

Evaluating Research in Career and Technical Education Using Scientifically-Based Research Standards

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Abstract

*The recent emphasis on scientifically-based research (SBR) as the government's favored research paradigm has direct implications for career and technical education (CTE). From a practical standpoint, federal funds will now be appropriated exclusively on scholars' readiness and ability to engage the "right" research questions. While the government can determine the agenda for federally-funded research, the narrow definition reflected by SBR guidelines does not, and should not, define CTE research. Even so, the CTE community's overall reaction to SBR has been limited rather than proactive, suggesting that a full examination of SBR's far-reaching implications for CTE research has yet to occur. This article examines the main tenets of SBR and outlines the major positions in the debate about SBR in educational research. This debate is applied to CTE research by examining published articles in recent issues of *Career and Technical Education Research* (CTER; 2001-2005). An overwhelming majority of the published articles examined were either descriptive or qualitative in nature. Only 6% employed quasi-experimental designs. No articles using true experimental designs were published during this period. The findings were further examined from political, conceptual, and practical positions. While the emphasis of most CTER research differs from the SBR focus mandated for government-funded research, this discrepancy does not necessarily indicate a lack of quality in CTE research. It does, however, suggest that internal dialogue and investigation are needed regarding the role of SBR in CTE research. This article may be one avenue for promoting such a dialogue.*

Introduction

Since the adoption of the [No Child Left Behind \(NCLB\) Act](#) in 2001, the notion of scientifically-based research (SBR) has had a substantial impact on the design, process, and evaluation of educational research. Six years after NCLB's inception, many scholars continue to grapple with SBR's fundamental propositions. Discourse regarding what constitutes the epitome of scientific inquiry in education remains highly controversial. The marginalization of so-called non-scientific endeavors in favor of empirical evidence and objective assessment has been criticized by a variety of researchers ([Berliner, 2002](#); [Erickson & Gutierrez, 2002](#); [Pellegrino & Goldman, 2002](#); [St. Pierre, 2002, 2006](#)). These scholars have pointed to

several concerns inherent in the federal government's approach towards educational research, such as (a) confusing scientific methods with the process of science, (b) the adoption of an evidence-based social engineering approach to educational program effectiveness, (c) the disregard for the complexity of issues concerning the scientific method and research quality, and (d) the utter rejection of postmodern theories.

Notwithstanding calls for a more inclusive attitude towards educational scholarship, many practitioners and agency officials have defined the usefulness of research solely in terms of objective achievement metrics (Kaestle, 1993). Increasing pressure towards program accountability has encouraged policymakers to impose a medical model of true experimentation to guide both federal funding allocations and administrative decisions on educational research. While federal guidelines defining the nature of acceptable research standards carefully avoid any formal deprecation of qualitative inquiry, the overwhelming majority of federally funded studies have posed research questions that require the exclusive application of true or quasi-experimental methods.

The preponderance of SBR as the government's exclusive research paradigm has direct implications for career and technical education (CTE). From a practical standpoint, appropriation of federal funds will largely depend on the field's readiness and ability to engage in the "right" research questions and employ the "right" research designs and methods. However, the CTE community's overall reaction has been limited rather than proactive. The fact that the literature features few detailed considerations about how CTE scholars have responded to the more stringent research standards corroborates the notion that a true examination of SBR's far-reaching implications has yet to occur.

As stewards of federal policy, the Department of Education is exerting considerable pressure on all sectors of education, including CTE, to propose research designs that follow the provisions of SBR. A primary driver for the federal position is based on a perceived need to answer questions related to student achievement and program improvement to raise the efficacy of current and future interventions. Tying the credibility of research results to specific questions and methods has allowed policymakers to establish rigorous quantitative designs as the *gold standard* for worthwhile academic inquiry. Against this background, the initial intent was to review and determine the extent to which publications in a major CTE journal, *Career and Technical Education Research (CTER)*, adhered to SBR guidelines since the adoption of NCLB in 2001 and the Education Sciences Reform Act (ESRA) in 2002. More specifically, it was sought to overlay the ESRA's scientifically-based research standards on journal articles that were published in *CTER* between 2001 and 2005. The ESRA was chosen as the primary frame of reference for this examination because its scientific research definition has been adopted as the standard in the most recent reauthorization of the Carl D. Perkins Career and Technical Education Improvement Act (2006).

Preliminary analysis for this study produced sobering results insofar as all articles in the sample failed to reference, let alone follow, SBR principles. Moreover, there seemed to be a significant gap between the rather broad questions addressed by the field and the government's strongly evaluation-driven research agenda. Given SBR's increasing importance as a *sine qua non* for securing federal program and research funding, this disregard of more rigorous research standards may eventually be harmful to CTE. Given an initial assessment of research in CTE relevant to SBR principles and the primary institutional definitions of SBR, the major themes and research questions that have emanated from recent research in CTE were reviewed. Ultimately, this article may enhance the level of engaged discourse regarding the current status and future direction of CTE research.

Scientifically-Based Research (SBR) Defined

Scientifically-based research is first and foremost a definition of parameters that identifies educational interventions or research endeavors worthy of federal funding. The term is a de facto procedural mandate that, arguably, will result in good academic research. However, what exactly constitutes good academic research in education? How is good academic research defined through SBR principles? A plethora of interpretations has emanated from within the scientific community that extends on a continuum from strictly conservative to more liberal definitions. Of these constructs, four primary mandates capture the essence of SBR as it is currently envisioned by federal and state agencies. In this section, the four definitions put forth by the [National Research Council \(2002\)](#), the [No Child Left Behind Act \(2001\)](#), the [Education Sciences Reform Act \(2002\)](#), and the [What Works Clearinghouse \(2006\)](#) are summarized and contrasted.

National Research Council (NRC). As the primary operating agency of both the National Academy of Sciences and the National Academy of Engineering, the NRC is a private, nonprofit organization that is instrumental in advising the federal government in the areas of science, technology, and health policy. Due to its strategic position at the crossroads between legislators, administrators, and the scientific community, the NRC is the key influencing body in the formulation of federal research policy. Acting upon the advice of NRC, Congress established the National Educational Research Policy and Priorities Board (NERPPB) under the Improving America's Schools Act of 1994 to facilitate the creation of a long term agenda for educational research, development, and dissemination ([United States Department of Education, 1999](#)). According to [Eisenhart and Towne \(2003\)](#), the NERPPB charged the NRC with an investigation of core elements that would constitute a sound approach to SBR in the eyes of education researchers. The objective was to construct a general definition of scientific research principles in education, not to assemble a checklist of acceptable methodologies and statistical procedures. Consequently, the NRC's work resulted in the formulation of components deemed necessary to engage in what it refers to as a successful program of research ([NRC, 2002](#)). All pieces of a

given research project considered jointly are, therefore, required to (a) pose significant questions that can be investigated empirically, (b) link research to relevant theory, (c) use methods that permit a direct investigation of the question, (d) provide a coherent and explicit chain of reasoning, (e) replicate and generalize across studies, and (f) disclose research data and methods to encourage professional scrutiny and critique.

The NRC's elements of a successful program of research represent a set of research principles that endorse both quantitative and qualitative research designs, including experimental research, case studies, grounded theory, and surveys. This broad, inclusive approach stands in stark opposition to the restrictive definition set forth in NCLB which was passed only months after the initial release of the NRC standards.

No Child Left Behind Act (NCLB). The goals of the NRC in defining SBR were inherently different from those of federal lawmakers involved in [NCLB \(2001\)](#). Whereas the NRC set out to infuse a scholarly perspective of sound research principles into education policy, NCLB mandated specific research criteria as a prerequisite for the distribution of federal program resources. The ensuing definition is one that embodies an essentially prescriptive approach to SBR that is highly exclusionary in its unequivocal championing of experimental and some quasi-experimental methods. According to NCLB, SBR is research that (a) applies rigorous, systematic, and objective procedures to obtain valid knowledge relevant to educational interventions, (b) employs systematic, empirical methods that draw on observation or experiment, (c) involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn, (d) relies on measurements or observational methods that provide valid data across evaluators and observers and across multiple measurements and observations, and (e) has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review.

The NCLB criteria offer a singular focus on hypothesis testing and statistical measures of significance. This government-endorsed gold standard has far-reaching implications for education service providers; it clearly marks the sole path to securing federal program funds. It should be emphasized; however, that NCLB's narrow definition of SBR is mainly targeted at program administrators for the justification of program expenditures and intervention costs, not at scholars who require funding for forthcoming research projects.

Education Sciences Reform Act (ES RA). In 2002, the ESRA led to the replacement of a long-standing federal agency, the Office of Educational Research and Improvement (OERI), with the Institute of Education Sciences ([IES, 2006](#)). The objective of the IES is to "provide rigorous evidence on which to ground education practice and policy" ([United States Department of Education, 2006, ¶ 1](#)). In order to achieve this goal, the ESRA introduced a set of scientifically-based research standards to which any IES-funded research would have to adhere. According to the

ESRA (2002), scientifically-based research standards mandate that research studies (a) apply rigorous, systematic, and objective methodology to obtain reliable and valid knowledge relevant to education activities and programs; (b) present findings and make claims that are appropriate to and supported by the methods that have been used; (c) employ systematic, empirical methods that draw on observation or experiment; (d) involve data analyses that are adequate to support the general findings; (e) make claims of causal relationships only in random assignment experiments or other designs (to the extent such designs substantially eliminate plausible competing explanations for the obtained results); (f) ensure that studies and methods are presented in sufficient detail and clarity to allow for replication or, at a minimum, to offer the opportunity to build systematically on the findings of the research; (g) obtain acceptance by a peer-reviewed journal or approval by a panel of independent experts through a comparably rigorous, objective, and scientific review; and (h) use research designs and methods appropriate to the research question posed.

The ESRA refrains from demanding that fundable projects be grounded exclusively in randomized control group designs. Instead, the ESRA standards allow for the research question to drive the method and, therefore, condone the use of exploratory, descriptive, or hypothesis-generating studies. Unlike NCLB, the ESRA targets education researchers and provides a framework for scientific inquiry. As such, the ESRA imparts upon the academic community a working definition of what it considers to be good academic research.

What Works Clearin ghouse (WWC). Following the passage of the ESRA (2002), the IES established the WWC as a direct means to “provide educators, policymakers, researchers, and the public with a central and trusted source of scientific evidence of what works in education” (What Works Clearinghouse, 2006, ¶ 1). The WWC’s objective is to ensure sound methodology and validity of education research and, to this end, provide standards to help identify studies that provide the strongest evidence of statistically significant effects. The WWC applies the following classification scheme:

1. Meets evidence standards:
 - a. Randomized controlled trials that do not have problems with randomization, attrition, or disruption
 - b. Regression discontinuity designs that do not have problems with attrition or disruption
2. Meets evidence standards with reservations:
 - a. Strong quasi-experimental studies that have comparison groups and meet other WWC evidence standards
 - b. Randomized trials with randomization, attrition, or disruption problems
 - c. Regression discontinuity designs with attrition or disruption problems

3. Does not meet evidence screens:
 - a. Studies that provide insufficient evidence of causal validity or are not relevant to the topic being reviewed

The WWC applies these rigorous standards to assess the effectiveness of education interventions with regard to quantity, quality, and relevance of evidence. Its focus is purely quantitative, with both a strong consideration of effect size and a heavy emphasis on random assignment. No qualitative study would meet WWC's evidence screens. Yet, this unidirectional focus represents an especially questionable antagonism insofar as the WWC emerged out of the ESRA, which purportedly supports quantitative and qualitative methods alike.

Purpose

The précis of SBR definitions casts a controversial light on the current state of affairs. While many practitioners and agency officials pay lip service to academe's demands for methodological diversity, the realities of federal funding guidelines strike a much less tolerant note. The inconsistencies between the de jure directives and the de facto consideration of what is good academic research are particularly striking in the case of the ESRA and the WWC. The ESRA offers generously composed *Scientifically-Based Research Standards*, while the WWC demands an exclusive focus on statistical chasteness. This dichotomy has direct implications for research in CTE. The reauthorized [Carl D. Perkins Career and Technical Education Improvement Act of 2006](#) stipulates that funding for the National Research Center for Career and Technical Education is to "carry out scientifically-based research and evaluation for the purpose of developing, improving, and identifying the most successful methods for addressing the education, employment, and training needs [...] in career and technical education programs" (p. 23). Perkins' explicit adoption of the ESRA definition of SBR provides a clear directive for CTE researchers. Yet, to what extent does research published in one of the field's leading scholarly journals conform to the ESRA's scientifically-based research standards? To date, no comprehensive cross-validation of the literature base has been conducted in which the methods applied in contemporary CTE research have been juxtaposed with federally mandated SBR guidelines.

Methodology and Findings

The examination of SBR's impact on research endeavors in CTE was based on a research synthesis strategy (Cooper & Hedges, 1994). This approach allowed for the review, extraction, and classification of the major research themes in the sample. The sample consisted of five recent complete volumes of the *CTER* journal, Vols. 26-30. The *CTER* journal was chosen for analysis because it is recognized as one of the field's premier refereed scholarly publications and provides a broad,

comprehensive consideration of important issues in CTE. The original research, literature reviews, and conceptual or opinion-based expository pieces published in *CTER* are, to some degree, reflective of the most current trends in the field. The time frame for the investigation, 2001 through 2005, was based on the adoption of NCLB in 2001. The NCLB provided the first federally-sanctioned definition of desirable and acceptable research standards and, therefore, confronted the academic community with a drastic change in the approach towards scholarly practices. The sample included 15 issues consisting of 64 articles that represented unsolicited research and was conducted by individual scholars who worked independently of a broader, coordinated research agenda (see Appendix).

In the investigation, the articles were classified into three different categories. Quantitative studies accounted for slightly over one-half of all published articles. Approximately 20% of the articles were qualitative in nature, with the remainder consisting of expository pieces including literature reviews and Association of Career and Technical Education Research (ACTER) Presidential Addresses. In total, 25% of all articles in the sample represented non-original research (see Table 1).

Table 1
Research by Type, Published in Career and Technical Education Research, 2001-2005

Type of research	2001		2002		2003		2004		2005		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Expository ^a	3	21	7	44	2	15	2	17	2	22	16	25
Original research												
Qualitative	4	29	2	12	6	46	—	—	2	22	14	22
Quantitative ^b	7	50	7	44	5	39	10	83	5	56	34	53

Note. ^a Includes conceptual articles, opinion articles, literature reviews, and ACTER Presidential Addresses. ^b Includes Delphi studies.

Of the 48 articles identified as original research, 14 employed qualitative research designs; whereas, 9 used a causal-comparative approach. A majority of publications in the sample was descriptive or correlational in nature. This is in opposition to the number of experimental ($n = 0$) and quasi-experimental studies ($n = 3$) which constituted a mere 6% of the sample. The scarcity of experimental research studies is of particular interest given SBR's unequivocal preference for such designs. Table 2 provides a detailed account of the different research designs employed in the sample.

Table 2
Research Designs Employed for Studies Published in Career and Technical Education Research, 2001-2005

Design	2001		2002		2003		2004		2005		Totals	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Qualitative	4	36	2	22	6	55	—	—	2	29	14	29
Descriptive/ Correlational	2	18	5	56	3	27	8	80	4	57	22	46
Causal-comparative	5	46	2	22	1	9	—	—	1	14	9	19
Quasi-experimental	—	—	—	—	1	9	2	20	—	—	3	6
Experimental	—	—	—	—	—	—	—	—	—	—	—	—

In order to classify articles by their respective focus of investigation and target audience, four distinct categories consisting of secondary CTE students, postsecondary CTE students, CTE teachers, as well as CTE professionals including policymakers, administrators, and researchers were identified. During the sorting process, a miscellaneous category was added to account for articles that fell outside of the four principal classification categories. Approximately 40% of the articles in the sample focused on issues related to secondary and postsecondary CTE students. A majority of these studies was directed at student achievement and persistence, as well as aspects of curriculum design. While most research explored characteristics of domestic students, several studies offered an international perspective, involving participants from Canada, Germany, Taiwan, and Thailand. Research involving or directed at CTE teachers represented approximately one-fourth of all sample articles and included a variety of topics such as technical teacher preparation, performance, attrition, motivation, and stress. Publications directed at CTE professionals revolved around issues of policy, CTE research frameworks, school-to-work transitions, statistical methods in CTE research, and future directions of the field in general. The remainder of the studies was classified as miscellaneous and featured a broad spectrum of topics from women entrepreneurs in Zimbabwe to the environmental sustainability of school-based enterprises. Table 3 provides an overview of the sample in terms of research focus. Table 4 illustrates the distribution of research topics.

The statistical methods employed for data analysis in the sample's quantitative research articles were mostly inferential in nature (80%) and relied on descriptive statistics. A total of 5% of the quantitative studies in the sample consisted of Delphi studies. Although several studies employed rather sophisticated inferential methods, many authors limited their analysis to procedures such as ANOVA, *t*-tests, and multiple regression or correlation. The relative frequency of simple statistical inference procedures was partially indicative of the level of inquiry of many studies.

In other words, simple inferential methods were employed to answer simple research questions.

Table 3
Research Focus for Studies Published in Career and Technical Education Research, 2001-2005

Research focus	<i>n</i>	%
Secondary CTE students	14	29
Postsecondary CTE students	6	13
CTE teachers ^a	11	23
CTE professionals ^b	9	19
Miscellaneous	8	17

Note. Totals reflect an unduplicated count of primary or exclusive focus of research article.

^aIncludes both secondary ($n = 9$) and postsecondary ($n = 2$) educators.

^bIncludes both CTE teacher educators ($n = 7$) and other CTE professionals ($n = 2$).

Table 4
Research Topics for Studies Published in Career and Technical Education Research, 2001-2005

Research topics	<i>n</i>	%
Conceptual frameworks, research, and trends in CTE	8	13
Student/teacher retention	4	6
Student interests	8	13
Curriculum development, integration, or assessment	16	25
Student/teacher performance	7	11
Teacher certification/preparation	10	16
Distance learning	4	6
Miscellaneous	7	11

Discussion

A majority of published articles in the sample was either descriptive or qualitative in nature; whereas, only 6% employed quasi-experimental designs. Clearly, the emphasis of most CTE research differs from the SBR focus mandated for government-funded research. However, this discrepancy does not necessarily indicate a lack of quality in CTE research. First of all, the mission of any scholarly journal, including *CTER*, is broader than the exclusive focus on disseminating quantitative research reports. The *CTER* journal also values and disseminates the results of qualitative, historical, and philosophical research; reviews of literature;

book reviews; and rejoinders to published work. In addition, there are numerous peer-reviewed publication outlets for CTE research. So, while the sample of published articles is delimited by these factors, it does provide a glimpse of what is important to CTE researchers.

It is important to also place the SBR mandate into perspective. As a funding agent, the federal government has the prerogative of establishing the expected outcomes for its funded programs and the types of research studies it deems important. As noted by the proponents of SBR, clearly, there is an important role of intervention studies in educational research. Given the historic pressures for demonstrating the effectiveness of CTE in public education, a greater appreciation and more widespread application of the SBR paradigm would address this concern. An increased focus on SBR standards with CTE research may enhance the credibility of CTE research in the eyes of policymakers and scholars from related educational disciplines. More importantly than reacting to external stimuli, however, an internal dialogue about the role of SBR in CTE research may provoke an internal assessment and, if necessary, a stronger push towards the enhancement of research standards from within the field.

Time and resource constraints may be two of the principal factors for the relatively marginal position of experimental studies in CTE research. The nature of universities' tenure track requirements obliges new faculty members to produce a proven track record of scholarly publications. Given the substantial pressure to publish, aspiring scholars may prefer descriptive and qualitative pieces that can frequently be completed in a more timely fashion with fewer logistical obstacles. In contrast, the time-intensive nature of experimental studies may be perceived as counterproductive to satisfying tenure track objectives. Furthermore, novice scholars frequently operate under resource constraints that are not conducive to the successful implementation of large-scale experimental designs. Overall, the current pattern for conducting CTE research is highly problematic because it fosters the creation of an academic mantra that gives preference to quantity versus quality. If CTE researchers decide to more actively promote SBR-compliant studies, attempts should be made to level the playing field for scholars interested in conducting experimental research in CTE.

Despite calls for a better balance between descriptive and experimental studies in CTE, SBR should not be considered as the ultimate cure for the perceived ills of educational research. A singular focus on issues of student performance or intervention efficacy would lead to the exclusion of extensive segments of the educational spectrum. For example, SBR purists might consider the descriptive approach of this very article to be rather trivial in advancing the understanding of CTE interventions. However, the purpose of the examination was to reflect upon the effects of SBR on the current status of CTE research. It is the authors' credo that essential questions and issues do exist beyond an exclusive focus on student performance, achievement, or retention. Clearly, then, the objective is not one of

promoting the SBR mandate as the predominant direction for future research efforts. Rather, CTE should take an informed approach and engage in a less polarized and ideology-laden debate. Many of the prior discussions of SBR in education have focused on either commending or rebuking federal research guidelines based on divergent philosophical positions. A more moderate debate might help the field determine the appropriate role SBR should play in order to ameliorate the overall quality of CTE research. This, however, requires thoughtful, ongoing discourse from CTE professionals. Such discourse could be facilitated through research symposia and special issues on SBR in major CTE research journals. Most importantly, individual researchers bear the primary responsibility to clearly identify the contributions their research will make to the field.

In reviewing the principal propositions of the SBR mandate, the study sought to gauge the current status of CTE research regarding the use of experimental designs that are congruent with the government's preferred research methods. The fact that state and federal funding is increasingly tied to the fulfillment of SBR criteria should prompt the field to grapple more seriously with these guidelines and propositions. There is no need to sacrifice diversity in CTE research on the altar of SBR standards or to place exclusive focus on the government's singular quantitative paradigm. However, CTE needs to be sensitive to accountability demands placed on it from outside actors. In the absence of discourse, the field faces the loss of credibility and may miss the opportunity to evolve for the benefit of CTE students. Ultimately, the question is whether CTE should promote a structured research agenda that focuses more attention on intervention efficacy. The authors look forward to ensuing dialogue and reactions to this important issue.

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Appendix. Coding Decisions Made for All Articles Published in *CTER*, 2001 – 2005 to Support Data Analysis and Conclusions

Year	Volume (Issue)	Author(s)	Title	Type ^{a,b}	Design ^c	Focus [Participants] ^d	Topic ^e
2001	26(1)	Camp, W.	Formulating and evaluating theoretical frameworks for career and technical education research	Expository	—	—	CTE conceptual frameworks, research, and trends
		Chen, S., & Thomas, H.	Constructing vocational and technical college student persistence models	Quantitative	Causal-comparative	Postsecondary CTE students	Student / teacher retention
		Ruhlman, S.	Factors that influence the turnover and retention of Minnesota's technical college teachers	Quantitative	Causal-comparative	CTE professionals [Postsecondary technical educators]	—
2002	26(2)	Athanasou, J., & Cooksey, R.	Judgment of factors influencing interest: An Australian study	Quantitative	Descriptive / Correlational	Postsecondary CTE students	Student interests
		Hutchinson, N., Munby, H., & Chin, P.	The intended curriculum in co-operative education in Ontario secondary schools: An analysis of school district documents	Qualitative	Qualitative [Doc analysis]	Miscellaneous	Curriculum development, integration, or assessment
		Ruhlman, S., & Brewer, J.	Implementing an assessment plan to document student learning in a two-year technical college	Qualitative	Qualitative [Doc analysis]	Miscellaneous	Curriculum development, integration, or assessment
		Jacobs, J.	What is the future for post-secondary occupational education?	Expository	—	—	CTE conceptual frameworks, research, and trends.
		Conroy, C., & Sipple, J.	A case study in reform: Integration of teacher education in agriculture with teacher education in mathematics and science	Qualitative	Qualitative [Case study]	CTE professionals [Teacher educators]	Teacher preparation / development or certification [Curriculum]
		Gordon, H.	American Vocational Education Research Association members' perceptions of statistical significance tests and other statistical controversies	Quantitative	Descriptive / Correlational	CTE professionals [Teacher educators]	Miscellaneous
2003	26(3)	Plank, S.	A question of balance: CTE, academic courses, high school persistence, and student achievement	Quantitative	Causal-comparative	Secondary CTE students	Student / teacher retention
		Griffith, J., & Wade, J.	The relation of high school career and work-oriented education to postsecondary employment and college performance: A six-year longitudinal study of public high school graduates	Quantitative	Causal-comparative	Secondary CTE students	Student / teacher performance [Outcomes]
		Warren, J., LePore, P., & Mare, R.	Employment during high school: Consequences for students' grades in academic courses	Quantitative	Causal-comparative	Secondary CTE students	Student / teacher performance
		MacIver, M., & Legters, N.	Partnerships for career-centered high school reform in an urban school system	Qualitative	Qualitative [Case study]	Miscellaneous	Curriculum development, integration, or assessment
		Shumer, R.	A new, old vision of learning, working, and living: Vocational education in the 21st century	Expository	—	—	CTE conceptual frameworks, research, and trends

(table continues)

Appendix. Coding Decisions Made for All Articles Published in *CTER*, 2001 – 2005 to Support Data Analysis and Conclusions (continued)

Year	Volume (Issue)	Author(s)	Title	Type ^a	Design ^c	Focus [Participants] ^d	Topic ^e
2002	27(1)	Rojewski, J.	Preparing the workforce of tomorrow: A conceptual framework for career and technical education	Expository	—	—	CTE conceptual frameworks, research, and trends
		Harkins, A.	The futures of career and technical education in a continuous innovation society	Expository	—	—	CTE conceptual frameworks, research, and trends
		McCaslin, N., & Parks, D.	Teacher education in career and technical education: Background and policy implications for the new millennium	Expository	—	—	Teacher preparation / development or certification [Secondary]
		Bartlett, J.	Preparing, licensing, and certifying postsecondary career and technical educators	Expository	—	—	Teacher preparation / development or certification [Postsecondary]
		Walzer, R., & Gray, K.	Teacher preparation licensure in career and technical education	Expository	—	—	Teacher preparation / development or certification [Secondary]
		Twomey, S.	The virtual teacher training center: A one-year program to transform subject-matter experts into licensed career and technical education teachers	Expository	—	—	Teacher preparation / development or certification [Distance Learning]
		Kuchinke, K.	Strengthening ties between career-technical education and human resource development	Expository	—	—	CTE conceptual frameworks, research, and trends
		Adams, J.	Going to work: An examination of the meaning of work in welfare-to-work	Qualitative [Case study]	Qualitative [Case study]	Postsecondary CTE students	Student interests
		Zohngen, S.	The role of key qualifications in the transition from vocational education to work	Quantitative [Delphi]	Descriptive / Correlational	CTE professionals	Student / teacher performance [Outcomes]
		Hainston, J.	Perceived knowledge level, utilization, and implementation of school-to-work by pre-service teacher educators in Ohio	Quantitative	Descriptive / Correlational	CTE professionals [Teacher educators]	Curriculum development, integration, or assessment
2003	27(3)	Kim, H., & Rojewski, J.	Using structural equation modeling to improve research in career and technical education	Quantitative	Causal-comparative	Secondary CTE students	Student interests
		Resch, T., & Hall, H.	Attrition, completion, and graduation rates in Georgia technical colleges before and after the initiation of the HOPE grant	Quantitative	Causal-comparative	Postsecondary CTE students	Student / teacher retention
		Clark, P.	The curriculum internationalization process in banking and finance school-to-work programs: A cross case study	Qualitative	Qualitative [Case study]	Secondary CTE students	Curriculum development, integration, or assessment
		Kerlin, T.	A comparison of role/task/environment stress experienced by beginning academic and career-technical teachers in southwestern Ohio career technical schools	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Miscellaneous
		Knobloch, N., & Whittington, M.	Novice teachers' perceptions of support, teacher preparation quality, and student teaching experience related to teacher efficacy	Quantitative	Descriptive / Correlational	CTE professionals [Teacher educators]	Teacher preparation / development or certification

(table continues)

Appendix. Coding Decisions Made for All Articles Published in *CTER*, 2001 – 2005 to Support Data Analysis and Conclusions (continued)

Volume Year (Issue)	Author(s)	Title	Type ^b	Design ^c	Focus [Participants] ^d	Topic ^e
2003 28(1)	Rojewski, J.W.	Globalization and the internationalization of research on career and technical education	Expository	—	—	CTE conceptual frameworks, research, and trends
	Field, D.	Applied technology proficiency of high school students in applied and traditional courses	Quantitative	Quasi-experimental	Secondary CTE students	Student / teacher performance
	Ruhlman, S.	Evaluating tech prep education programs: Implications for reporting program and student outcomes	Qualitative	Qualitative	Secondary CTE students	Curriculum development, integration, or assessment
	Neumark, D., & Allen, A.	What do we know about the effects of school-to-work? A case study of Michigan	Qualitative	Qualitative	Secondary CTE students	Curriculum development, integration, or assessment
	Eisenman, L., Hill, D., & Bailey, R.	The beauty of teacher collaboration to integrate curricula: Professional development and student learning opportunities	Qualitative	Qualitative	CTE professionals [Secondary teachers]	Teacher preparation / development or certification
	Arenas, A.	School-based enterprises and environmental sustainability	Qualitative	Qualitative [Case study]	Miscellaneous	Curriculum development, integration, or assessment
	Brewer, E., & McMahon, J.	Job stress and burnout among industrial and technical teacher educators	Quantitative	Descriptive / Correlational	CTE professionals [Teacher educators]	Miscellaneous
	Farrell, B., & Kotriak, J.	Design and evaluation of a tool to assess strategic information processing styles	Quantitative	Descriptive / Correlational	Postsecondary CTE students	Student interests
	Zinke, C.	Distance education and career and technical education: A review of the research literature	Expository	—	—	Distance education
	28(3)	Shafiqul Azam, M., & Branchie, P. E.	A study of supervisor and employee perceptions of work attitudes in information age manufacturing industries	Quantitative	Causal comparative	Miscellaneous
Ncube, L., & Greenan, J.		Entrepreneurial careers of women in Zimbabwe	Qualitative	Qualitative [Phenomenology]	Miscellaneous	Miscellaneous
Hernandez, V. M., & Brendefur, J.		Developing authentic, integrated, standards-based mathematics curriculum: [More than just] an interdisciplinary collaborative approach	Qualitative	Qualitative [Case study]	CTE professionals [Secondary teachers]	Curriculum development, integration, or assessment
Ruhlman, S. K., & Brenner, C.		Perceptions of traditionally and alternatively certified career and technical education teachers	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Teacher preparation / development and certification
Redmann, D., & Kotriak, J.		Analysis of technology integration in the teaching-learning process in selected career and technical education programs	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Miscellaneous
Birkholz, A.		An investigation of student, faculty, and administration perceptions of the application of accelerated learning strategies in the Wisconsin technical college system	Quantitative	Descriptive / Correlational	Secondary CTE students (also CTE teachers)	Curriculum development, integration, or assessment

(table continues)

Appendix. Coding Decisions Made for All Articles Published in *CTER*, 2001 – 2005 to Support Data Analysis and Conclusions (continued)

Year	Volume (Issue)	Author(s)	Title	Type ^a	Design ^c	Focus [Participants] ^d	Topic ^e
		Stewart, R., Moore, G., & Flowers, J.	Emerging educational and agricultural trends and their impact on the secondary agricultural education program	Quantitative [Delphi]	Descriptive / Correlational	CTE professionals	CTE conceptual frameworks, research, and trends
		Linneham, F.	The relation of source credibility and message frequency to program evaluation and self-confidence of students in a job shadowing program	Quantitative	Quasi-experimental	Secondary CTE students	Student interests
29(2)		Zinser, R., & Lawrence, F.	New roles to meet industry needs: A look at the advanced technological education program	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Curriculum development, integration, or assessment
		Johnson, S., Benson, A., & Duncan, J.	Internet-based learning in postsecondary career and technical education	Quantitative	Descriptive / Correlational	CTE professionals [Postsecondary teachers]	Distance learning
		Branchle, P., & Azam, M.	Factorial invariance of the occupational work-ethic inventory	Quantitative	Descriptive / Correlational	Miscellaneous	Student interests
		Becker, K., & Maunsaityat, S.	A comparison of students' achievement and attitudes between constructivist and traditional classroom environments in Thailand vocational electronics programs	Quantitative	Quasi-experimental	Secondary CTE students	Student / teacher performance
29(3)		Zirkle, C.	Distance education programming barriers in career and technical teacher education in Ohio	Quantitative	Descriptive / Correlational	CTE professionals [Teacher educators]	Distance learning
		Keiser, J., Lawrence, F., & Appleton, J.	Technical education curriculum assessment	Expository	—	—	Curriculum development, integration, or assessment
		Stone, J., Kowalski, B., & Alfeld, C.	Career and technical education in the late 1990s: A descriptive study	Quantitative	Descriptive / Correlational	Miscellaneous	Curriculum development, integration, or assessment
		Edwards, M.	Cognitive learning, student achievement, and instructional approach in secondary agricultural education: A review of literature with implications for future research	Expository	—	—	Student / teacher performance
2005	30(1)	Barabasz, A., & Lakes, R.	School-to-work transition in East Germany: Challenges of a market society	Expository	—	—	Miscellaneous
		Chadd, J., & Anderson, M.	Illinois work-based learning programs: Work-site mentor knowledge and training	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Student / teacher performance
		Geunry, M., Rizza, M., Peters, S., & Hu, S.	Professionalism, sense of community and reason to learn: Lessons from an exemplary career and technical education center	Qualitative [Case study]	Qualitative [Case study]	Secondary CTE students	Student / teacher performance
30(2)		Whittington, S.	Using standards to reform teacher preparation in Career and Technical Education: A successful reform	Expository	—	—	Teacher preparation / development and certification
		Hanus, B., & Knobloch, N.	Preservice teachers' motivation and leadership behaviors related to career choice	Quantitative	Descriptive / Correlational	CTE professionals [Preservice teachers]	Teacher preparation / development and certification

(table continues)

Appendix. Coding Decisions Made for All Articles Published in *CTER*, 2001 – 2005 to Support Data Analysis and Conclusions (continued)

Year	Volume (Issue)	Author(s)	Title	Type ^{a,b}	Design ^c	Focus [Participants] ^d	Topic ^e
		Stone, J.R., & Aliaga, O.	Career and technical education and school-to-work at the end of the 20th century: Participation and outcomes	Quantitative	Descriptive / Correlational	Secondary CTE students	Curriculum development, integration, or assessment
30(3)		Günun, P., Workman, J., & Anderson, M.	Influences of training and strategic information processing style on spatial performance in apparel design	Quantitative	Causal comparative	Postsecondary CTE students	Student interests
		Hammish, D., & Lynch, R.	Secondary to postsecondary technical education transitions: An exploratory study of dual enrollment in Georgia	Qualitative	Qualitative [Case study]	Secondary CTE students	Curriculum development, integration, or assessment
		Smith, B., & Katz, S.	Employability standards: Teachers' perceptions of inclusion in family and consumer sciences secondary curriculum	Quantitative	Descriptive / Correlational	CTE professionals [Secondary teachers]	Curriculum development, integration, or assessment

^aExpository includes conceptual articles, opinion articles, literature reviews, and ACTER Presidential Addresses. ^bQuantitative designation includes Delphi studies, Editor's Notes not included. ^cResearch designs were categorized as qualitative, descriptive/correlational, causal-comparative, quasi-experimental, or experimental. ^dFocus [Participants] included secondary CTE students, postsecondary CTE students, CTE teachers, CTE professionals, and miscellaneous. ^eEight research topics were used, including CTE conceptual frameworks, research, and trends; student/teacher retention; student interests/self-efficacy; curriculum development, integration, or assessment; student/teacher performance; teacher preparation/development and certification; distance learning; and miscellaneous. Volume 27(1) was a special issue of scholarly papers presented at the 2002 National Career and Technical Education Institute. These articles may slightly bias our results because of the expository nature of all 6 papers.