

JOURNAL OF INDUSTRIAL TEACHER EDUCATION
Winter Issue Contents
Volume 43, Number 4

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A Big Smile and a Little Tear

For the past two years, the *Journal of Industrial Teacher Education* has been a significant part of my life. I didn't realize when I began this editorship how much it would permeate my thoughts, both day and night. Each issue was a pleasure to produce as I met scholars from across the United States and got to know them through their writing or reviewing. Of course, my editorship was not stress-free, by any means. We had our share of problems, such as frustrated writers and ominous deadlines. However, the good far outweighed the bad. Sending out acceptance letters was one of the best parts of this job, as was sending the letters with reviewer comments to help writers revise and re-submit their manuscripts. The excitement of publishing is contagious and something I will truly miss.

I cannot end my term as *JITE* editor without thanking many people. I am grateful to NAITTE for giving me the opportunity to edit its flagship publication and for allowing me the autonomy to make editorial decisions. My institution, Georgia State University, has been generous in its support of my editorship, and the faculty of the Middle Secondary Education and Instructional Technology Department has shown interest and enthusiasm for *JITE's* presence in our department.

I could have never turned out eight issues of *JITE* without the assistance of members of the editorial board in reviewing manuscripts and helping me clarify my thinking on various dilemmas. I am grateful to Richard A. Walter, Pennsylvania State University; James C. Flowers, Ball State University; Richard D. Lakes, Georgia State University; Andrew E. Schultz, Lincoln Public Schools; and Mary Jo Self, Oklahoma State University. Karen Schaefer, Georgia State University (ret.) has been a most valuable asset to our journal as style editor. Her attention to detail, sense of responsibility, and knowledge of APA style enriched the professional quality of each issue. Thanks also to Karen Juneau, University of Southern Mississippi, for keeping the circulation running smoothly (all this while living in a FEMA trailer).

JITE could not survive without the work of its outside reviewers. The Editorial Board thanks these reviewers for their conscientious service to the *Journal*. The following individuals served as reviewers for Volume 43:

David Bjorkquist	University of Minnesota
Paul A. Bott	California State University-Long Beach
W. R. Caldwell	Southern Illinois University
Robert A. Chin	East Carolina University
Jeffery Cantor	Norwalk Community College
Phillip L. Cardon	Eastern Michigan University
Rodney Custer	Illinois State University
W. Tad Foster	Indiana State University
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George E. Rogers	Purdue University
Karen M. Schaefer	Georgia State University (Ret.)
Dale E. Thompson	University of Arkansas
Kenneth D. Welty	University of Wisconsin-Stout.

Becoming editor of the *Journal of Industrial Teacher Education* means filling the shoes of some giants of the profession, and I thank them for the example they have set. I especially appreciate the friendship and advice of George Rogers, my predecessor, whose counsel I sought on many occasions and who never failed to help. As *JITE* is turned over to its new editor, Richard Walter, I know it will be in good hands. His knowledge of the profession, his extensive experience, and his respect for the work of others will enrich the *Journal* as it continues to evolve. I look forward to the *Journal's* continued success under his editorship. Richard Walter was installed as editor for Volumes 44 and 45 at the annual NAITTE breakfast during the ACTE

convention in Atlanta. Watching the installation I wore a big smile as I contemplated having more free time, but I must admit at the same time, I also shed a little tear.

In This Issue

This issue of *JITE* contains three feature articles related to career and technical education (CTE). In the first article, Ausburn and Brown investigate the learning strategies of students in CTE programs. The study discusses the implications for CTE instructors of learning strategies and instructional preferences, analyzes what types of learners may be most attracted to CTE, and considers why the curriculum and instruction in CTE may be particularly suited to meet the learning needs of certain students.

The second feature article is a follow-up to Flowers and Baltzer's previous research article (Volume 43:3) which addressed the issue of the growing demand for higher education faculty in technical education. The current study investigates the demand for online doctoral programs in the field of technology education and provides data on motivations and obstacles to pursuing a doctoral degree. Flowers and Baltzer present recommendations to institutions that may be considering offering online doctoral degrees in technical education.

The third feature article is a descriptive piece in which Walter details an on-going partnership between the Carpenter's International Training Fund of the International United Brotherhood of Carpenters and Joiners Union and the Workforce Education and Development Program of Pennsylvania State University. The goal of the partnership is to produce high quality training for journeymen and apprentices in order to maintain a productive, efficient workforce.

In the "At Issue" section, Gagel presents an argument that the definition of technological literacy should be broadened to expand its scope in order to integrate it with the goals of general education.

An index for Volume 43 is included in this issue. The *Journal* concludes with the "Bits and Pieces" section.

JZB

Learning Strategy Patterns and Instructional Preferences of Career and Technical Education Students

Lynna J. Ausburn
Dovie Brown
Oklahoma State University

In an effort to individualize instruction and improve the effectiveness of instructor-learner transactions, education and instructional research has addressed a wide assortment of learner variables and assessed their relationships to instructional methods and environments. Frequently included in this research are analyses of how information is obtained and processed. Identified in the literature alternatively as learning style, cognitive style, or cognitive control, these variables are learner classifications that describe how a student approaches, acquires, processes, and uses information in addressing learning tasks. An individual's specific learning classification conveys his or her preferred approach to learning tasks and charts his or her particular instructional needs.

Adult education has recently seen the development by Conti and Kolody (2004) of a new model for the study and classification of learning preferences, which they call learning strategies. To accompany their model, they created a new assessment instrument named Assessing the Learning Strategies of Adults, or ATLAS. Although learning strategy research using the ATLAS test has appeared in dissertations and other, less formal, research, it has not yet developed a sizeable base in peer-reviewed, published literature. Nevertheless, the ATLAS learning strategies are grounded historically and theoretically in concepts of psychological types and learner differences, and their wider use may provide means for educators to identify learning preferences and may suggest methods for instructors to individualize and strengthen their students' learning experiences.

Ausburn is Associate Professor and Brown is Research Assistant in the Department of Occupational Education Studies at Oklahoma State University in Stillwater, Oklahoma. Ausburn can be reached at lynna.ausburn@okstate.edu.

While the ATLAS assessment of learning strategies and associated instructional preferences has not yet been applied directly to career and technical education (CTE) students, it has been used in studies of several other non-traditional populations. Aspects of existing ATLAS research that may be of particular interest to career and technical educators are the findings that (a) the distribution of learning strategies of non-traditional students differ from those of the general population, (b) specific strategy types differ in their associated instructional preferences, and (c) knowledge of learners' preferred learning strategies and favored instructional methods improves learning performance.

Study Purpose

The purpose of this study was to apply the ATLAS test to identify and describe the learning strategies and the associated instructional preferences of students in CTE programs and to compare these results with those found in previous ATLAS studies of non-traditional learner populations. The study also sought to determine if the ATLAS results for the CTE students were consistent with ATLAS learning strategy theory. In addition the researchers strove to assess the perceived accuracy of the ATLAS classifications. Specifically, the study addressed the following questions:

- (1) What are the learning strategies of the CTE students as measured by the ATLAS test?
- (2) According to the CTE students, how accurately does the ATLAS test identify their preferred learning strategies?
- (3) Do the ATLAS learning strategy distributions of CTE students match those established for the general population and/or those identified in other non-traditional learner populations?
- (4) Are certain instructional methods preferred by all the CTE students across all ATLAS learning strategy groups, and, if so, do these preferred methods match those preferred by other non-traditional learners?
- (5) Are there differences in instructional method preferences between specific ATLAS learning strategy groups of CTE students, and if so, do they match the

differences identified between the learning strategy groups of other non-traditional learners?

- (6) Are the instructional method preferences of the ATLAS learning strategy groups of CTE students consistent with the expectations of the ATLAS theory base?

Background

Categorizing Learning Preferences

The ATLAS system of categorizing learning strategies is grounded in a large body of research on individual differences. Jung (1934-1954) identified basic human psychological types, or archetypes, which formed a theoretical foundation for the separation of individuals into stable groups classified according to combinations of preferred methods of perception and judgment. Later extensions of Jungian theory of human personality groups led to an array of grouping typologies and a variety of assessment instruments. In the 1950s, the Myers-Briggs Type Indicator identified 16 personality types based on specific combinations of four scales identified earlier by Jung (Briggs-Myers & McCaulley, 1985). Later, Keirsey and Bates (1984) brought personality typing closer to educational application by applying the 16 Myers-Briggs types to identify four categories of learning styles, which they used to specify groups of individuals based on the instructional techniques each group consistently preferred across all kinds of learning tasks.

Additional extensions of the concept of human typing and grouping according to learning preferences or to methods of information processing have furthered the study of what has been identified in the literature by a variety of terms. Theorists who categorized individual learner differences in terms of cognition and by how learners perceived and processed information designated the differences they found among learners as “cognitive styles” or “cognitive controls” (Ausburn & Ausburn, 1978). Cognitive style/control has been systematically studied along several dimensions including field independence/dependence (e.g. Witkin, 1950; Witkin, Dyk, Faterson, Goodenough, & Karp, 1962; Witkin, et al., 1954);

reflective/impulsive cognitive tempo (e.g. Kagan, Rosman, Day, Albert, & Phillips, 1964); leveling/sharpening memory assimilation (e.g. Santostefano, 1964); flexible/constricted field control (e.g. Santostefano & Paley, 1964; Stroop, 1935); and visual/haptic perceptual types (e.g. Lowenfeld & Brittain, 1970). Primary characteristics of all the various dimensions of cognitive style/control are relative independence from general intellectual ability, relationship to human behavior and personality variables, development early in childhood, stability over time, and resistance to training and change.

The literature documents two other models which classify individual differences in approaches to learning. Both returned to the term “learning styles” to name their learner variables, and both represent a combination of the original Jungian personality theory framework, the Keirseley typology, and the newer information processing base of the cognitive stylists. The Dunn and Dunn learning styles model posited 21 elements organized into five groups—environmental, emotional, sociological, physical, and psychological—which were then combined in identifiable ways to determine a learning style that persists in an individual across a broad spectrum of learning tasks. (Dunn & Dunn, 1978, 1992).

In contrast to the personality and information processing theories that underlie the Dunn and Dunn model, Kolb based his learning style model and inventory on a theoretical framework of personal experience. Kolb drew from work in experiential learning of Dewey, Lewin, and Piaget, which he tied together with common themes in psychology, philosophy, and physiology. Kolb proposed two sets of polar opposite systems for gathering, organizing, and transforming information based on past experiences. He identified these dichotomies as concrete experience/reflective observation and abstract conceptualization/active experimentation. Through combinations of these polar pairs, his model identified four distinct learning styles (Kolb, 1984).

Kolb’s experiential base gave his learning style categories a theoretical fit and a substantial research record in the field of adult learning. The andragogy model of modern adult learning emphasizes the importance to adults of using and valuing their

past experiences, of becoming self-aware of their own individual ways of knowing and understanding, and of applying this awareness to self-directed life-long learning (Brookfield, 1986; Knowles, 1980, 1990; Knowles, Holton, & Swanson, 1998; Merriam, 2001; Smith, 1982, 1991).

Some adult education theorists have moved away from the Kolb learning style model and adopted a new approach to identify and classify types of adult learners. These theorists apply the term “learning strategies” to their learner classification types. While this model preserves the theory and principle of identifying and describing stable groups of individuals based on their approaches to learning, it also incorporates both the precepts of andragogy developed by Knowles (1980, 1990) and the principles of cognitive theory. The learning strategies typology set out in the work of Conti, Fellenz, and Kolody bases learners’ personal learning preferences and choices directly on their previous experiences in undertaking learning tasks (Conti & Kolody, 1995; Fellenz & Conti, 1993). Fellenz and Conti (1989) suggested that these strategies may be manifestations of all the positive and negative experiences that have ever affected individuals as learners. In their recent analysis of instructional methods and techniques for adult learners, Conti and Kolody (2004) defined learning strategies as “those techniques or specialized skills that the learner has developed to use in both formal and informal learning situations.” Learning strategies, they stated, are the “behaviors developed by an individual through experiences with learning” that they elect to use to accomplish learning tasks (p. 184). By aligning learning strategies closely to lived experience and human behavior, these definitions ground the strategies model in the principles of both cognitive theory and modern andragogy.

Learning Strategy versus Learning Style Research

Under the general label of “learning styles,” many studies have investigated the differences in individuals’ preferences and capabilities in undertaking learning tasks. While this research has yielded some useful information, it has been hampered by several problems. First, learning styles have been conceptualized, defined, and assessed in numerous ways, making interpretation

and comparisons of results problematic. A second obstacle is the difficulty found in generalizing and applying learning style research. While learning styles have been found to be consistent for individuals across a variety of tasks, research has shown these styles to be related to learning performance only when a learning task requires a specific cognitive process that is limited by a particular learning style (Ausburn & Ausburn, 1978, 2003). This fact is implicit in Cronbach and Snow's Aptitude-Treatment-Interaction (AII) model (Cronbach & Snow, 1977), which is the research methodology frequently used to study the effects of learning styles on learning performance. The AII model focuses on identifying specific interactions between learner characteristics, the nature of a learning task, and the features of an instructional treatment. It acknowledges that the effects of learning styles are not general, but rather are related to specific learning tasks and instructional methods.

In contrast to learning styles studies, learning strategy research has several characteristics that may make it particularly useful for an analysis of the instructional preferences of CTE students. Rather than a broad range of definitions and an assortment of assessment methods, learning strategy theory has a unified theoretical framework and is assessed by means of a single assessment instrument, the ATLAS test, which is both easily administered and interpreted. In addition, recent ATLAS studies with several groups of non-traditional learners offer a basis for same-instrument, direct comparisons of test results with groups of learners similar to CTE students.

Each of the three learning strategy categories identified by the ATLAS test describes a specific set of alternative approaches to learning. These approaches are based on an individual's lived experiences with learning and are applied by the individual to both formal and informal learning tasks and situations (Conti & Kolody, 1995, 2004; Fellenz & Conti, 1993). Since these ATLAS learning strategy categories represent broad, general processes and techniques that are preferred by individuals in all learning situations, they may have direct relationships to all types of learning and thus may offer general instructional usefulness for CTE practitioners. These characteristics of the ATLAS learning strategy model and

assessment instrument contributed to its selection as the vehicle for this current study.

The Atlas Instrument

Development

Arising from corporate sector work on using inventory-type devices in order to gain self-knowledge to improve performance (Blake & Mouton, 1972; Mouton & Blake, 1974, 1984), the ATLAS test of learning strategy is a relatively new, self-administered instrument for assessing learning strategy preferences. As a step in creating a learning instrument to assist adult learners in developing an understanding of their metacognitive self-awareness, the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) test was developed in the early 1990s. Based on Brookfield's (1987) theories, the SKILLS test identified 15 learning strategies representing different combinations of several components of critical thinking: testing assumptions, generating alternatives, and conditional acceptance of general knowledge (Conti & Kolody, 1999). The SKILLS instrument underwent extensive validation and was used successfully in a large body of adult learning strategy research (Fellenzi & Conti, 1993). However, in order to maximize the usefulness of the SKILLS learning strategy model, there was a need for a tool that was less lengthy and complex than the SKILLS test and one which could be administered easily, completed quickly, and used immediately by both learners and facilitators. This need prompted the development of the ATLAS test of learning strategy (Conti & Kolody, 1999).

Because the ATLAS test was derived statistically from the SKILLS model that preceded it, it potentially carried the established validity of its parent instrument. The ATLAS test creators, Conti and Kolody (1999) produced the ATLAS test through an extensive research process. Construct validity for the ATLAS instrument was established by synthesizing the results of the numerous SKILLS studies at the Center for Adult Learning Research at Montana State University. Cluster analysis was used to consolidate these results and to establish the learner groupings identified by SKILLS responses. Following this consolidation, a process of discriminant analysis determined the specific questions

that separated the clusters. This statistical process produced a three-cluster solution with an accuracy of 96.1% in group placements. These three groups formed the conceptual/theoretical basis for the ATLAS model and its three learning strategies.

To establish content validity for the ATLAS test, discriminant analysis was used to determine the differences between the proposed three learning strategy groups. Once these differences were established, the specific wording of items in the ATLAS instrument was based on the exact pattern of learning strategies used by each group. Thus, while the ATLAS test has only a few items, each item was “based on the powerful multivariate procedure of discriminant analysis” (Conti & Kolody, 1999, p. 19).

Criterion-related validity for the ATLAS test was initially established by comparing ATLAS placements to actual group placements using the SKILLS parent instrument. This process indicated a 70% accuracy rate for the ATLAS test in placing respondents in their corresponding SKILLS group. According to Conti and Kolody (1999), on-going research continues in an effort to ascertain the exact ways members of each learning strategy group go about learning and to clarify what things facilitators do that help or hinder them. These studies are expected to lead to review and adjustment of the wording of each ATLAS item to ensure it is “extremely compatible with the comments of the group members” (p. 19).

Test-retest reliability for the ATLAS instrument has not yet been established in either its initial development or in subsequent published research, an omission which currently hampers its general acceptance as a research tool. However, reliability for the ATLAS test has been demonstrated in both dissertations and informal studies that have found strong test-retest coefficients. For example, Ghost Bear (2001) reported reliability as .87, and the present principal investigator has generally found it to be at or above .90 in informal studies.

Feedback from study subjects suggests that the ATLAS results accurately identified their learning preferences (Conti & Kolody, 2004). Both James (2000) and Lively (2001) reported interview support for the perceived accuracy of ATLAS test results, and Ghost Bear (2001) reported that over 90% of her

respondents agreed that their ATLAS category correctly identified their learning strategy. In follow-up studies to the one reported here, Ausburn and Brown (2005b) also found similar levels of perceived ATLAS accuracy with groups of CTE students.

ATLAS Theory Base

Conti and Kolody (1999) developed the ATLAS instrument to measure the learning strategies of adults. The ATLAS test can be taken individually or in a group, either online or via a booklet that guides a user through a short series of questions which identify the user's preferred strategy group. The test requires only two or three minutes to complete. From responses to its few simple questions, the ATLAS test classifies a learner into one of three strategy groups based on his or her preferred approach to learning. The three strategy groups are (1) navigators, (2) problem solvers, and (3) engagers. Each strategy group possesses distinct personal characteristics and a well-defined set of methods its members find most effective when approaching and working through learning tasks (Conti and Kolody, 1999).

Studies of adult learners in hybrid online courses (Ausburn, 2004a, 2004b) have demonstrated the existence of the ATLAS learning strategy groups of navigators, problem solvers, and engagers. Conti and Kolody (2004) state that the three ATLAS categories of learning strategies have been observed in a wide variety of groups, both within and outside the United States. They report the categories to be consistent, largely unrelated to demographic variables and personality measures, and transcendent of cultural boundaries. Through extensive study of diverse adult populations, their research has shown that the three ATLAS learning strategy categories have a nearly equal distribution in the general adult population with 36.5% classified as navigators, 31.7% as problem solvers, and 31.8% as engagers (Conti & Kolody, 1999, 2004).

Navigators. In addition to establishing the three categories, Conti and Kolody (1999) outlined the associated instructional preferences of each learning strategy type. According to Conti and Kolody, navigators are focused, conscientious, and results-oriented learners who favor efficient

and effective learning through a carefully charted plan. Navigators require and impose order and structure on their learning process. They plan and organize learning activities and favor making logical connections as they learn. They “plan the work and work the plan.” Navigators tend to be high-achievers. They generally do not enjoy group work unless they are able to take control. For navigators, emotions play little role in learning; they are able to separate the message from the messenger. They prefer teachers who are well organized and provide clear objectives, schedules, and deadlines. They learn best in logical sequence in controlled classrooms with instructors who provide prompt feedback

Problem Solvers. Conti and Kolody (1999) describe problem solvers as critical thinkers who explore a variety of options as they work through a learning activity. Consequently, problem solvers will avoid closure until they investigate an assortment of alternatives. They test assumptions, generate alternate possibilities to create numerous learning options, and are open to conditional acceptance of learning outcomes. Their curiosity, inventiveness, and intuition may sometimes cause them difficulty in making decisions. Problem solvers thrive in learning environments that promote experimentation and hands-on activities. They may find group learning difficult unless they can set the learning pace and do things their own way. They typically do not like multiple-choice tests, which force them to make choices they may be unwilling to make. Problem solvers appreciate deadlines, but prefer to go about learning in an unstructured way. They dislike lectures, favoring a more personalized recounting of information that includes examples and illustrative stories.

Engagers. Engagers comprise the only ATLAS group which approaches learning from the affective domain. According to Conti and Kolody (1999), engagers are emotional learners who love to learn and learn with feeling. Because they value relationships, they seek personal identification and a high level of involvement in the learning process. Engagers seek out learning activities that offer them the greatest opportunity for involvement, interaction, and collaboration. They will completely immerse themselves in an activity or project they find rewarding.

Engagers prefer long-term activities that result in a sense of achievement and a perception of personal growth. They recognize the need to have fun and find both joy and personal satisfaction in a job well done. Engagers thrive in group learning environments that involve interaction and collaboration. They are most successful with teachers who focus on learning rather than on formal evaluation and who customize student projects based on individual student interests. Engagers gravitate towards teachers who show a personal interest in them and with whom they can develop an emotional affinity.

Learning Strategy Distributions among Non-traditional Learners

While the distribution of the three ATLAS learning strategy groups has been consistent among most adult populations, there are populations for which the picture is quite different. Researchers found that among high school non-completers returning to education (James, 2000), first-generation American community college students (Willyard, 2000), adult learners at a two-year technical college (Massey, 2001), and at-risk urban youths (Shaw, 2004), the ATLAS group distributions differed significantly from that of the general population. The common element among the subjects of these studies is that they all represent non-traditional learners, broadly defined here as youths or adults who, for a variety of reasons, have followed education options outside the typical route of high school directly through to baccalaureate. The studies found that, in contrast to the general population, in these non-traditional populations there was a strong skew in favor of the engager learning strategy. Furthermore, all these studies of non-traditional learners reported that some learning method preferences were common to all three learning strategy groups. At the same time, researchers observed differences between the strategy groups in other learning method preferences which were consistent with the ATLAS theory base.

These findings prompt the question of what results might be found for CTE students on the ATLAS test of learning strategy. Although, no study has as yet related the ATLAS learning strategies directly to students in CTE programs, the similarities between CTE students and non-traditional

populations suggest that inquiry into the ATLAS learning strategy distribution among CTE students may yield similar findings to those for the non-traditional populations.

Whether or not the findings for CTE students prove similar to those for non-traditional populations, information gathered from those findings may provide instructional implications for CTE educators. Studies of individual differences in preferred instructional methods and approaches to learning have shown that student learning benefits from identifying such differences and from using them to customize instruction. Research has indicated that student achievement and motivation generally improve when instruction matches student learning styles (Gee, 1996; Wakefield, 1993). In a meta-analysis of 42 experimental studies undertaken between 1980 and 1990 by 13 different universities, Dunn, Griggs, Olson, Goreman, and Beasley (1995) concluded that there was a positive relationship between students' academic achievement and instruction that matched their learning styles. Specific to the ATLAS test and its identification of learning strategies, D.R. Munday (2002) and W.S. Munday (2002) both found, in a pair of cross-case validation studies, that knowledge of learning strategies by both learners and instructors improved academic performance.

Study Method and Procedures

Subjects

The subjects in this study were 621 CTE students whose instructors were already using the ATLAS instrument as part of their instructional techniques. The students were enrolled in 13 different career and technical programs in the CareerTech system in various locations and schools across Oklahoma. Of the 621 subjects, 617 provided the required ATLAS data and were included in the data analysis. The sample comprised 65% males and 35% females. Forty-five percent were high school students and 55% were adults who were not taking a program for high school credit. While this convenience sample was neither random nor representative of all CareerTech programs in the state, it did offer broad program and demographic coverage. Details of the demographics of the sample are shown in Table 1.

Table 1
Demographics of Sample (N = 617)

	<i>n</i>	%
Gender		
Male	404	65%
Female	213	35%
Age		
High school	276	45%
Adult	334	54%
Not reported	7	1%
Career/Technical Program		
Business and Communications	77	12.5%
Carpentry	15	2.5%
Welding and HVAC	47	8%
Electrical and Industrial Technology	43	7%
Drafting	11	2%
Licensed Practical Nursing	31	5%
Health Science Technologies	15	2.5%
Child Care and Early Childhood Development	37	6%
Food Services	76	12%
Cosmetology	3	0.5%
Emergency Services	155	25%
Auto Body	44	7%
Auto Mechanics	63	10%

Instrumentation

Data for the study were gathered from two instruments: The Assessing the Learning Strategies of Adults (ATLAS) test of learning strategies, and a short questionnaire developed specifically for the study. The questionnaire asked the subjects to identify themselves on several demographic and perception variables, including gender and whether or not they were taking the course for high school credit. Those who were taking the course for high school credit were classified as high school age; those who were not, as adults. The study subjects also indicated on the questionnaire the CareerTech program in which they were enrolled and the ATLAS learning strategy group to which they

belonged. In addition, subjects used a four-point Likert scale to rate their perception of the accuracy of their ATLAS learning strategy placement. Finally, the questionnaire solicited open-ended responses to two questions which asked the students to identify (a) things teachers do that they liked or that helped them learn, and (b) things teachers do that they disliked or that made learning more difficult for them.

Procedures

The principal research investigator asked Oklahoma CareerTech teachers who were known to be using the ATLAS instrument if they and their students were willing to participate in the study. Only volunteers were included in the research. The participating CareerTech teachers administered both the ATLAS test and the study questionnaire to their own students in their own classroom settings. The teachers chose whether to use the online or the paper version of the ATLAS instrument. All completed questionnaires were given to the principal investigator for analysis.

A one-sample chi-square test was performed to compare the ATLAS learning strategy distribution found among the CareerTech students to the reported general-population norms for the test. One-sample chi-square tests were also calculated to assess the distribution of ATLAS types within each of the 13 career and technical program areas included in the study.

Analysis of the open-ended data concerning the subjects' teaching-technique likes and dislikes was based on the qualitative constant comparison method of identifying response categories based on key themes. No response categories were set *a priori*; all categories were established from within the data as they arose naturally from the comments of the participants. The frequency of comments in each response category was tabulated and then further broken down to determine the frequency of comments for each response category within each ATLAS learning strategy group.

Results and Discussion

Distribution of Learning Strategies

Results of the analysis showed that all three ATLAS learning strategy groups were well represented in the sample of CareerTech students. However, a one-sample chi-square test revealed that the distribution of ATLAS types among the CareerTech students ($n = 617$) was significantly different from the established norms in the general population ($\chi^2 = 61.28$; $df = 2$; $p = .000$). Details of the observed ATLAS distribution are reported in Table 2.

Table 2
ATLAS Learning Strategies Distribution of CTE Students
($N = 617$)

Learning Strategy	n	Sample %	Normative %
Navigators	150	24.3%	36.5%
Problem Solvers	187	30.3%	31.7%
Engagers	280	45.4%	31.8%

As shown in Table 2, the proportion of problem solvers, 30.3% in the CareerTech group, was very similar to the expected norm. However, there were far fewer navigators (24.3%) and far more engagers (45.4%) than in the norm established for the general population. Likewise, a similar distribution, with significantly greater than expected proportions of engagers, was also observed throughout most of the 13 individual career programs represented in the study. A summary of the frequency and chi-square data for the whole sample and for each of the 13 CareerTech programs is presented in Table 3,

Perceived Accuracy of ATLAS Learning Strategy Classifications

According to their Likert-scale ratings, the 617 CareerTech students in the study generally felt that the ATLAS test correctly identified their preferred learning strategies. In all, 94% perceived that the ATLAS description of their learning

strategy had some degree of accuracy. Sixteen percent viewed their ATLAS results as very accurate, 45% as accurate, and 33%

Table 3

Chi-Square Comparisons of Sample ATLAS Distributions to Normative Distributions (N=617)

Program	n_{observed}	n_{expected}	χ^2 ($df = 2$)
Entire Sample	617		
Navigators	150	225	
Problem Solvers	187	196	
Engagers	280	196	$\chi^2=61.28$; $p=.00^*$
Business and Communications	77		
Navigators	20	28	
Problem Solvers	21	24	
Engagers	36	25	$\chi^2=7.50$; $p=.02^*$
Carpentry	15		
Navigators	5	5	
Problem Solvers	1	5	
Engagers	9	5	$\chi^2=6.40$; $p=.04^{**}$
Welding and HVAC	47		
Navigators	12	17	
Problem Solvers	15	15	
Engagers	20	15	$\chi^2=3.14$; $p=.21$
Electrical and Industrial Technology	43		
Navigators	7	16	
Problem Solvers	18	13	
Engagers	18	14	$\chi^2=8.13$; $p=.02^*$
Drafting	11		
Navigators	3	-	
Problem Solvers	3	-	
Engagers	5	-	χ^2 not calculated ⁺⁺
Licensed Practical Nursing	31		
Navigators	7	11	
Problem Solvers	8	10	
Engagers	16	10	$\chi^2=5.45$; $p=.06^{**}$

Table 3 continued

Health Science			
Technologies	15		
Navigators	4	5	
Problem Solvers	10	5	
Engagers	1	5	$\chi^2=8.40$; $p=.01^{**\dagger}$
Child Care and			
Early Childhood	37		
Navigators	10	13	
Problem Solvers	8	12	
Engagers	19	12	$\chi^2=6.11$; $p=.05^*$
Food Services	76		
Navigators	16	28	
Problem Solvers	17	24	
Engagers	43	24	$\chi^2=22.23$; $p=.00^*$
Cosmetology	3		
Navigators	1	-	
Problem Solvers	2	-	
Engagers	0	-	χ^2 not calculated ⁺⁺
Emergency Services	155		
Navigators	37	57	
Problem Solvers	55	49	
Engagers	63	49	$\chi^2=11.75$; $p=.00^*$
Auto Body	44		
Navigators	11	16	
Problem Solvers	12	14	
Engagers	21	14	$\chi^2=5.35$; $p=.07^{**}$
Auto Mechanics	63		
Navigators	17	23	
Problem Solvers	17	20	
Engagers	29	20	$\chi^2=6.06$; $p=.05^*$

*Significant at .05 level

**Significant at .10 level

+ Cell sizes marginal for χ^2 calculation++ Cell sizes too small for χ^2 calculation

† Preponderance of Problem Solvers, not Engagers

as fairly accurate. Only 6% felt it was not very accurate. This finding is consistent with results of previous dissertation studies of the perceived accuracy of the ATLAS test.

Instructional Method Likes and Dislikes

The open-ended question asking what things teachers do that the CareerTech students liked or they felt made learning easier or more pleasant drew 802 comments. Of these, 528 (66%) were classifiable through constant comparison methods into six categories or instructional factors. The remaining 274 comments (34%) were unreadable, uninterpretable, unrelated to instructional techniques or unique items with no useful frequency and were therefore omitted from this analysis.

The six instructional factors identified as positive by the CTE students were (1) hands-on instruction ($f=230$; 44% of usable positive comments), (2) clear and thorough explanations ($f=103$; 20% of usable positive comments), (3) use of visual and audio-visual materials ($f=60$; 11% of usable positive comments), (4) sense of humor and making learning fun ($f=51$; 9% of usable positive comments), (5) group activities, interactivity, and class involvement ($f=47$; 9% of usable positive comments), and (6) relating content to real life experiences through anecdotes and stories ($f=37$; 7% of usable positive comments).

All three ATLAS learning strategy groups were equally likely to contribute to these comments and each group contributed comments in a proportion similar to their representation in the sample. Table 4 details the responses of the three ATLAS groups on these six instructional techniques.

Because two instructional factors, hands-on learning (44% of positive responses) and clear/thorough explanations (20% of positive responses), were the instructional techniques mentioned most frequently by students in all three ATLAS learning strategy groups, the preference for these two instructional factors appeared independent of the learning strategies of the CareerTech students. However, as shown in Table 4, there were several differences among the ATLAS learning strategy groups regarding their preferences for other instructional techniques. While these observed differences may have been biased by the

elimination of unclassifiable responses, these differences are nevertheless consistent with the ATLAS theory base.

The study found that the use of audio/visual materials was most important to the CareerTech navigators (18% of positive navigator responses) and least to problem solvers (9% of problem solver positive responses). This finding was unexpected in light of

Table 4

Instructional Methods Preferred/Liked by CTE Students

($N_{students} = 617$; $N_{responses} = 528$)

Instructional Method	Response	Navigators	Problem Solvers	Engagers	Totals
Hands-on instruction	frequency	55	82	93	230
	% of group	42%	49%	40%	
	% of total	24%	36%	40%	44%
Clear and thorough explanations	frequency	30	33	40	103
	% of group	23%	20%	17%	
	% of total	29%	32%	39%	20%
Use of visual & audio-visual materials	frequency	23	15	22	60
	% of group	18%	9%	10%	
	% of total	38%	25%	37%	11%
Sense of humor & making learning fun	frequency	8	7	36	51
	% of group	6%	4%	16%	
	% of total	16%	14%	71%	9%
Group activities, interactivity, & class involvement	frequency	9	13	25	47
	% of group	7%	8%	11%	
	% of total	19%	28%	53%	9%
Relating content to real life through anecdotes & stories	frequency	6	16	15	37
	% of group	4%	10%	6%	
	% of total	16%	43%	41%	7%
Totals	frequency	131	166	231	528
	% of total	25%	31%	44%	

problem solvers' assumed affinity for the use of multiple resources and learning options. Ausburn and Brown (2005a) hypothesized that this finding may reflect problem solvers' tendency to seek out information from a variety of sources of their own choosing rather than confining themselves to information from a single source, such as a teacher.

Other patterns that were consistent with the ATLAS construct and theory base also appeared among the ATLAS learning strategy groups of CareerTech students. The engagers identified an instructor's sense of humor and ability to make learning fun as important to their learning and contributed 71% of the total favorable comments received for this instructional factor. When analyzed within each strategy group, an instructors' sense of humor accounted for 16% of the engagers' positive responses compared to only 6% of the navigators' positive responses and 4% of the problem solvers' positive responses. This result seemed consistent with the ATLAS theory base which describes engagers as enjoying learning experiences and seeking a sense of fun. The navigators' contribution of only 16% of the total positive comments towards this instructional factor also accords with the ATLAS theory base which suggests that navigators separate emotions from learning and the learning message from the messenger (Conti & Kolody, 1999). The contribution by the problem solvers of only 14% of the total positive comments about this instructional factor may reflect their greater desire for a learning environment that allows them personal freedom to pursue their own learning choices rather than one featuring a "fun" or charismatic teacher. (Ausburn and Brown, 2005a).

Working in groups and having opportunities for interaction with others were also mentioned frequently by the CareerTech engagers (11% of positive engager responses; 53% of the total favorable comments for this factor), but less often by the problem solvers (8% of positive problem solver responses; 28% of the total favorable comments for this factor) and the navigators (7% of positive navigator comments; 19% of the total favorable comments for this factor). This result is also consistent with the ATLAS theory base which suggests that engagers, who enjoy

sharing their accomplishments and are skilled at networking, will value working in groups. In accord with ATLAS theory, problem solvers, on the other hand, are likely to find group work appealing only if they can take the lead and guide the group to creative solutions. The CareerTech navigators, as ATLAS theory predicts, were the group who least liked working in groups. This fit their ATLAS description as a group that values control and tends to follow a step-by-step, logical path to learning. Consequently, navigators may find group work frustrating and a waste of time. (Conti & Kolody, 1999).

Another result found in the CareerTech study which was also consistent with previous ATLAS research concerned the instructional technique of relating learning content to real life and personal stories. This instructional factor was mentioned most frequently by the CareerTech problem solvers (10% of positive problem solver responses; 43% of the total favorable comments for this factor) and engagers (6% of positive engager responses; 41% of the total favorable comments for this factor) but appeared to be less important to the CareerTech navigators (4% of positive navigator responses; 16% of the favorable responses for this factor). This finding accords with the ATLAS theory explanation that problem solvers value stories and personalized recounting of information as a method of learning. The fact that the CareerTech navigators did not express a strong liking for stories as a method of instruction also agrees with ATLAS theory which depicts navigators as task-oriented and focused on efficiency. ATLAS theory suggests navigators may be put off by stories that they view as irrelevant and pointless (Ausburn & Brown, 2005a; Conti & Kolody, 1999).

The CareerTech students' comments concerning what teachers do that they disliked or they felt made learning harder or less pleasant also revealed some clear patterns. This question drew 645 comments. Of these, 273 (42%) were classifiable through constant comparison methods into five instructional factor categories and were included in this analysis. The remaining 372 (58%) were unreadable, uninterpretable, unrelated to instructional techniques, or unique items with no useful frequency and were therefore omitted from this analysis. Thus, the "disliked techniques" question drew considerably more

responses that were unique or irrelevant than did the “liked techniques” question.

The five clearly identified disliked instructional factors were: (1) failing to provide clear and adequate explanations ($f=95$; 35% of usable negative responses), (2) lecturing without involving students ($f=73$; 27% of usable negative responses), (3) making students sit and read ($f=66$; 24% of usable negative responses), (4) assigning too much homework ($f=20$; 7% of usable negative responses), and (5) reading to students from textbook or other resources ($f=19$; 7% of usable negative responses).

As with the positive instructional factors, the three ATLAS groups of CareerTech students contributed to the negative comments in proportions similar to their representation in the sample. Table 5 details the responses of the three ATLAS groups on the five disliked instructional factors.

The three instructional factors which received the most frequent negative responses were (1) failure to provide clear and adequate explanations, (2) lecturing without involving students, and (3) making students sit and read. These three instructional techniques were mentioned most frequently as negative factors by students in all three of the CareerTech ATLAS groups and thus appeared to be independent of learning strategy. These factors match the students’ desire for clear and thorough explanations (see Instructional Method 2, Table 4) and preference for active rather than passive learning (see Instructional Method 5, Table 4).

At the same time, differences between the CareerTech ATLAS learning strategy groups’ dislikes also appeared, all of which conformed to the ATLAS theory base. Navigators, who ATLAS theory characterizes as achievement oriented, submitted the fewest negative comments about homework (5% of negative navigator responses; 15% of the total negative responses for this factor) and expressed the least dislike of being read to (2% of negative navigator responses; 5% of the total negative responses for this factor). In contrast, the problem solvers (10% of negative problem solver responses) and the engagers (7% of negative engager responses) provided more comments stating they disliked being read to (47.5% each of the total negative responses for this factor). Engagers also contributed more comments expressing

Table 5
Instructional Methods Disliked by CTE Students
 ($N_{students} = 617$; $N_{responses} = 273$)

Instructional Method	Response	Problem			Totals
		Navigators	Solvers	Engagers	
Failure to provide clear & adequate explanations	frequency	23	30	42	95
	% of group	39%	35%	33%	
	% of total	24%	32%	44%	35%
Lecturing without involving students	frequency	17	23	33	73
	% of group	29%	27%	26%	
	% of total	23%	32%	45%	27%
Making students sit and read	frequency	15	18	33	66
	% of group	25%	21%	26%	
	% of total	23%	27%	50%	24%
Assigning too much homework	frequency	3	6	11	20
	% of group	5%	7%	8%	
	% of total	15%	30%	55%	7%
Reading to students from textbooks	frequency	1	9	9	19
	% of group	2%	10%	7%	
	% of total	5%	47.5%	47.5%	7%
Totals	frequency	59	86	128	273
	% of total	22%	31%	47%	

their dislike of homework (8% of negative engager responses; 55% of the total negative responses for this factor) as well as a large number of comments indicating a dislike for the solitary activities of sitting and reading (26% of negative engager responses; 50% of the total negative responses for the factor).

This distribution of dislikes over the three learning strategy groups also meshes with the theoretic descriptions of the three learning strategy groups formulated by the ATLAS researchers. Navigators, the ATLAS research suggests, concentrate on learning goals rather than on an instructor's delivery methods. Their emphasis on goals may explain the fewer

negative comments by the CareerTech navigators concerning homework and having instructors read to them. The fact that the CareerTech problem solvers submitted more negative comments about homework and having an instructor read to them corresponds to the ATLAS researchers finding that this group prefers to explore a wide variety of learning methods and may therefore balk at limited choices imposed by a teacher. The CareerTech engagers' aversion to homework, being read to, and the solitary activity of sitting and reading appears to bolster the ATLAS findings that this group of learners finds it difficult to learn in situations that do not involve them actively and personally (Ausburn & Brown, 2005a; Conti & Kolody, 1999).

Comparisons with Other ATLAS Studies

Previous Studies of Similar Populations

Because no previous studies have used the ATLAS test to specifically examine the learning strategies and instructional preferences of students in state career and technical programs, it was not possible to directly compare the results of the current study to those of other CTE student populations. However, several ATLAS-based studies of relatively similar populations were available for comparison. Using these studies as a comparative basis, the learning strategy distribution and instructional preferences of the CTE students closely resembled those of such non-traditional learners as non-high-school-completers returning to study (James, 2000), students in a two-year technical institute (Massey, 2001), first-generation American higher education students in a community college, (Willyard, 2000), and at-risk urban youths transitioning into adulthood (Shaw, 2004). As in all these studies, the CTE students in the current study were top-heavy with engagers. In addition, the studies of non-traditional students as well as this study of CTE students revealed that, regardless of their learning strategy, the study subjects preferred active and hands-on learning, teachers who care about their students, clear explanations and instructions, and friendly learning environments. Across all learning strategy groups they also reported a strong dislike for passive learning, long lectures, repetitive and restrictive

instruction (such as reading from a book or being read to), and impersonal approaches to teaching.

Specific preference patterns within each of the ATLAS learning strategy groups of the CareerTech study also paralleled some of the patterns reported by James (2000) and Shaw (2004) for the corresponding groups in their respective studies. Similar to the findings of the current study, both James and Shaw identified preferences among navigators for clear and thorough instructions, well organized lessons, and individual rather than group work. Problem solvers in the current as well as in the James and Shaw studies indicated that they liked to have learning method alternatives, freedom to do things their own way, and teachers who used personal examples in their instruction. Engagers in each of these studies indicated they learned best when allowed to learn with groups of people, when working on learning projects that they perceived as useful and worth their time, and when taught by teachers who demonstrated enthusiasm and humor and who treated their students with friendship and respect.

Follow-up Studies with Oklahoma CTE Students

Following this study, the authors conducted two additional studies to test the replicability of the current study's finding that engagers dominate the learning strategy distribution of CareerTech students in Oklahoma. Using an identical methodology to that used in this study, Ausburn and Brown (2005b) conducted a pair of field-based "snapshot" analyses of convenience samples provided by Oklahoma CareerTech teachers who were employing the ATLAS model in their instructional programs. In one follow-up study, the subjects consisted of 46 students (43 high schoolers and 3 adults) in a computer science program in a large urban CareerTech center. In this sample, engagers again dominated the ATLAS distribution. Of the 46 students, 15.21% were navigators, 17.39% problem solvers, and 67.40% engagers.

In a second larger and more structured study, Ausburn and Brown obtained ATLAS data on 251 CareerTech students in nine different program areas taught by 15 different instructors across Oklahoma. The results of this second study showed an

ATLAS learning strategy distribution of 26% navigators ($n = 66$), 27% problem solvers ($n = 67$), and 47% engagers ($n = 118$). Once again, this sample's distribution demonstrated the engager bias in the CareerTech students' learning strategy pattern and showed it to be significantly different from the general population norm ($\chi^2 = 27.22$; $df = 2$; $p = .000$). This follow-up study also provided additional ATLAS data for the cosmetology area, which had only token representation ($n = 3$) in the original study. The second follow-up study included 34 cosmetology students of whom 76% were engagers, thus confirming that in this CareerTech program engagers also dominate the learning strategy distribution.

The second of the two follow-up studies also gave credence once again to the perceived accuracy of the learning category placements of the ATLAS test. Of the 251 CareerTech students who participated in the second follow-up study, 204 reported on their perceptions of the accuracy of their assigned ATLAS learning strategy group. A total of 89% ($n = 181$) rated their placement as having some degree of accuracy. Eighteen percent ($n = 37$) felt it was very accurate, 46% ($n = 94$) perceived their placements as accurate, and 25% ($n = 50$) as fairly accurate. Only 11% ($n = 23$) rated their learning strategy placement as not very accurate (Ausburn & Brown, 2005b).

Conclusions and Recommendations

Several conclusions with implications for career and technical education can be drawn from this study and its follow-ups. First, it appears that CTE instructors can expect to find learners with all three ATLAS learning strategies in their classes, and that CTE students have some general instructional likes and dislikes that cut across all ATLAS learning strategy types. This study revealed several conditions and teaching techniques that may enhance the learning environment for CTE students. These include providing CTE students with hands-on learning activities, clear explanations, multiple learning resources, active rather than passive learning, applied learning related to real life experience, meaningful learning assignments and projects, and personal rather than formal learning environments. While many CTE instructors may believe that their students perform best

under these conditions, this study's findings lend empirical support to those informally-held beliefs.

These general instructional preferences also match those reported for other groups of non-traditional learners reported in recent ATLAS-based research. Some broad instructional guidelines appear to emerge from these studies that characterize the best practice of CTE instructors as members of a larger group of educators whose task it is to maximize the learning experiences of students who may not fit the traditional high-school-to-baccalaureate molds.

Although the finding of several general instructional likes and dislikes common to all three ATLAS types may assist CTE instructors in selecting instructional techniques that engage all their students, it would be an error to focus only on these universally-preferred techniques. A look at another finding of the study points out that this would not comprise a complete and effective instructional approach. The study found several variations among navigators, problem solvers, and engagers in their instructional likes and dislikes. These variations were consistent with both the ATLAS theory base and with the findings reported in dissertation studies with other populations of non-traditional learners (James, 2000; Massey, 2001; Willyard, 2000; Shaw, 2004). Previously cited research has indicated that students' motivation and learning performance generally improve when their learning preferences are used to differentiate and personalize instruction. Thus, in order to maximize the learning of all their students, CTE instructors will need to employ specific techniques that appeal to individual ATLAS learning strategy groups as well as general instructional techniques that engage CTE students across all learning strategy types.

To design personalized instruction that fits the preferences of individual ATLAS learning strategy groups will require that CTE teachers understand how each group approaches learning tasks and will necessitate that CTE teachers learn appropriate instructional methods for each group. Since it is the task of CTE teacher educators to equip CTE instructors with such knowledge, this has implications not only for CTE instructors but for CTE teacher education programs as well. The ATLAS learning strategies model could provide CTE teacher

educators with a learning tool to teach CTE instructors how to customize their instructional techniques for each ATLAS learning strategy type.

A key conclusion arising from this study and its follow-ups is that CTE students have a learning strategy distribution characterized by a predominance of the engager learning strategy, a distribution that differs from the general population. While the sampling used in the present study has limitations and raises cautions concerning generalizing its results, the study does corroborate the findings of other research with other non-traditional learner populations. In all of these non-traditional populations, engagers predominate. Taken collectively, this entire group of studies may identify an indicative pattern and suggests that engagers are the type of learner who tend to leave conventional secondary education and traditional higher education and turn instead to career and technical programs and other non-traditional educational options. For this type of learner, active, hands-on, collaborative, applied, and personalized teaching methods are preferable, and an adult education model based on ownership of learning outcomes, self-direction, and an emphasis on life experiences is typically appealing. This style of teaching is often missing in conventional education classrooms and in many courses in traditional higher education. It is, however, commonly found in career and technical education. In fact, such teaching is generally a hallmark of the CTE system. Findings from the current study may reveal some important answers to the questions of what type of learners CTE is most likely to attract and to why and how CTE curriculum and instruction are often more successful in meeting their needs. Results of this study also point to the particular importance for CTE teachers to understand the learning strategy of engagers and the instructional needs and preferences that accompany it.

While this research raises interesting possibilities and implications for CTE teachers, students, and teacher educators, the results must be re-tested and verified through replication and repetition. The researchers recommend further investigation through replication of this study with additional samples of CTE students drawn from a variety of locations and programs in a focused line-of-inquiry series of research. In addition, related

questions should be investigated. These might include identifying the distribution of the ATLAS learning strategies of CTE teachers as well as students; the effects on learning of matching teachers and students based on preferred learning strategy; the effects on teaching and learning of making teachers aware of the ATLAS learning strategies and their instructional implications; the effects of differentiated teaching methods based on students' preferred learning strategies; the effects of training students to recognize and work with peers with different learning strategy preferences; and the effects of training students to be adaptive in their selection and use of learning strategies.

The studies reported and cited here represent a step forward in exploring the learning strategy patterns and instructional method preferences and needs of CTE students. Knowledge of the instructional likes and dislikes of CTE students both within and across all learning strategy groups can serve as guidelines for instructional methods planning and training for teachers in the CTE field. By using the ATLAS model to help design effective instructional practices, CTE instructors and teacher educators may enhance the learning environment for all their students, whether navigators, problem solvers, or engagers.

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Perceived Demand for Online and Hybrid Doctoral Programs in Technical Education

Jim Flowers
Holly Baltzer
Ball State University

Data from the recurring Sloan-C snapshot of the status of online education in the US indicate that online education is becoming increasingly a part of the long-term goals and strategies of many institutions (Allen & Seaman, 2005). Fifty-nine percent of schools surveyed in 2005 indicated options for online education as a critical part of their long-term plan, up from 49% in the 2003 survey. Online enrollments increased 18% in 2004, with over 2.3 million students taking at least one online course in fall 2004.

However, online education is not growing uniformly across degree levels or program disciplines. Penetration rate is defined as the “proportion of institutions that offer a particular type of face-to-face course or program [and] provide the same type of offering online” (Allen & Seaman, 2005, p. 5). Online program penetration rates in 2005 were 29.9%, 43.6%, and 12.4% for bachelor’s, master’s and doctoral programs, respectively. But degree programs in education at public institutions were found to lag behind all six other major program areas analyzed by Allen and Seaman, with an online penetration rate of 30.4%, a finding which is paradoxical since online programs stem from educational innovation. Moreover, even though doctoral programs have lower overall penetration rates than other degree programs, the highest penetration rates for each level (associate’s, bachelor’s, master’s, and doctoral) were seen at doctoral institutions. One may conclude from this fact that it is at institutions offering doctoral degrees where most changes have occurred in transitioning to online education.

Flowers is Professor and Director of Online Education and Baltzer is Research Assistant in the Department of Technology at Ball State University in Muncie, Indiana. Flowers can be reached at jcflowers1@bsu.edu.

Technical education, defined here to include technology education and other areas typically covered under the career and technical education umbrella, has begun taking advantage of the online market by offering online education at the bachelor's and master's level (Bouchillon & Muga, 2005; Flowers, 2005). However, the critical need is at the doctoral level for technical education students who are enrolled in programs designed to promote research and to train faculty researchers (Reed, 2002; Brown, 2002). In his 2002 study, Brown focused on faculty searches in technical education. He found a 34% search failure rate in 2000-2001, which he contrasted to earlier studies that found failure rates of 24% in 1997-1998 and 27% in 1998-1999. According to Brown, the number of applicants per position in 2002 was 8.5, down from 9.6 in a 2000 study, and down from 17.3 in a 1987 study. In addition, Brown found that 75% of his subjects thought the applicant pool to be "inadequate" (Difficulty in Filling Positions, ¶ 1), concluding, "We should seek ways to increase numbers of qualified applicants for faculty positions." (Discussion and Conclusions, ¶ 5). His study provides evidence that technical education needs more doctoral graduates. If this need is to be met, the field may be positioned to benefit from a new way of reaching and educating those doctoral students. In other fields, both online doctoral programs and hybrid programs (i.e., those combining distance and face-to-face delivery) have appeared (Adams & DeFleur, 2005). Although some doctoral programs in the technology education field include distance education elements, it is ironic that a field based in technology has lagged behind non-technical fields in taking advantage of the new technologies available for delivering doctoral studies online.

Study Purpose

While there has been an analysis of online learning needs in technology education (Flowers, 2001), there has been no study focused specifically on online doctoral education in technical education. In order to provide information for institutions planning to implement an online or hybrid doctoral program in technical education, a four-part study was designed to characterize

1. The perceived need for new hires and hiring attitudes towards those who earned their doctoral degree online (analyzed through data collected from a survey of coordinators and chairs of bachelor's and master's programs in the field) (Flowers & Baltzer, 2006);
2. The perceived demand for an online or hybrid doctoral program in technical education (gathered through a survey of perspective students);
3. The status of current doctoral programs in technical education (determined from a series of telephone interviews with doctoral program directors at selected universities); and
4. Models for online and hybrid doctoral education (designed with input from a series of telephone interviews with directors of online or nearly online doctoral programs, mostly in other fields).

This article details the second phase of this study. The purpose is to characterize the reported demand for online and hybrid doctoral programs in technical education and the attitudes and recommendations of prospective students. It also explores attitudes held toward this type of degree by those who have completed a traditional face-to-face doctoral degree in the field of technical education.

Methods

Sample

The population for this study was intended to be those people currently involved in technical education and related fields as evidenced by their membership in the International Technology Education Association (ITEA), the American Technical Education Association (ATEA), or the Association for Career and Technical Education (ATCE). Following human subjects' protocol approval, invitations to participate in an online survey and facts informing subjects of their rights were e-mailed by the investigators in February 2006 to all 2737 professional members and 398 student members of ITEA. Seventy-five of these e-mails were rejected as undeliverable. A similar notice was sent by ATEA staff on behalf of the investigators to what the ATEA reported as "the approximately 700 members of ATEA" for whom there was a

working e-mail address. ACTE declined the investigators' request to survey their members. Due to this fact, the results obtained are skewed toward technology education because of the large number of respondents from ITEA.

The survey sample was partitioned into those who had earned a doctoral degree and those who had not. Survey respondents without a doctoral degree were asked how important it was to them to earn a doctoral degree. They rated their responses to this item on a five-point Likert scale ranging from 1- "not important" to 5- "extremely important." This question was used to filter out those respondents for whom pursuing a doctoral degree was of moderate or low importance. Only data from subjects without a doctorate who rated the importance of obtaining a doctoral degree as a 4 or 5 were used in the survey analysis. This was deemed appropriate in order to attain a clearer picture of demand from those who are more likely to enroll in a doctoral program rather than attempt to generalize to a population which includes those who consider undertaking doctoral studies unimportant. In this study, the non-doctorate group was used to characterize a "before" attitude of potential students, and the doctorate group to characterize an "after" attitude of those who had completed a face-to-face doctorate some time in the past.

Instrumentation

The researchers used an online survey method of data collection in order to maximize sample size while minimizing the time and cost required for data entry as well as minimizing data-entry errors. A preliminary instrument was pilot tested with a number of individuals whose highest degree was either a doctorate, a master's, or a bachelor's. The pilot test indicated that having a question worded in both the past and future tense on a single instrument was confusing. This led to a decision to divide the survey into two separate instruments, one comprised of 17 items for survey subjects with a doctorate and 23 items for those without a doctorate. The result was two shorter, more reliable instruments.

The survey instruments included items on demographics concerning job title, highest level of education earned, years to

retirement, and number of online courses taken. One section examined motivation for doctoral study with items concerning motivating factors and the perceived benefits of obtaining a doctoral degree. Another survey item investigated the relative appeal of online versus face-to-face doctoral programs. Those without doctorates were also asked a series of questions about their perceived likelihood of enrolling in doctoral programs based on the differing methods of delivery—face-to-face, hybrid, or online. Based on Rogers (2002) findings that the three most influential barriers to doctoral study perceived by technology teachers were time commitments, location to university, and financial constraints, these three factors formed the basis of several items on the current surveys pertaining to doctoral study obstacles.

Data Analysis

The overall return rate in this study was 14% (532 of 3760). Seventy respondents had doctorates (DOC group), and 462 did not. Of those not having doctorates, 181 indicated a desire to pursue a doctoral degree and made up the ND group. The data from the 281 respondents who did not indicate a desire to pursue a doctorate were discarded. Participates from ATEA made up 20% of the DOC group and 6% of the ND group, and ITEA participates made up the remaining 80% of the DOC and 94% of the ND groups respectively. Comparisons within and between samples were performed in order to better characterize attitudes and demand. Taking a conservative approach, non-parametric procedures for ranks were performed (using SPSS software) since normality could not be assumed. All tests for significance were two-tailed and considered to be significant at the $p < .05$ level. Analysis of open-ended items was performed by reading and classifying all responses, determining a general attitude for the majority of the respondents, and in some cases the attitudes of a strong minority, and choosing quotations that best portrayed the investigators' interpretations of those attitudes.

Results and Discussion

Some considerations must be kept in mind when reflecting on the study findings. First, because the sample was

self-selected, it is likely that those who felt strongly about online doctoral offerings, positively or negatively, may have responded in greater numbers than those with less extreme opinions. Second, while the results are the respondents' views on several factors that characterize demand for an online or hybrid doctoral program, their views do not predict the demand of the entire population. Lastly, this survey was conducted in the spring of 2006 on a topic that is in constant flux.

Demographics

The majority of the ND group of respondents consisted of secondary school technology education teachers, with minorities of lecturers, professors and graduate assistants. Most of the ND group had completed master's degrees (74% of the sample), while 24% had earned bachelor's degrees and the remaining 2% had earned degrees below the bachelor's level. Of the 61 ND respondents currently seeking a degree, 29 (48%) were enrolled in a master's program, 19 (31%) in a doctoral program, 3 (5%) in a bachelor's program, with the remaining 10 (16%) enrolled in education specialist or other unspecified programs. Most of the DOC respondents were employed as professors or deans of various ranks. For the DOC group, the mean number of years since the doctorate had been earned was 15 years.

The ND group's median number of years until retirement was in the 21-25 year range, and the median for the DOC group fell between the 5-10 and 11-15 year ranges. Both groups were asked how many classes they had taken online. The average for the ND group was calculated at 2.7 ($n = 173$). However, this is an under-estimation for this group since there were several answers such as "many" and "lots" that were not included in the calculations. The average number of online classes taken by the DOC group was 1.1 ($n = 69$). Using a Mann-Whitney U test, it was found that the ND sample had taken significantly more online classes ($z = -3.051, p = .002$) than the DOC group.

Motivation

The survey included questions pertaining to a subject's perceptions of the benefits of earning a doctoral degree, either in the past or the future. Respondents were asked how much a

doctoral degree would help or did help them advance in their current position. On a five-point Likert scale ranging from 1-“not at all” to 5-“very much,” the ND group responded with a mean of 4.0 ($n = 181$) and the mean for the DOC group was 4.1 ($n = 68$). This indicates both groups believed that earning a doctorate will be or was more than of modest benefit to them in their current positions.

Non-doctorates were also asked what their primary motivation would be for seeking a doctoral degree. The answer choices were “pay raise” “status/position advancement at current employer,” “to be eligible for a different job,” “personal fulfillment,” and “other” with multiple selections possible. (See Table 1.) Upon analysis of all choices except “other,” a Cochran’s Q Test identified a significant difference between at least two of the answer choices ($Q = 46.254$, $df = 3$, $p < .001$, $n = 181$). Upon pair-wise analysis, the critical level of significance ($p = .05$) was divided by 6 using a Bonferoni approach to control Type I error, resulting in $p = 0.008$ for each of the six comparisons. This analysis showed “personal fulfillment” and “eligibility for a new job” to be a significantly greater motivation than “pay raise” or “status.” However, no difference was found between “pay raise” and “status,” or between “personal fulfillment” and “eligibility for a new job.”

Table 1

Q Statistics for Pairwise Comparison Among Motivations for Doctoral Study for the ND Group Using a Cochran’s Test ($n = 181$). †

	Status	New job	Personal fulfillment
Pay raise	1.976	23.211***	11.215***
Status		28.582***	16.200***
New job			2.586

† Frequencies for each motivation: New job (126), Personal fulfillment (111), Pay raise (84), and Status (75).

*** $p \leq .001$

Cochran's Q was similarly used to identify any significant differences between two or more of the motivations in the DOC groups' responses to the same question (asked in the past tense). The results for the DOC group are shown in Table 2 with $Q = 45.655$, $df = 3$, $p < .001$, $n = 70$. Pair-wise comparisons of the choices in the DOC group revealed the same significant differences found in the ND group, also at the $p = .008$ level.

Table 2
Q Statistics for Pairwise Comparison among Motivations for Doctoral Study for the DOC Group Using a Cochran's Test (n = 70). †

	Status	New job	Personal fulfillment
Pay raise	1.800	27.457***	26.471***
Status		15.244***	16.000***
New job			.029

† Frequencies for each motivation: New job (46), Personal fulfillment (45), Status (21), and Pay raise (15).

*** $p \leq .001$

Obstacles

Rogers (2002) investigated reported obstacles to completing a doctoral degree in technology education. The present study expanded on the top three obstacles revealed in that study (time commitments, location to the nearest university, and financial costs) in order to gain a better understanding of how critical each obstacle was. The present study confirmed the findings of Rogers, with all three obstacles rated as "moderate" by the ND group, but with no statistically significant differences found among them.

Respondents were asked how a university might help a student overcome the obstacle that was most insurmountable for them of the three. Most of the DOC group's suggestions centered on alleviating the financial burden on the student and allowing more flexibility in the time allotted for completion. The ND

group's responses to the same question overwhelmingly recommended that the university find ways to make a program more flexible regarding time and space for the student, although this response might have been influenced by attention in the survey instrument to online education. There was also a strong indication of the need to make doctoral programs more attainable financially. Interestingly, there were also responses from both groups indicating that the student alone, not the university, is responsible for creating the conditions under which it is possible to pursue an advanced degree. One response from the DOC sample illustrates this:

A doctorate should be neither cheap nor easy—the top professionals in our field should ONLY be those who are willing to invest enormous amounts of personal time and resources and forgo self interests for a few years...

The survey posed several questions about financial concerns. When asked whether they would be more likely to consider an online program if it offered reduced tuition, 90% ($n = 181$) of the ND group said yes. However, when the DOC group was asked if they would have been more likely to consider an online doctorate if reduced tuition had been offered, only 41.1% ($n = 68$) said yes. Those in the DOC group are understandably less likely than the ND group to consider a less costly doctoral program since they are among those who were able to overcome the financial obstacles in obtaining a doctorate, possibly with the help of tuition waivers from assistantships that might have made the cost of tuition irrelevant to the student. Also contributing to this result was the fact that doctoral degrees for this sample were earned, on average, 15 years ago, when online doctorates were not an option. On the other hand, the ND result may be due in part to recent increases in tuition rates.

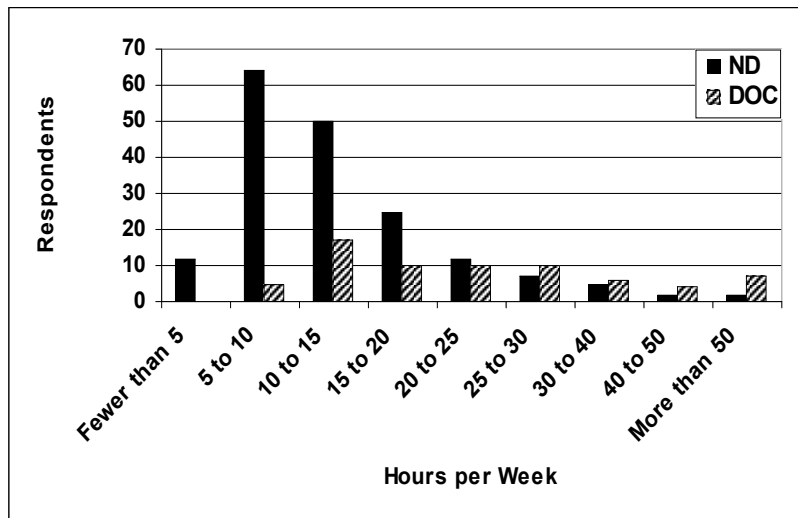
Questions on the survey asked both groups whether they would be, or were, limited to an institution that awarded graduate assistantships to students pursuing a doctorate. Thirty-four percent ($n = 180$) of the ND group said yes, whereas 51.5% ($n = 68$) of the DOC group said yes. This item may indicate that many in the ND group do not wish to leave or postpone their already established careers in order to pursue a doctoral degree, possibly making the time constraints involved in fulfilling a

graduate assistantship a deterrent for these individuals. Hence this new set of potential students should be recognized as established professionals by those offering doctoral programs in technical education. Furthermore, this item suggests this group is still financially constrained when attempting to pursue doctoral studies, but that increased graduate assistantships may not be the best way to help address this concern.

The survey posed a more detailed question pertaining to the time commitments required to earn a doctorate degree. Both groups were asked how many hours per week, not during the summer months, they would be able to spend, or did spend, on doctoral class work. The results can be seen in Figure 1. For the DOC group, the median number of hours per week they had spent doing class work while pursuing a doctorate was reported as 20-25 hours ($n = 69$), whereas the median number of hours that the ND group indicated that they could spend on doctoral class work was 10-15 hours ($n = 181$). Results from a Mann-Whitney U test for a between-groups comparison, showed that the DOC group

Figure 1

Total Hours Per Week the Respondent Could/Did Devote to the Pursuit of a Doctoral Degree.



indicated that they spent significantly more hours per week doing class work than the ND group indicated they would be able to spend ($z = -6.806, p < .001$). The account from the DOC group was more realistic, possibly because they had experienced how much time doctoral studies actually require. The responses to this item suggest that individuals similar to the ND group may be more able to enroll in part-time, rather than full time, doctoral programs and that flexibility in time commitments should be considered by institutions intending to attract these doctoral candidates.

Appeal

One means of increasing program flexibility and helping reduce tuition costs is to add online elements, including courses or even entire degree programs. This survey documented the appeal reported by the study participants for an online doctoral program. All subjects were asked, "Compared to a face-to-face doctoral program, how much less or more appealing is an online doctoral program?" Respondents placed their answer choices on a five-point Likert scale ranging between 1-"much less appealing" and 5-"much more appealing." The resulting data were tested for significance against the midpoint of the scale (i.e., neutral) using a Wilcoxon Signed Ranks test. The ND sample indicated that the appeal of an online doctoral degree over a face-to-face degree was significantly greater than neutral (mean = 3.71, $z = -6.244, p < .001, n = 180$). In contrast, the DOC sample indicated that the appeal of an online doctoral degree over a face-to-face degree was significantly less than neutral (mean = 2.24, $z = -3.801, p < .001, n = 68$). These results demonstrated a strong dichotomy between those who have and those who have not completed a doctoral program when considering the appeal of an online doctoral degree. Despite the appeal reported by possible prospective students of online doctoral programs, if those in a position to create such offerings do not find them appealing there may be little chance online doctoral programs will be created.

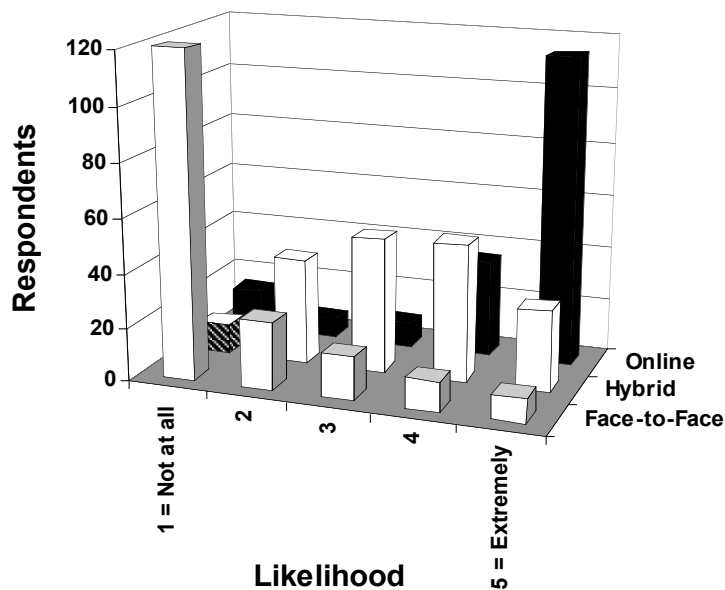
Likelihood to Pursue

The survey asked the ND group three questions concerning their likelihood of pursuing a doctoral degree by three different

methods of delivery: face-to-face; hybrid (requiring several on-campus visits but no extended stay); and completely online (no extended on-campus visits). Survey participants used a five-point Likert scale ranging between 1-“not at all likely” and 5-“extremely likely” to respond to each question. A Wilcoxon Signed Ranks test showed the reported likelihood of pursuing a face-to-face doctoral degree was significantly lower than moderate, or 3.0 (mean = 1.70, $z = -9.952$, $p < .001$, $n = 181$). The reported likelihood of pursuing a hybrid doctoral degree and a doctoral degree that required no on-campus visits were both

Figure 2

Reported Likelihood for ND Group of Pursuing a Doctoral Degree by Delivery Method



significantly above moderate (means = 3.28 and 4.25, $p = .001$ and $< .001$, respectively, $n = 181$), as seen in Figure 2. Thus, a decrease in the required on-campus time increases the reported likelihood of doctoral enrollment.

It is notable that 150 individuals indicated the top two levels (4 or 5 on the Likert scale) of likelihood to pursue a doctoral degree that requires no campus visits, with 114 of those individuals reporting they were “extremely likely.” In contrast, those individuals indicating the top two levels of likelihood for a hybrid program numbered 81, with 30 indicating “extremely likely.” This number fell to 20 respondents indicating the top two levels of likelihood to pursue a face-to-face doctoral degree, with only 9 indicating “extremely likely.” These numbers suggest a strong demand for completely or partially online doctoral programs.

Respondents' Comments

Another section of the survey asked respondents to include any additional comments that might help clarify the demand for an online doctorate in fields related to technical education. The ND group's views varied through an entire spectrum from greatly supportive, to totally against online doctoral programs:

- I think it is an excellent idea!!!
- I consider this the promotion of another means of acquiring [*sic*] something that will mean nothing. [These are] people that want the honor without the sacrifice and schools willing to bastardize the value for the sake of commercial appeal and greater revenues.

However, the majority of respondents fell somewhere in the middle, with a cautious, but not completely negative attitude towards the idea of an online doctoral degree in technical education. Areas of concern included the quality and accreditation of the program, financial constraints, and the loss of student-to-student interaction. Most respondents seemed to think a partially online, or hybrid degree, would be a better solution:

- A program [where] core course work could be completed online and elective course work was completed in workshops and summer residencies would be ideal for

many working student/educators.

- Online degrees may have an inherent debate surrounding them as to the validity and integrity of their promise. Too much is lost if the entire degree/course is online...

In contrast, the comments of the DOC group were mainly negative. In general, they doubted that the quality of an online program could match that of a face-to-face degree:

I am aware there is potential for several people to pursue [*sic*] an on-line doctoral program. How will this on-line program prepare the graduates for the professorship without mentorship? Will this only be a doctoral degree in name or will it be quality? If you are going to compete with the current doctoral programs then you need to insure there is quality and the product needs to be equal or better...

There were also some negative feelings expressed from this group concerning job eligibility for a person who had earned their doctoral degree online:

I sense that the main goal of online programs is to mass produce graduates as quickly and efficiently as possible. I feel any program that is 100% online cannot possibly be as effective as one that involves face-to-face interactions with colleagues UNLESS the goal is to produce graduates who will teach online courses exclusively.

This again speaks to the perceived lack of quality in an online program but also hints at a potential willingness to have at least some online elements, as long as face-to-face contact is not completely eliminated. There were also a few supportive responses from this group, mainly indicating that online education may help address the need for a greater supply of professors and researchers in the technical education field:

I recognize the need for leadership in our profession (and others) and hope the on-line experience can provide the human-to human experience(s) necessary...

Both the ND and the DOC groups expressed concerns about the different attributes of online doctoral programs versus face-to-face programs. Issues dealing with the quality of the program and the perceived lack of contact with professors and other students predominated these concerns. In their comments,

the ND group was a bit quicker to endorse online doctoral programs than the DOC group, but again, the ND group seemed to lean more toward a hybrid version. However, even with the reservations, overall, these results indicate that many of the professional association members surveyed recognize the value of a new avenue for pursuing a doctoral degree in technical education.

Summary and Conclusions

Results of this study show that there is demand from prospective students for online or partially online doctoral programs in technical education. In this study, 150 of the 181 ND respondents reported they are likely to pursue an online doctoral degree. Also, 81 of the original 181 said they are likely to pursue a hybrid doctoral degree. While this is not a representative sample and cannot be generalized to the entire population, the responses of these individuals are evidence of demand for such programs.

At the same time, there are serious concerns about the quality of online programs in general. Some of these concerns may be alleviated for potential students if a program is regionally accredited under standards that include guidelines for distance education programs (The Higher Learning Commission, n.d.). Despite the existence of these guidelines, there is still unease about the quality of accredited online doctoral programs among higher education faculty (Adams & DeFleur, 2005) and those seeking jobs in technical education at the university level may find an online doctorate a disadvantage in the eyes of those making hiring decisions (Flowers & Baltzer, 2006). Future providers of online or hybrid doctoral degrees should attempt to insure that their programs have sufficient quality to be valued outside of their own institution so that their graduates are considered on a par with other prospective employees. Providers should take steps to document program quality, and disburse that information widely.

The survey revealed that the ND and DOC groups had many similarities. The primary motivations of both groups for earning a doctoral degree were personal fulfillment and job eligibility. Both the ND and DOC groups agreed on the perceived benefits of a doctoral degree. The ND group's perceptions of the

benefits they anticipated a doctoral degree would bring them corresponded to the benefits that the DOC group reported the degree had, in fact, provided them.

Although there were similarities between the two groups, this survey revealed several key differences as well. The survey disclosed a discrepancy between the number of hours prospective doctoral students reported they would be able to devote to coursework, and the number of hours actually invested by those who have completed a doctoral program. This is one of several factors related to time commitment, which was found by Rogers (2002) to be the most severe barrier reported to enrollment in a doctoral program in technology education. Also contributing to time commitment concerns are residency requirements, years to complete a degree, and time lost in transportation. Online and hybrid programs may be effective in addressing some factors related to time commitments, though any quality doctoral program would necessarily entail substantial commitment by serious students.

The survey question concerning graduate assistantships reveals another key difference between the ND and DOC groups. The low number of prospective students in the ND group (34%) who reported they would be limited to an institution that offered graduate assistantships, along with concerns regarding location, calls on doctoral degree providers to consider a potential pool of students who may be atypical compared to those in traditional, on-campus programs. Many may not want to give up their current positions to pursue a doctoral degree. The investigators argue that this group of potential doctoral students is not the same as a group of doctoral students seeking face-to-face degrees, and their different concerns should be addressed if they are to be attracted to doctoral studies.

The following recommendations are offered for doctoral degree providers:

- Quality assurance for online education must be rigorous.
- Online elements might be best incorporated as a hybrid degree.
- Providers should realize that the population of those who may be able to pursue an online or hybrid degree

has different characteristics than those who attend on-campus programs.

- Greater time flexibility will likely be attractive to online doctoral students, both in time allowed for completion of the degree and in the academic calendar.
- Eligibility for a new or advanced position and the personal fulfillment from doctoral study should be emphasized in marketing, though with considerations concerning the view some in higher education might have as to the acceptability of an online doctorate.

The four-phase project exploring online doctoral degree programs, of which this is the second part, will next investigate current doctoral programs in the field of technical education and explore models for online/hybrid doctoral program delivery. Other researchers are encouraged to further study online elements in technical education and explore how they can be best incorporated into their own institutions' programs.

Acknowledgments

ITEA, ATEA, ACTE, CTTE Research and Teacher Preparation Committees, Dr. James Jones, Pilot Testers, and Survey Respondents

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Developing an Effective Workforce through Instructor Training

Richard A. Walter
Pennsylvania State University

Career and technical educators have long recognized the fact that a highly skilled craftsperson is not necessarily a highly skilled instructor of that craft. "Experience has shown that a trained instructor can do a much better instructing job than an untrained man, no matter how competent that man may be in his trade or on his job" (Allen, 1919, p. 22). In the belief that the key to a productive, efficient workforce lies in high quality training for journeymen and apprentices, the Carpenter's International Training Fund (CITF) partnered with the Workforce Education and Development Program (WF ED) of Pennsylvania State University in an effort to improve the quality of workforce education.

Background

In the fall of 1991, representatives of the CITF contacted a WF ED faculty member and expressed their interest in conducting an international training seminar that would focus on the professional development of their instructors. The initial discussions centered on issues of improving the effectiveness of the apprenticeship-and-journeymen instructors, who were employed throughout North America by Joint Apprenticeship and Training Committees. During the discussions, it became apparent that the CITF representatives hoped to fulfill three objectives with the planned seminar: 1) Enhance the content knowledge of their instructors with technical workshops demonstrating new products and processes; 2) Enhance their instructional performance through academic workshops focused on essential teaching skills; and 3) Enable the participants to earn college credits applicable to the adult education certification requirements enacted by several states.

Walter is Associate Professor in the Program of Workforce Education and Development at Pennsylvania State University in University Park, Pennsylvania. Walter can be reached at raw18@psu.edu.

As a result of the initial planning session, the first week-long International United Brotherhood of Carpenters and Joiners Union (UBC) Instructor Training Workshop was held in May 1992 at a St. Louis, Missouri UBC Training Center. Eighty-seven participants attended this first workshop, which consisted of a mixture of technical seminars taught by a select group of UBC members, and multiple sections of an academic seminar taught by WF ED faculty. The design of the academic seminar reflected needs that had been identified by CITF personnel, and it provided participants one semester-hour of credit through Penn State's Office of Continuing and Distance Education. From feedback provided through on-site evaluations as well as the follow-up assessments conducted during the summer of 1992, the CITF personnel revised their original intentions of conducting periodic events and instead, immediately begin planning a series of annual workshops along with several train-the-trainer sessions for the UBC personnel who were selected to serve as instructors for the future technical seminars.

The St. Louis training center continued to be the site for the annual workshops from 1993 through 1996. Each year the instructional content for the technical and academic seminars was revised based upon feedback from the previous year and on needs identified by the CITF staff. Members of the Coordinators International Training Advisory Group, who are selected throughout North America by UBC district vice presidents as regional representatives of the UBC Training Coordinators, also offered advice and suggestions for the content of the annual workshops. By the time of the 1996 workshop, the relevance of the content, the increasing acceptance of the philosophy that high-quality training is essential to a productive workforce, as well as a shift in scheduling of the workshop from May to August, resulted in the number of participants growing from the original 87 to 290.

This combination of factors, combined with the UBC's continuing commitment to ensure a productive workforce, prompted several changes in the instructor training program. Along with a change in location for the workshops, the workshops' intended outcomes were re-examined and the strategies for attaining them revised.

Outcomes and Strategies

Although the initial three workshop objectives that had been identified in 1991 continued to be addressed in the annual workshops, by 1995 the members of the Coordinators International Training Advisory Group decided to seek ways to repackage and more effectively market its instructor training to the membership. Subsequent discussions with the CITF staff and WF ED faculty members led the Coordinators International Training Advisory Group to establish the Carpenters Instructor Certification Program (1996) with the intention to "...develop a framework of certification standards that assure that Carpenters Apprenticeship instructors will have the necessary competencies to meet the training demands of the industry now and in the future" (p. 1). The program consisted of three levels of instructor certification, each requiring a combination of technical, safety, and academic training. However, rather than awarding one semester-hour credits through the workshops' academic seminars, the members of the Coordinators Advisory Group selected six three-credit undergraduate courses for inclusion in the certification program. These were

- WF ED 105 Integrated Curriculum Implementation – Occupational analysis for instructional planning: emphasis on instructional methods to deliver a competency-based program in an integrated learning environment
- WF ED 106 Program and Facilities Management – Organization and management of learning laboratory to facilitate the delivery of a competency-based program in a safe environment
- WF ED 207w Assessment Techniques – Assessments, recording, and reporting of learning in an integrated competency-based vocational education system
- WF ED 270 Introduction to Industrial Training – Overview of the training profession. Introduction to economic and psychological foundations. Examination of relationship of industrial training to education
- English 015 - Instruction and practice in writing expository prose that shows sensitivity to audience and purpose

- Speech 100 - Introduction to speech communication: formal speaking, group discussion, analysis and evaluation of messages

These specific courses were selected because they constituted the requirements for new teachers to secure Vocational Instructional I certification in Pennsylvania and were equivalent to the adult instructor requirements established by other states in which UBC training facilities were located. To facilitate completion of the WF ED courses, UBC representatives contracted with Penn State's Office of Continuing and Distance Education for the development of customized versions of the courses to be delivered in a blended instructional approach of both on-site and distance delivery. Although the English and speech courses were already available through distance learning, equivalent courses from regionally accredited institutions were also accepted as fulfillment of the certification program requirements. Implemented in 1997, the certification program has been modified several times and now includes an additional course, WF ED 471 Training in Business and Industry, within the 2005 version as detailed in Figure 1.

Relocation of Training

By 1996, the number of workshop participants had grown to exceed the capacity of the St. Louis training center. Therefore, the 1997 and 1998 workshops moved to the larger UBC training center in Chicago. However, with 330 and 360 participants respectively, within those two years the attendance exceeded the capacity of even that training center to provide space for the technical and academic seminars. Other logistical problems grew with each year as well. Neither the St. Louis, nor the Chicago training centers were located near facilities with sufficient accommodations for housing and feeding the participants. Daily bus trips to and from the training centers through rush hour traffic consumed valuable workshop time. In addition, the use of the training center for the workshops disrupted the everyday functioning of the local training center. The five days of the seminars, as well as at least one additional day to prepare the center and another to return it to its normal configuration, stole

instructional time from the local's apprentices who normally used the facility.

Figure 1
Carpenters Instructor Certification Program

Level I Certification

Complete at least 10,000 OJT hours as a UBC member
 Complete one or more Carpenters International Training Fund Train-the-Trainer Technical Workshops
 Hold a valid first aid/CPR card
 Complete UBC/Penn State Academic workshop WF ED 105 (or equivalent)
 Complete UBC/Penn State Academic workshop WF ED 106 (or equivalent)

Level II Certification

Hold a Level I certification for at least one year
 Complete two or more Carpenters International Training Fund Train-the-Trainer Technical Workshops
 Complete one or more Carpenter International Training Fund Safety workshops (or equivalent)
 Maintain a valid first aid/CPR card
 Complete UBC/Penn State Academic workshop WF ED 207w (or equivalent)
 Complete either English 015 or Speech 100 (or equivalent)

Level III Certification

Hold a Level II Certification for at least one year
 Complete three or more Carpenters International Training Fund Train-the-Trainer Technical Workshops
 Complete two or more Carpenters International Training Fund Safety workshops (or equivalent)
 Maintain a valid first aid/CPR card
 Complete UBC/Penn State Academic workshop WF ED 270 (or equivalent)
 Complete UBC/Penn State Academic workshop WF ED 471 (or equivalent)
 Complete English 015 (or equivalent)
 Complete Speech 100 (or equivalent)

Maintain Level III certification by developing a "Personal Professional Development Plan" with their supervisor. The plan will be based on local needs and will include a minimum of one education course and one Safety Train-the-Trainer workshop every five years. The following Workforce Education courses are available from the CITF and meet the education requirement:
 WF ED 413 Vocational Education for Special Needs Learners
 WF ED 445 Vocational Guidance

Maintaining the quality of instruction also proved to be difficult given the over-crowding of existing classrooms and the use of temporary classrooms located in the shop area. As one instructor noted, the noise generated by 16 routers operating in the solid surface class on the other side of a temporary divider made thinking difficult and talking impossible in the print reading class he was supposed to be teaching. Although the move from May to August played a role in increasing workshop participation by enabling the attendance of instructors whose apprenticeship programs held an August break, others whose programs were still in session in August were excluded from attending.

These logistical problems necessitated a revamping of the annual workshop design and resulted in a two-part solution: 1) replace the single large workshop with several smaller regional workshops, at least temporarily and 2) build a training center dedicated to year-round training.

Commitment to Training

UBC personnel had engaged in discussions about the need for the construction of an International Training Center as early as 1996. However, the continuing success of the annual workshop format, as demonstrated by the attendance outgrowing the capacity of the largest existing facility, added new momentum for the plan. After consideration of several alternative sites, the decision was made in 1998 to locate the United Brotherhood of Carpenters International Training Center (CITC) in Las Vegas, Nevada. The ground-breaking ceremony for the \$22 million training center was conducted on September 28, 1999, followed a year and a half later by the grand opening ceremony on March 23, 2001.

Situated in a commercial zone south of McCarran International Airport, the CITC is a self-contained facility which eliminates the transportation, lodging, instructional, and other logistical problems that plagued the international seminars held in St. Louis and Chicago. The CITC includes 80,000 square feet of shop space; twelve 1200-square foot classrooms and six 600-square foot classrooms, all of which feature teaching stations equipped with audio/visual and computer instructional resources;

a 75-seat theater/classroom; a 300-seat meeting room; a cafeteria; 128 single occupancy dormitory rooms; and an exercise facility.

In 2002, a second building was added to the CITC to facilitate a week-long gas and steam turbine workshop for UBC millwrights. The turbine building includes a 20,000-square foot shop area; two 1100-square foot classrooms; a 6-bay welding shop; and a 1200-square foot maintenance shop.

Currently, the CITC curriculum includes more than 90 workshops that are scheduled from 1 to 12 times per year. Since 2003, the facility has enrolled an average of more than 5,000 students per year in its workshops. Costs for participating in the workshops including travel, lodging, food, and tuition are paid for through the Carpenter's International Training Fund which is supported by the \$.04 per hour of work paid into the fund by all members. As a result of its success, the CITC staff is already planning to double the number of dormitory rooms as well as add additional classrooms (D. Shoemaker, Personal Communication, August 2005).

Expanded Academics

As the future home of the Carpenter's International Training Center (CITC) took shape, planning to maximize its potential for professional and academic training was well under way. In August 2000, CITF personnel convened a train-the-trainer seminar for the UBC and WF ED annual workshops' instructors. The seminar included sessions on instructional techniques, planning the curriculum, designing the instructional spaces and classrooms, planning the schedule for existing courses, and considering the inclusion of additional technical, safety, and academic courses. From these sessions, came the recommendation that the following academic courses be added to the program:

- WF ED 413 Vocational Education for Special Needs Learners – Introduction to program modifications, supplementary services, and resources for special needs learners
- WF ED 445 Vocational Guidance – Problems and possibilities of vocational guidance; the field of guidance and guidance literature; methods of field-work; guidance techniques

- WF ED 471 Training in Business and Industry – Appraisal of training functions and development of competencies in work analysis, design, development, delivery, an evaluation of training

As with the earlier WF ED courses, these three were customized for the UBC through Penn State's Office of Continuing and Distance Education and designed for delivery in a blend of on-site, classroom-based instruction followed by individual study through distance learning.

Also arising from the CITF train-the-trainer session was the recommendation to continue the accessibility of the technical and academic seminars but to eliminate the daily shift between the two that proved to be troublesome during the national workshops. Therefore, it was decided to schedule the WF ED classes for three full days, typically Wednesday through Friday and Monday through Wednesday. This new schedule would facilitate attending technical classes prior to or subsequent to the academic classes. It would also permit a UBC member to enroll in two technical classes and two academic classes within a two-week period. A sample of the implemented schedule for August 2005 is displayed in Figure 2.

Just as the members of the Coordinators Advisory Group in 1995 created the Instructor Certification Program in order to encourage continuing professional development, the instructors who attended the CITC train-the-trainer seminar in August of 2000 sought ways to increase opportunities for those members who wished to attain credentials beyond the third level of certification by earning an associate degree or, ultimately, a baccalaureate degree. Since the UBC instructors are dispersed throughout North America, the two primary challenges in developing associate and baccalaureate degree pathways for them were accessibility and transferability. To provide wide access to the program, the existing 60-credit Associate Degree in Letters, Arts, and Sciences available through Penn State's World Campus was selected instead of a more specialized technical associate degree. As displayed in Figure 3, this degree program contains a combination of general education courses, Labor and Industrial Relations (LIR) courses, as well as all of the WF ED courses required to complete the UBC instructor certification program.

Figure 2
UBC International Training Center Schedule of Classes
August 2005

8/3/2005 - 8/4/2005	Siemens Westinghouse and UBC Welding Partnership
8/5/2005 - 8/6/2005	Millwright Marketing
8/8/2005 - 8/12/2005	Curriculum Committee
8/8/2005 - 8/11/2005	Soffit Framing
8/8/2005 - 8/12/2005	GE Gas Turbine Member Training
8/8/2005 - 8/12/2005	Commercial Door Hardware
8/8/2005 - 8/9/2005	Ingersoll-Rand Door Hardware Certification Refresher
8/8/2005 - 8/12/2005	I INSTALL - Floor Layer Curriculum
8/10/2005 - 8/12/2005	Workforce Education 105 - Integrated Curriculum Implementation
8/10/2005 - 8/12/2005	OSHA 502 Construction Safety & Health Outreach Training
8/10/2005	Ingersoll-Rand Electrified Door Hardware
8/10/2005 - 8/12/2005	WF ED 270 - Introduction to Industrial Training
8/10/2005 - 8/12/2005	WF ED 445 - Vocational Guidance
8/10/2005 - 8/12/2005	WF ED 207 - Assessment Techniques
8/12/2005 - 8/13/2005	Millwright Marketing
8/15/2005 - 8/17/2005	WF ED 106 - Program and Facilities Management
8/15/2005 - 8/17/2005	WF ED 413 - Vocational Education for Special Needs Learners
8/15/2005 - 8/19/2005	GE Gas Turbine Member Training
8/15/2005 - 8/17/2005	WF ED 471 - Training in Business and Industry
8/29/2005 - 9/2/2005	GE Gas Turbine Member Training

Because all of the general education and LIR courses are available at a distance through the World Campus, and the WF ED courses are scheduled at the CITC on a regular basis, this degree is easily accessible throughout North America. Additionally, courses completed at other regionally accredited institutions can be applied towards the degree requirements, and all 60 credits earned in the associate degree program can be applied towards the baccalaureate, making the degree widely transferable.

The Adult Learner Baccalaureate Degree Program in Workforce Education and Development also fulfills the desired accessibility and transferability criteria by offering more flexibility than the more traditional full-time enrollment degree. For example, as long as a degree candidate enrolls in a minimum of one Penn State course during every three-year period, the degree requirements remain unchanged no matter how long it takes for the individual to earn the degree. In addition, UBC instructors who choose to enroll in the baccalaureate degree

Figure 3
World Campus Associate Degree in Letters, Arts, and Sciences

Requirements	Credits
<i>General Education: (21 Credits)</i>	
ENGL 015 Rhetoric and Composition	3
CAS 100 Effective Speech	3
STAT 100 Statistical Concepts and Reasoning	3
LIR 100 Industrial Relations	3
STS 101 Modern Science, Technology and Human Values	3
EMSC 150 Out of the Fiery Furnace	3
ART 001 The Visual Arts and the Studio	3
<i>Major (24 credits)</i>	
ENGL 202 Effective Writing	3
BI SC 004 or PHYS 001	3
ECON 002 Introductory Microeconomic Analysis and Policy	3
ART 020 or MUSIC 005	3
HIST 020 or HIST 021	3
LIR 136 Race, Gender, and Employment	3
LIR 435 Labor Relations in the Public Sector	3
LIR 201 Employment Relationship: Law and Policy	3
<i>Electives (15 credits)</i>	
WF ED 105 Integrated Curriculum Implementation	3
WF ED 106 Program and Facilities Management	3
WF ED 207w Assessment Techniques	3
WF ED 270 Introduction to Industrial Training	3
WF ED 471 Training in Business and Industry	3
Total Credits	60

program are eligible to purchase up to 24 credits, based upon their work experience. Since all 60 credits of the associate degree transfer into the baccalaureate program, the result is that the instructors have, or may be eligible to receive, as many as 84 credits of the 130 credits required for the baccalaureate degree. As with the associate degree, the remaining 46 credits may be completed through the World Campus and at the CITC, or through another regionally accredited institution.

An Effective Workforce

From the beginning, the ultimate goal has been to produce an effective workforce by enhancing the training provided to apprentices and journeymen by UBC instructors. To fulfill that goal, all workshops are evaluated not only by the participants in terms of the relevance and quality of the content as well as the quality of the instruction, but also by the instructors of the workshops, the Director of the International Training Center, and the members of the Coordinators International Training Advisory Group. The feedback gathered through this evaluative process has resulted in an increased number of workshops offered and the addition of optional associate and baccalaureate degrees to provide on-going career development. The success of the program has linked the UBC instructor certification program to salary advancements and the increasing expansion of the Carpenters International Training Center. As Douglas McCarron, General President of the UBC, stated, "Skills taught at the International Training Center make our contractors more productive and competitive, creating more jobs for our members" (2005, p. 2). The commitment that began with plans by the CITF and WF ED for a single seminar has grown into the fulfillment of the premise that from high-quality instruction flows high-quality workmanship.

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Towards an Authentic Technological Literacy

Charles W. Gagel
University of Idaho

How would you respond if asked to define technology? What first comes to mind? If you are like most people today, your immediate response would likely mention computers, cell phones, or the Internet. While most people, when questioned further, may acknowledge a broader reach of technology, it is the commonness of that first response which suggests that a one-dimensional understanding of technology pervades our social consciousness.

Background

According to Ihde (1990), in our modern world, living through a typical day involves us with technology from the moment we open our eyes. The day begins as we wake to the sound of the morning alarm clock. We rise from the material coverings and structure of the bed and proceed to the bathroom with its water systems, fixtures, and accessories. In the kitchen we start the coffee maker, open the refrigerator, turn on the stove, or perhaps slip a slice of bread into the toaster. We then commute to work in our automobiles or some other form of transportation, bolstered all the while by their technological systems. In the workplace we rely on a vast assortment of tools and equipment. After work, we might stop at a store filled with arrays of products, displays, and advertising. Nor does Ihde limit technology to the material world; he also includes social, political, and economic processes. Even our intimate relationships, Ihde points out, include the use of technologies. Thus Ihde places technology in a context well beyond the confines of the material artifacts that many perceive as its boundary.

Gagel is Associate Professor in the Department of Adult, Career and Technology Education at the University of Idaho, Boise, Idaho. Gagel can be reached at cgagel@uidaho.edu.

Could it be that a limited understanding of the scope of technology is due, in part, to a marginal and narrowing treatment of technology in the school curriculum? This may indeed be the case. In this age of authentic assessment, where context and application are considered essential, the overall general curriculum frequently does not offer an authentic treatment of technology and, consequently, may not be engendering a truly authentic technological literacy. In the broad perspective of technology provided by Ihde, the teaching of technological literacy merits a more authentic treatment in the curriculum and requires a focus directed firmly towards its context in everyday life.

Ihde's multidimensional concept of technology is widely supported in the literature. For instance, Feenberg (1999) emphasizes the social implications of technology in the form of power, control, and politics. Feenberg does not, however, dismiss the more physical aspects of technology. He argues that the study of "technology as a total phenomenon...must include an experiential dimension since experience with devices influences the evolution of their design" (p. xii). In a discussion of vocation, Feenberg maintains that "the technical subject appears autonomous only insofar as its actions are considered in isolation from its life process. Taken as a whole, the succession of its acts adds up to a craft, a vocation, a way of life....These human attributes of the technical subject define it at the deepest levels, physically, as a person, and as a member of a community of people engaged in similar activities" (p. 206). Here, the carpenter is a carpenter because of the tools, materials, and processes used in the practice of carpentry.

Feenberg's essential theme is that "technological design is central to the social and political structures of modern societies....Every major technical change reverberates at countless levels: economic, political, religious, and cultural. If we continue to see the social and technical domains as being separate, then we are essentially denying an integral part of our existence..." (p. i). Changes in a vocation over time are, therefore, directly shaped by the evolution of its artifacts and techniques. It is the rarity of this historical and sociopolitical perspective within

the general curriculum that creates weakness in the teaching of technological literacy.

There are several philosophers and historians of technology that argue for including a historical perspective in the study of technology. Their claim is that too much of today's understanding of technology fails to take into account the mixed blessings that technology provides humanity. Segal (1994), Tenner (1996), and Wenk (1999) hold that unintended consequences are one of the perils of technology. They and many others maintain that all technologies harbor both positive and negative effects. To ignore the risks of technology, Wenk suggests, would be tantamount to "technological sin" (p. 111). Wenk acknowledges the ethical dimensions of technology by stating: "To be sure, technological sin seems an oxymoron because when technology is colloquially defined it is considered value-neutral. When the human ingredients of technology are recognized as vital [to a full understanding of technology], the linkage is obvious" (p. 111). Yet, aside from an occasional elective course on technology and society—usually limited to the university level—there is little treatment of these consequential and ethical issues in the curriculum as it is delivered in the classroom.

Another overlooked aspect of technology is its linkage with science. When mentioned along with science, technology almost invariably is mentioned second. Some maintain that technology is a secondary form of science (i.e., applied science), which therefore justifies its subordinate stature. Tiles and Oberdiek (1995) describe this debate as being rooted in a "conflict between utility and intellectual status" (p. 74). The authors explain that "the use of the 'scientific method' for problem solving, both in science for answering theoretically posed questions and outside science for answering practically posed questions, is one of the reasons why, in the public mind, 'science' has come to cover engineering and technology as well as theoretical science" (p. 87). With science and technology so intertwined and interdependent in today's world, Tiles and Oberdiek suggest that it makes more sense to speak of "techno-science" rather than "applied science." They conceptualize science and technology as two functionally distinct forms of knowledge and reason; the former seeking to explain the natural world, the latter seeking to modify it.

Given even this brief appraisal of technology, it seems reasonable to conclude that technology constitutes more than mere artifacts and technique, and that because of technology's innate relationship with humanity, it possesses intellectual, social, and cultural dimensions. Yet narrow definitions of technology, ones which have ignored its broader ramifications, have limited the teaching of technological literacy.

Technological Literacy

There have been innumerable attempts to define technological literacy over the past two decades. Many fields of study have engaged in this discourse and have invariably tended to emphasize their own disciplinary values. In the field of technology education, the tightening embrace of engineering further constrains the field's perception and treatment of technology. Such differing and self-absorbed viewpoints have resulted in a conflicting variety of interpretations and a curriculum still confused as to what it truly means to be literate in technology.

In direct contrast to definitions which promote one field or another, a holistic concept of technological literacy has entered the curricular literature. For instance, Seemann (2003) argues for a set of holistic principles to guide the teaching and learning of technology. He remarks, "Increasingly, more is asked of technology educators to be holistic in the understanding conveyed to learners of technology itself itself in order to make better informed technical and design decisions in a wider range of applied settings" (p. 28). Seemann states that a case has been "made for technology to not merely be a 'know how' learning experience, but necessarily also a holistic 'know why' learning experience..." (p. 28). The intent of a holistic approach is to develop in the learner an ability to consider a technological problem and/or solution in a full context. The basic principles that Seemann advocates are intended to develop a habit of mind that naturally considers the technical not only in the applied setting, but in the greater social, environmental, and time context as well.

Technological literacy, as described here, requires a multi-disciplinary, coordinated treatment within the broader school curriculum. The inclusion of a historical, sociopolitical,

environmental, as well as instrumental appreciation of technology would create technological literacy that prepared the average citizen for everyday life and living.

One of the most succinct definitions of technological literacy is published by the International Technology Education Association (ITEA). It states that technological literacy is “the ability to use, manage, understand, and assess technology” (ITEA, 2000, p. 242). In an analysis of technology education curricula of six countries, Rasinen (2003) found that the ITEA themes (ability, usage, management, etc.) are common in the curricula of the nations reviewed. Across the various curricula, goals consistently required students to develop an understanding of the effects of technology on society and culture; to know the history of technology; to recognize its relationship with the environment; to master the necessary skills to plan, produce, and evaluate; to tolerate uncertainty and adapt to new technologies; and to recognize the interconnections between technology, the workplace, and everyday life. An interdisciplinary delivery, which often included science, social studies, mathematics, and occasionally, history, was also common.

The Case for an Authentic Technological Literacy

The notion of authentic technological literacy came about through efforts to create an authentic assessment instrument for technological literacy. The practice of authentic assessment requires that a topic be presented through a naturalistic context. It also requires that the learner demonstrate an appropriate level of application. The authenticity of the curriculum, therefore, can be judged in terms of how, and to what degree, a particular aspect of technology is experienced and assessed in the learning process.

As test designers attempted to develop test items, it became apparent that everyday encounters with technology were only incidentally treated in the curriculum. The majority of available tests for technological literacy were composed of items that were void of context or application. Moreover, the existing tests did not seem to recognize that the general population can function very well technologically in everyday life without being able to recall technical nomenclature, exacting specifications, algorithmic procedures, or specific historical events. In the

existing tests, assessment that required application, analysis, synthesis, and/or evaluation of everyday technological encounters were extremely rare.

In designing authentic assessment instruments, test designers reasoned that technological literacy exists at varying levels of mastery and across an assortment of technological domains. Exactly what domains and what level of mastery is required for a standard of technological literacy that meets the needs of the general population was (and still is) unclear. For test design purposes, technological domains were defined within areas of life where one commonly encounters technology; namely, food, shelter, clothing, communication, wellness, transportation, and entertainment. Highly specialized technology, such as that found in specific workplace environments, was not included because it was not considered applicable to the needs of the general population. It is the effort to meet the needs of the general population that draws into question the growing popularity of an engineering focus in technology education. Rather than encourage a more holistic approach, such a focus could potentially narrow the field's treatment of technology and therefore further marginalize technology's presence in the overall curriculum.

Conclusion

The tendency of the general population to view technology as a narrow, restricted field confined to computers, cell phones, and the Internet suggests that the present treatment of technology in the school curriculum may be too fragmented and too abstract. In order to create a greater understanding of the pervasive reach of technology in today's world, the teaching of technological literacy should broaden its context to include the uses of technology in the common everyday experiences of our daily lives and to consider its influences on our culture, politics, economics, and social interactions. Rather than move towards an engineering design focus, which would only serve to pigeonhole it further, technological literacy needs to expand its scope to integrate it with the goals of general education; that is, to provide an education that generalizes to everyday life in society. By providing a holistic representation of technology, technological literacy would realize the goals of general education, fulfill the

provisions of authentic assessment, and meet the needs of the typical citizen.

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Information for Authors

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