tests, which are standard on agricultural science curriculum of this nature, consisted of five parts: (a) 10 matching items, (b) six to 15 one-word completion items, (c) one to three short answer essay questions, (d) 10 to 15 multiple-choice response items, and (e) a comprehension assessment. The comprehension assessment for two of the tests asked students to read a passage related to the lesson, and then create a concept map about their comprehension of the material. For the third test, the comprehension assessment asked the students to read a passage and then write a summary of the passage. Grading rubrics were provided to each teacher for scoring all items on the test. Post hoc reliability was assessed using the Kuder-Richardson 20 (coefficient alpha = .87).

Motivation to Read. Data regarding motivation to read were gathered using a researcher-derived instrument. The instrument was evaluated for face and content validity by a panel of experts including reading specialists and teacher educators. It asked respondents to answer two questions related to: (a) the number of books they had read in the previous month, and (b) the time spent reading for school and pleasure in the past week. These were all items for which respondents had "an accurate, ready-made answer" (Dillman, 2000, p. 37). The items did not require considerable thought, or variation, and posed no considerable reliability risk.

Findings

H_1: Agricultural content posttest scores will be higher for students instructed with CARS than those students instructed with the teachers' normal routine of instruction.

Overall, students correctly answered 37.6% of pretest questions and 60.4% of posttest questions. The difference between the groups in the proportions of students answering questions correctly was not significantly different. On the pretest and posttest, students in the treatment correctly answered 37.9% and 59.2%, and students in the comparison correctly answered 37.3% and 61.5%, respectively. These figures represented no significant difference with an alpha level of .05.

For dichotomous variables, a dummy coding was utilized. Students in the comparison group, who were female, a minority, and/or qualified for the school's

free or reduced lunch program were coded higher than students in the treatment group, who were male, white, and/or did not qualify for the free or reduced lunch program, therefore, indicating high socioeconomic status. Positive correlations would be indicated if the participant was in the comparison group, female, minority, and/or participated in a free or reduced lunch program. These data would, therefore, indicate lower socioeconomic status. Before inferential analysis of any of the variables, they were examined for possible correlations (Miller, 1998). The conventions proposed by Davis (1971) were used to indicate the magnitude of the correlations.

Substantial positive correlations were found between FCAT reading level and the pretest and posttest scores (see Tables 2 and 3). Substantial positive correlations also existed between the agriculture pretest and posttest. Moderate positive correlations were discovered between grade point average and the posttest, FCAT reading level, and pretest. A moderate positive correlation was observed between gender and both the posttest and grade point average. Moderate positive correlations were also observed between grade level and ethnicity. Low positive correlations were discovered between the treatment group and grade point average and ethnicity. Low positive correlations were also observed between ethnicity and socioeconomic status and between gender and FCAT reading. A low negative correlation was observed between ethnicity and the posttest.

Table 2
Correlations between Continuous Variables

	1	2	3	4	5
1. Grade level	---	.18	-.07	.03	.04
2. Grade point average		---	.42*	.38*	.40*
3. FCAT reading level			---	.61*	.66*
4. Pretest				---	.66*
5. Posttest					---

*$p < .05$.

In Hypothesis 1, the impact of CARS instruction versus the teachers' normal routine of instruction was compared. Thus, the first step was to describe the variance in posttest scores explained by the linear combination of treatment group, grade level, gender, ethnicity, socioeconomic status, grade point average, FCAT reading level, and pretest scores of students. Backward stepwise regression was used to select

the most appropriate model for explaining the posttest scores based upon the variables (Agresti & Finlay, 1997). Backward regression was used because of its power to construct a model using only those factors that contribute significance to explaining the dependent variable (Gall et al, 2003). Variables initially included in the model were treatment, gender, grade level, ethnicity, socioeconomic status, grade point average, FCAT reading level, and pretest score. Variables required an alpha level of .05 or lower significance to enter the regression equation, while variables with an alpha level of .10 or higher were removed.

Table 3
Point Biserial Correlations between Categorical Variables

	Treatment Group	Gender	Ethnicity	SES
Grade level	.20	-.02	.29*	-.14
Grade point average	.23*	.33*	-.08	-.14
FCAT reading level	.06	.23*	-.02	-.04
Pretest	-.02	.09	-.09	-.20
Posttest	.06	.33*	-.26*	-.14

*$p < .05$.

The regression analysis produced a model consisting of the linear combination of FCAT reading level, grade point average, pretest, grade level, ethnicity, and gender (see Table 4) to explain the posttest score, $F_{(85)} = 27.26$, $p < .05$. R^2 for the model was .67, and the adjusted R^2 was .65. The linear combination of these variables explained 65% of the variance in the posttest score. Forward stepwise regression was used to determine R^2 change, or additional variance explained by each factor. FCAT reading level explained the most variance (44%). Grade point average explained 12.1% of the variance, the pretest explained 4.9%, grade level explained 2.4%, ethnicity explained 2.1%, and gender explained 1.9%. Because the treatment variable was not included in the overall regression model, Hypothesis 1 was rejected. Also, since no significant difference existed between the treatment and the comparison group scores, no effect size was calculated.

Table 4
Backward Regression Analysis to Predict Posttest Score[a]

	B	*SE*	β	*t*	R^2 change
(Constant)	-.09	.13	---	-.66	---
FCAT reading level*	.06	.01	.36	4.12	.440
Grade point average*	.05	.02	.24	2.99	.121
Pretest*	.36	.11	.29	3.41	.049
Grade level*	.04	.01	.17	2.41	.024
Ethnicity*	-.08	.03	-.19	-2.84	.021
Gender*	.06	.03	.15	2.16	.019

Note. [a]Adjusted $R^2 = .65$ ($p < .05$).
*$p < .05$.

H_2: Students' motivations to read, as measured by their reading behaviors, will be greater for students instructed with CARS than those students instructed with the teachers' normal routine of instruction.

On the pretest, 29 students (31.5%) indicated that they were currently reading a book, while 27 students (30.7%) indicated they were reading a book at the end of the study. In the treatment group, 12 students (26.7%) indicated they were reading a book during the pretest period, while the number of students increased to 16 (36.4%) who were reading a book during the posttest phase. In the comparison group, 17 students (36.2%) indicated that they were reading a book at the beginning of the study, but declined to 11 students (25%) at the end of the study.

The pretest and posttest asked participants to report the number of books that they had read during the previous month, time per week of school reading, and time per week of pleasure reading (see Table 5). Overall, students did not read significantly more books at the end of the study (1.74 books during the previous month at the beginning versus 1.78 at the end). At the beginning of the study, they read 3.44 hours per week for school compared to 3.70 at the end, and 1.94 hours for pleasure compared to 2.01 hours at the end. However, there were changes within the groups. The treatment group increased the number of books read in the previous month from 1.40 prior to the study to 1.80 at the end. They also increased the time spent reading for school from 3.42 to 3.74 hours per week. They significantly increased the time spent in pleasure reading from 1.33 to 2.57 hours per week.

Students in the comparison group decreased the number of books read in the previous month from 2.07 prior to the study to 1.76 at the end. They also decreased the time spent reading for school from 3.45 to 1.71 hours per week, and decreased the time per week spent reading for pleasure from 2.52 to 1.47 hours per week. At the end of the study, the difference between the groups on school reading was significant ($\alpha \leq .05$). Cohen's *d* (1992) was .47 and the effect size was .23.

Table 5
Reading Habits of Students

	Treatment			Comparison			Total		
Habit	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
				Pretest					
Books per month	46	1.40	1.71	47	2.07	4.17	93	1.74	3.20
School reading (hrs./wk.)	43	3.42	4.17	47	3.45	5.49	90	3.44	4.88
Pleasure reading (hrs./wk.)	44	1.33	2.47	47	2.52	5.61	91	1.94	4.40
				Posttest					
Books per month	44	1.80	2.13	45	1.76	3.02	89	1.78	2.60
School reading (hrs./wk.)	43	3.74*	5.58	45	1.71*	2.42	88	2.70	4.37
Pleasure reading (hrs./wk.)	44	2.57	5.05	47	1.47	3.23	91	2.01	4.23

*$p < .05$.

Comparing the change in reading habits of students, students in the treatment group increased the time per week that they read for pleasure significantly more than the comparison group ($p \leq .05$). The treatment group increased the hours per week reading for pleasure by 1.35 hours, while the comparison group *decreased* the time per week reading for pleasure by 1.14 hours (see Table 6). With 95% confidence, students in the treatment group read for pleasure between .39 and 4.57 hours more per week than students in the comparison group. Cohen's *d* was .51 and the effect size was .25.

Table 6
Change in Reading Habits of Students

	Treatment			Comparison					
Habits	*n*	*M*	*SD*	*n*	*M*	*SD*	*t*	*p*	Confidence Interval
Books/month	43	.56	1.69	44	-.22	3.25	1.39	.17	(-.33, 1.88)
School reading (hrs/wk)	40	.60	6.87	44	-1.92	5.83	1.81	.07	(-.25, 5.27)
Pleasure reading (hrs/wk)	41	1.35*	5.03	44	-1.14*	4.67	2.36	.02	(.39, 4.57)*

*$p < .05$.

Discussion, Conclusions, Implications, and Recommendations

Participants and Their Reading Abilities

The majority of the students in this study were 9th-grade students (57.9%), male (61.1%), white (72.6%), and did not qualify for lunch subsidies (63.8%). The overall grade point average for the 95 students was 2.62/4.00, or "B-." Sixty-nine percent of the students in the agricultural science courses read below grade level, which is similar to the 73% of students who read below grade level in the general school population of the schools tested (FDOE, 2004a, 2004b). Only 31% of the students in the study read at or above grade level, indicating that many students had "limited" or "little" success reading (FDOE, 2004b). Further, while students read below grade level, their individual cumulative grade point averages suggest that poor reading ability may not hinder earning high grades. This finding may suggest several confounding variables regarding teachers' use of reading in secondary classes. First, teachers may be enabling students to learn without requiring them to read. Teachers may not require reading in their assessments of student learning. Students may have learned how to cope with learning, or at least earning passing marks, without actually reading in career and technical education courses.

When instructed to read a career and technical education text, many students (69% in this study) lacked complete understanding of the text. Reading problems are further compounded by the diversity and complexity of reading material encountered by students in career and technical education courses (Alexander & Kulikowich, Bintz, 1997; Cresson, 1999; Digisi, 1993; Kim et al, 2004; Menke & Davey, 1994; Vacca, 2002a). The difficulty of career and technical education texts was demonstrated by the text selected for use in this study which had a readability level suitable for college freshmen (Fry, 1977). Difficult career and technical education texts pose inherent challenges to learning and could explain some of the frustrations

that students and teachers feel when attempting to read, comprehend, and learn from the text. By implementing CARS, agricultural science teachers and career and technical education teachers may be able to help students activate relevant background knowledge, set purposes for reading, organize information, and summarize content in order to solve problems in the field.

Teacher Implementation of CARS and Learning Strategies

Teachers in the treatment group used 16.5 CARS and taught the three animal science lessons for a total of 1,570 minutes. Teachers in the comparison group used 29.5 different learning strategies and taught the three lessons for 1,110 minutes. While not a specific objective of this study, it is interesting to note that the teachers in the comparison group implemented nearly twice as many learning strategies as teachers in the treatment group. Yet, while implementing nearly twice as many learning strategies, comparison group teachers taught for nearly 30% less instructional time than treatment group teachers. In essence, teachers in the treatment group used one CARS per 95 minutes of class time, while teachers in the comparison group used a learning strategy of some type every 38 minutes of class time.

What was the impact of more learning strategies on students' comprehension and motivation to read? This research did not specifically address the learning strategies used by teachers in the comparison group. Future research in career and technical education should be conducted to determine the appropriateness of multiple learning strategies in instruction. Areas of career and technical education are applied sciences, where teachers use reading and literacy to learn, apply, and solve problems. Perhaps, a *few* literacy tools would be more effective or at least as effective for student learning and achievement as a large cadre of strategies.

While the initial target population of the intervention in this study was students in career and technical education courses, the observation regarding how many CARS and learning strategies teachers in both groups implemented was an interesting finding. It provides the relevancy of conducting this study within the career and technical education context. Career and technical education teachers have traditionally perceived their disciplines as "hands-on;" therefore, reading was unnecessary or at least secondary to learning in career and technical education (O'Brien & Stewart, 1990). With the increasing availability of information from multiple genres of text in career and technical education, today's students must be adept at constructing meaning from those texts. A single textbook is not sufficient in today's career and technical education course. Therefore, teachers must assist students in learning how to read and comprehend from multiple sources of information.

As standardized testing will likely continue in the secondary schools, career and technical education teachers will increasingly be called upon to demonstrate how their instruction and courses contribute to students' overall academic achievement.

As teacher educators prepare the next generation of teachers, they must know how academic literacy strategies impact learning in career and technical education. Also, when teacher educators have the opportunity to provide professional development for current teachers, they must be able to equip those teachers with the most effective strategies.

Effect of CARS Instruction on Students' Agricultural Science Comprehension

Consistent with previous research, white, female (Donahue, Voelkl, Campbell, & Mazzeo, 1999; NCES, 2000, 2001; Pomplun & Sundbye, 1999; Wirt et al., 2004), upper grade level (McKenna & Robinson, 2002; Stanovich & Cunningham, 1993; Stewart & Tei, 1983) students who had higher cumulative grade point averages, FCAT reading levels, and agriculture content pretest scores (Alexander & Kulikowich, 1991) scored higher on the posttest. In this study, the treatment did not have a significant effect on comprehension when compared to the comparison group.

Possible explanations for why the treatment did not provide a significant difference from the control group include the high number of other learning strategies that comparison group teachers implemented and the short duration of the study, the short duration of teacher professional development, and the lack of assistance in schools from reading experts and coaches. In future studies of reading strategy use in career and technical education, the use of content area reading strategies should be compared to an actual control where students receive no assistance with their reading assignments. While this practice may be ethically challenging, the true magnitude of impact will not be known without comparing the intervention to a true control group. Further, because reading is a cognitive skill, students require a longer amount of time in which to refine that skill. Teachers may require more intensive professional development about the use of content area reading strategies, as well as additional assistance during the initial stages of using those strategies within their teaching. Additional time would also allow teachers to become more familiar with reading strategies and, therefore, improve their use in instruction.

While treatment was not a significant factor in explaining variance, this finding may have implications for teachers, especially when coupled with the rate of CARS use. The comparison group teachers implemented twice as many learning strategies as the rate at which treatment group teachers implemented CARS, yet their students performed at a similar level of comprehension. With career and technical education teachers' finite time for planning and delivering instruction, teachers may be wise to carefully consider how they implement CARS. It may be of less importance how many CARS are implemented, but rather where in the lesson and how they are implemented that makes the significant difference in student achievement. This is certainly an area for further research.

Implementing CARS in a systematic, planned, and thoughtful manner may save teachers time and effort and have positive impacts on students' reading behaviors. Based on the findings of this study, it could be concluded that career and technical education teachers can implement twice as many learning strategies in a less strategic manner and obtain the same results as those career and technical education teachers who fine-tune their instruction and use reading strategies in an explicit manner. Career and technical education teachers do not need more to do; therefore, implementing fewer strategic reading strategies could save time and be equally or more effective as implementing several strategies in the classroom.

Effect of CARS Instruction on Students' Motivation to Read

Significant differences were noted in the self-reported reading behaviors of students between the treatment and comparison groups. Research (Choochom, 1995; Guthrie, 2001; Guthrie & Alao, 1997; Hurst, 2004; Knoll, 2000; Morgan & Hosay, 1991) has indicated that using strategies helps students develop confidence and efficacy in reading, motivation to engage in reading, and reading of a wider variety of texts. Students in the treatment group *increased* their time per week of pleasure reading, while the students in the comparison group *decreased*, contributing to a significant difference in time for pleasure reading at the end of the study. The effect sizes approached the medium range (Cohen, 1992). The changes in both areas, overall time of reading for school and the change time of reading for pleasure, were nearly 15 minutes per week. An increase of 15 minutes per week in reading for both school and pleasure could amount to nearly 18 additional hours of reading per year, which is quite substantial.

Students in the treatment group, where CARS were implemented in a systematic, planned, and thoughtful manner, allocated more time for school reading and increased the time that they allocated for pleasure reading. Comparison group teachers may have inadvertently diminished students' motivation to read by using too many learning strategies and/or poorly implementing them. Inappropriate implementation could include not making the strategies explicit for learning, poor timing of strategy implementation, and/or a lack of intensity of strategy use. Further study could help ascertain why students in the comparison group diminished their reading behaviors.

Career and technical education teachers, especially those in agricultural science, should consider the impact that their instructional routines have on students' motivation to read. Introducing a large number of strategies to students may have a negative impact on their reading behaviors. An explanation for this finding could be more systematic, planned, and thoughtful focus on reading among treatment group teachers. Depending upon the micro-period (International Reading Association, 1988; Ryder & Graves, 1994; Snider, 1989; Snow, 2002), teachers in the treatment group may have implemented CARS more correctly than teachers in the comparison

group implemented their learning strategies. Consequently, students were engaging with text for longer periods of time and in a manner that aided comprehension while improving their reading efficacy. For example, during the prereading micro-period, treatment group teachers chose between the K-W-L strategy and anticipation guides to activate background knowledge and develop student interest in reading. The teachers' appropriate use of these strategies may have contributed to students' increased reading behaviors for the treatment group.

Recommendations for Further Research

This study catalyzes questions for further research within the realm of career and technical education, where reading and comprehension are vitally important to student learning. For example, what is the effect of systematic, planned, and thoughtful implementation of CARS in career and technical education on comprehension and motivation to read when compared to a defined control group? Further, what is the effect of CARS instruction on comprehension and motivation to read when students are exposed to the treatment over a longer duration, perhaps a year or more? Perhaps, more investigation is needed at the secondary level with respect to reading and literacy in career and technical education. Additionally, how effectively do agricultural science teachers implement CARS before and after professional development?

From this study, several recommendations come to light. First, teacher educators in career and technical education must work to educate current teachers and equip them with the CARS necessary to assist students in reading. Secondary administrators will increasingly demand that teachers demonstrate how their instruction and curriculum complements all students' academic achievement. Accordingly, career and technical education teachers will be required to demonstrate how they improve students' literacy and reading comprehension. One of the means of accomplishing this is through explicit instruction of career and technical education content with proven content area reading strategies.

In career and technical education, implementation of literacy and reading strategies mandates that current approaches to instruction be changed. The traditional "hands-on" mentality that is prevalent with secondary career and technical education teachers will not sufficiently educate today's students and adequately prepare them for success in tomorrow's world. Career and technical education teachers have an applied context in which to help students become lifelong learners. As lifelong learners, students must be literate in and about the areas of career and technical education. They must know how to use textual information to solve problems and make decisions about themselves, their careers, and their communities. Today's career and technical education demands that students and teachers proceed beyond the "hands-on" mentality, or at least access and use textual information.

To create a culture of literacy in career and technical education, reading strategy instruction should be implemented in teaching methods courses as proper approaches to instruction *in addition to* stand-alone courses. Additionally, teacher educators should deliver in-service and professional development workshops that introduce current career and technical education teachers to effective reading strategies that are relatively easy to implement. Further, teacher educators should explore how they model reading behaviors and use reading strategies with their pre-service teachers. Because many college courses rely heavily on reading as a means of learning, college faculty could model appropriate uses of reading methods of using text for learning to build future teachers' knowledge and use of strategies.

Changes may also be necessary with the current curricula used in agricultural sciences and other areas of career and technical education. New career and technical education curricula should be designed with embedded instruction about reading and literacy strategies. When implemented in a systematic, planned, and thoughtful manner according to the specific micro-periods of reading, reading strategies may save teachers time and improve reading behaviors. Therefore, curricula should be developed that incorporate CARS directly into lesson plans and student activities. Further, career and technical education teachers should participate in professional development that models CARS and shows where and how to appropriately implement them into lessons.

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