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The Influence of Technology on Vocational Teacher Education

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Abstract

Teacher education is experiencing new formats that combine conventional classroom objectives with evolving technologies in order to transfer knowledge to students at remote sites. While this format is convenient for some students, it is not clear that distance learning technology can permanently modify the educational landscape. Indeed, this study is reported because little is known about how this issue impacts actual learning behavior in vocational teacher- education. This study determined how student cognitive styles and attitudes relate to satisfaction with a distance learning course, the instructional methods used, and the instructor. Findings are reported, along with implications for teaching and learning in this format. Detailed planning and awareness of how to use a broad range of instructional options seem important. This includes strategies that increase learning tempo and enhance student-teacher interaction. Recommendations for further study are identified.

The traditional educational delivery system at many universities offered vocational teacher education through two modes - courses on campus and through itinerant educators who traveled to off-campus locations (Roberts, 1957). In recent times, smaller enrollments at single off-campus sites and less travel monies forced some universities to question the continued viability of the off-campus option. The loss of such options could erase educational opportunities for students who, largely due to distance, do not readily attend on-campus courses . When faculty in the Department of Occupational Studies at The University of Georgia (UGA) faced this situation, they turned to technology and distance learning delivery systems.

The earliest attempt with distance learning at UGA was during the Spring Quarter, 1986 with a curriculum development course that enrolled ten off-campus students. Distance learning technology at that time consisted of a computer and modem that enabled students to use a college-wide electronic bulletin board system to receive and deliver instructional assignments. A fax machine was also available to send assignments when the bulletin board was busy or off-line. Outside class time, a password-protected e-mail system was used to facilitate two-way communication. Foell and Weitman (1992) reported that a major limitation of this system was that student-teacher interaction seemed slow and non-direct, and real-time interaction was not possible.

These experiences not only suggested differences in traditional and technology-based teaching-learning delivery systems; they also suggested a problem with student satisfaction with learning experiences. Some students seemed indifferent or unmotivated by this newer learning format. Because research on traditional teaching-learning systems (see Fritz, 1981 and Witkin, Moore, Goodenough, & Cox, 1977) did not address this issue, the need for insight in technology-based vocational-teacher education systems seemed evident.

The problem addressed in this study involves the nature of student-teacher interaction and its implications for effective learning. The mechanical devices in distance learning systems mediate student-teacher contact and could impact learning satisfaction. Because both learning tempo and cognitive style could be important to this issue, they were the primary concerns of this study.

Background

UGA's distance learning system was modified in 1993. The newer system, called the Georgia Statewide Academic and Medical System (GSAMS), used compressed video technology. This system overcame the real-time interaction deficit of the earlier system. Instructors and students could see, hear, and ask questions during a lesson and interact in real-time with the other sites. Even with these interactions, two efficacy-related issues remained- tempo and cognitive style.

Learning tempo is important. Hill (1981) and Cronbach and Snow (1997) associate it with factors that mediate the learning process. Hill saw learning as a sensory experience, where environmental conditions mediate the meaning of personal experience. Cronbach and Snow put emotional attachment in the same context. In sum, these researchers view learning as a rich personal experience. Factors that mediate quality experience can impact effective learning.

The connection to distance learning technology is easily demonstrated. For example, if five sites are linked for a specific course, GSAMS allowed only two of those locations to interact at the same time. Students at the other three can only observe and listen to the interaction. The resulting impact on tempo could effect sensory contact and emotional involvement, making it difficult to fully engage all participants.

The second issue involved cognitive style. Witkin and Goodenough (1981) hypothesized that youths and adults react to learning stimuli differently. Students with a field-dependent cognitive style use sensitive social radar that produces an automatic preference for interpersonal circumstances in the learning environment. Those with a field-independent cognitive style have an independent or self-directed learning style. Instead of valuing interpersonal contact, they prefer cognitive pursuits and problem solving activities.

Summarized research (Fritz 1981 and Witkin and Goodenough, 1981) shows that the field-independent cognitive style should be common in technology education. Holland's (1985) explanation involves personal reinforcement. Individuals seek education and work environments that support one's learning style. As a discipline of study, technology education concepts are more focused on cognitive tasks and less on interpersonal skills.

Until this study, field-dependence theory was not applied to distance learning in vocational teacher education or to technology education. Witkin and Goodenough (1981) developed this theory in a traditional learning environment, and Fritz (1981) largely applied it to conventional vocational and marketing education settings. Thus, until now it was not clear if field-dependence theory could explain teaching and learning in this educational system.

Though this study of student satisfaction in a distance learning context focused on learning tempo and cognitive style, hypotheses about student-treatment interaction are not new. In fact, several theorists (see Cronbach & Snow, 1977; Snow, 1989) long believed that these interactions clearly predict learning outcomes. Together with views promoted by Lazarus (1982) and Hill (1981), these situations help explain differential adaptive behavior in task situations. For example, Snow (1989) believed that performance differences are most likely if tasks are complex. These tasks require students to demonstrate special and often sophisticated abilities or traits. What was not clear until now is whether distance learning required specialized learning preferences.

The need to understand this dynamic in distance learning is implied, if not directly stated. Several researchers (Fritz, 1984; Hill, 1981; Lazarus, 1982) portray learning as a personal and individual experience. The way individuals learn involves not only a learning style, but also a personal history. At some point in life, Holland's (1985) logic concludes that individuals need different environments to support unique and automatic learning style interests and skills. Is this true for distance learning?

To have long-term value, distance learning technologies must produce high quality learning experiences. They must promote engagement in learning through sensory appeal and emotional stimulation. Given this information, the purpose of this study was to probe the dynamics of this technology-based system and derive implications for effective learning.

The objectives of this study were (a) identify student cognitive styles, (b) assess attitudes toward learning in a distance learning context, and (c) estimate the learning tempo in this context. Because prior studies like this in vocational-technical education were not identified through a literature review, the authors contend that answers to these objectives can be used to advance knowledge about effective learning in a technology-based instructional environment.

Method

Population

The study population was 27 undergraduate and graduate college students. These students were at one on-campus site and three different remote sites in north and central Georgia. Seven students were females and 20 were males. All were majors in UGA's Technological Studies program. Basic demographics are on Table 1.

Table 1
Student demographics (n=27)

Variable	Sites			
	n = 8	n = 6	n = 5	n = 8
Male	5	6	3	6

Female	3	0	2	2
Graduate	3	5	3	3
Undergraduate	5	1	2	5

Course Description

The course was "Needs Analysis in Technology Education" (ETS 512/712). It was offered for 5 quarter hours of credit during the Spring Quarter, 1994. Ten class sessions were held. Three were Saturday sessions at UGA and the other seven were via the GSAMS system. Class time for the GSAMS sessions was from 4:00-9:00 p.m. on Tuesday evenings. The instructor had teaching experience with this course and over seven years experience with distance learning programs.

The three on-campus sessions were at the beginning, middle, and end of the quarter. The first session provided a course orientation and introduction to technology. The syllabus, textbook, and course materials were distributed and reviewed. The second session was for the mid-term exam. The last session was for the final exam, course evaluation, and the submission of required term papers.

The course was designed to develop systematic skills in the design, implementation, and analysis of vocational instructional needs. Examples of specific course objectives capture this intent: (1) Survey manpower needs using a variety of library and human resources, (2) identify instruments to assess student learning needs, (3) analyze data and sequence instructional objectives, (4) explore the impact of new technology on workplace and classroom environments, and (5) identify strategies and resources that portray women and minorities as equals in the workplace.

The instructional delivery system was diverse. Lectures, readings, computerized slide shows, videotapes, class discussions, student presentations, fax, and a video graphic stand projector (ELMO) were used.

The ELMO projector was used to project selected text and graphic images that are similar to an opaque projector, but with two major differences: (1) The video image is shown on a television monitor instead of a screen, and (2) the material placed on the projector can be in a textbook, a multi-dimensional model, a real object, or a photograph. A transparency is not necessary or even desired.

A typical GSAMS class meeting followed this pattern. Roll call was taken to ensure that students at the three remote sites could see and hear the instructor. An illustrated lecture of new material using the ELMO preceded a class discussion. Participation was enhanced by requiring students to engage in the discussion through prompting, as necessary, with questions. Next, students made presentations based on course assignments. Students could highlight their class presentations by showing diagrams, photographs, drawings, etc., using videotapes, faxes, and the ELMO graphic stand. Follow-up was with questions and answers. A previously announced test or a pop quiz might then be given via the ELMO. Students could fax the answers to the instructor for evaluation, while feedback was then faxed to the students for discussion. Finally, the evening's activities were summarized and assignments for the next class meeting were reviewed and discussed. This description of a typical GSAMS class meeting helps in illustrating how distance learning settings contrast with more traditional classroom settings.

Instrumentation

The *Group Embedded Figures Test (GEFT)* and a *Semantic Differential Inventory (SDI)* were used to collect data. The GEFT has 18 simple forms that are embedded in complex or camouflaged backgrounds. Subjects locate and outline the simple forms. Those who have trouble with this task, and thus the lowest scores on the 0 to 18 range, have a field-dependent or social cognitive style. Their scores clustered between 0 and 5. Students that find the simple forms with greater ease have the highest scores and a field-independent or analytic cognitive style. Their scores clustered between 13 and 18 on the range. According to Witkin, Oltman, Raskin, and Karp (1971), the GEFT has satisfactory reliability (.89 on test-retest over a three year period) and validity (a correlation of .82 between the two major sub-sections).

The SDI was designed according to procedures specified by Osgood et al. (1957) to assess two attitudinal concepts: "How (instructor's name) taught in a system designed for distance learning" and "The skills and the concepts I learned in the distance learning delivery system."

Each concept was measured with 8 adjective pairs that were randomly presented in a bipolar format. Four scales were used to measure two factors: Activity and potency. Osgood et al. (1957) defined activity as "Concerned with quickness, excitement, warmth, agitation and the like" (p. 73). Potency is "Concerned with power and the things associated with it, size, weight, toughness, and the like" (pp. 72-73).

The four adjective pairs for each factor were selected from lists provided by Osgood et al. (1957). With the positive ends listed first, the activity pairs were complex-simple, fast-slow, active-passive, and excitable-calm. The potency pairs were soft-hard, lenient-severe, humorous-serious, and light-heavy.

The SDI was scored using a 1 to 7 range. Extremely positive received the number 7 and extremely negative the number 1. Quite positive received the number 6 and quite negative the number 2. Somewhat positive had the number 5 and somewhat negative the number 3. Four was a neutral score. Total scores for the four adjective pairs for each concept created overall factor mean scores.

Procedures

Standardized test administration procedures were used to collect data. For the GEFT, they were the methods outlined by Witkin et al. (1971). Students completed the GEFT first. It had three timed sections, one for practice and two for actual scoring. Instructions were then given to complete the SDI.

After data were collected, the researchers hand scored the GEFT and transferred scores to computer scan sheets that students used to record SDI responses. The data were coded to denote sex, site location, student classification as graduate or undergraduate, GEFT scores, and SDI scores. Data were then tabulated and processed through The University of Georgia Educational Research Services Laboratory.

Results

The findings for cognitive style are presented first, followed the SDI attitude scores. Implications for learning and teaching tempo that are derived from this data are reported in the discussion section. GEFT score data by site are on Table 2. The score range for the study population was from 0 to 17. The overall GEFT mean was 9.41 or roughly the mid-point, with 68% of all scores ($\pm$ 1 SD) between 3.74 and 15.07.

Table 2
GEFT Scores by cognitive style

GEFT Group	Frequency

	Site 1	Site 2	Site 3	Site 4	Total
n	8	6	5	8	27
Field-Dependent	3	1	0	4	8
GEFT=0-5					
Mixed Group	2	3	2	3	10
GEFT=6-12					
Field-Independent	3	2	3	1	9
GEFT=13-18					
M	8.500	10.667	13.200	7.000	9.407
SD	-----	-----	-----	-----	5.667

This is a wide-ranging score distribution pattern. ANOVA analysis indicated no statistically significant differences among GEFT scores by site (df=3, F=1.47, p=0.2484).

Table 3 shows the SDI factor mean scores for activity and potency by site and factor for the two attitudinal concepts-"How (instructor's name) taught in a system designed for distance learning" and "The skills and the concepts I learned in the distance learning delivery system."

Table 3
SDI factor mean scores by concept and site

Factor	Sites

	#1	#2	#3	#4
"How (instructor's name) taught in a distance learning system."				
Activity	4.000	4.500	3.500	4.875
Potency	4.250	3.583	4.000	3.813
"The skills & concepts I learned in the distance learning system."				
Activity	3.844	4.917	3.750	4.563
Potency	3.969	3.375	4.050	3.750
Overall factor scores				
Activity	3.922	4.708	3.625	4.719
Potency	4.110	3.479	4.025	3.781

Findings suggested no statistically significant differences by site. In addition, mean scores were primarily neutral.

Where Osgood et al. (1957) indicate that activity is "Concerned with quickness, excitement, warmth, agitation and the like" (p. 73). Potency is "Concerned with power and the things associated with it, size, weight, toughness, and the like." The students in this study, regardless of GEFT score or learning site primarily viewed their experiences as neutral.

In sum, the data revealed that GEFT scores were wide-ranging, from highly field-dependent to highly field-independent, with the group mean in the mixed category. With minor exception, SDI attitudinal scores were neutral for each concept and at each site. Implications are discussed below.

Discussion

The purpose of this study was to examine dynamics in distance learning technology to establish implications for effective learning. Though the study design and literature created the expectation of statistically significant findings, none were found for cognitive style or SDI attitudes. There was a wide range of cognitive styles in the study population, and attitudes toward learning in a distance learning environment were consistently neutral. Even so, a connection to learning tempo seemed possible.

Cognitive style researchers (Snow, 1989; Witkin & Goodenough, 1981) seemed to create an expectation. They contend that learning must be complex and demanding before students use special cognitive skills to meet task demands. GEFT data indicated that half of the students lacked these traits. They had field-dependent or had a mixed cognitive style. If the course were overly simple, students would be expected to provide negative SDI evaluations for the potency factor. This was not the case.

And, while Osgood et al. (1957) contend that the SDI should elicit extreme scores for concepts, these findings were not strong. Yet, the concepts used here were successful elsewhere (e.g., Fritz, 1981, 1994) and matched examples that Osgood et al. provided for similar concepts. The data were within the range of neutral scores.

Osgood et al. (1957) linked the activity factor to quickness. In this study, respondents did not rate their experiences as complex or simple, fast or slow, active or passive, or excitable or calm. Hill's (1981) logic explains this through reduced sensory stimulation. GSAMS offers limited forms of sight and sound experience. And, as noted earlier, it limits learner interactions. GSAMS, as well as other technology-based learning systems, are not yet able to match the sensory stimulation of conventional teaching-learning systems.

In sum, while statistically significant findings were not found in this study, the data carries an important message to educators who teach in technology-based learning systems. It may be important for them to plan instruction with learning tempo in mind. Students need emotional involvement (Cronbach & Snow, 1977), as well as rich sensory experience and the opportunity to derive meaning from the environment (Hill, 1981), to have effective learning experiences. The neutral attitudes reported here suggest that some learners were not fully engaged in their own learning. Technology-based learning systems could mediate learning behavior.

Teaching in such a setting requires skill with the technology to be employed and must include knowledge about the nature of learning itself. Neither high quality video programs nor computer generated multimedia presentations can substitute for insight to the sensory nature of learning. Skill with instruction is, above all else, linked to skill at working with individuals. A major goal in the UGA Department of Occupational Studies is to focus on instructional effectiveness.

Recommendations for Further Study

It is recommended that further study be conducted to determine:

1. Strategies and test ways to increase learning tempo in distance learning.
2. A focus group technique to gain deeper knowledge about student perceptions of learning through distance technology.
3. The instructional concepts that are best taught through direct on-campus instruction and those that are better delivered through the distance learning system.

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