The relationship between learning style and achievement in a one-way video, two-way audio preservice teacher education computer literacy course was investigated. The learning styles were determined by the Group Embedded Figures Test measuring field dependence-independence, and the Rotter Internal-External Locus of Control Scale. The results indicated that there was no relationship between learning style and achievement, as measured by final course grade. However, a relationship was found between learning style (field independence) and final exam performance. Field independent learners scored significantly higher on the course final exam. The findings are congruent with research on field dependence-independence in higher education and support the position that varied support mechanisms in a distance learning environment help to accommodate diverse learning styles.
Distance education programs, offered by many institutions and business organizations, cover a wide variety of curricula, one of which is education. Degree programs are now delivered to preservice and inservice teachers in all types of locations, including rural areas (Boone & Anderson, 1995; Tressman, 1995; Williams, Gold, & Russell 1995) and are both effective and cost efficient (Ludlow, 1994).

Even though distance education course content is varied, most are effective because students find the video/audio lecture with audio student interaction environment similar to standard classroom delivery. According to Hanson, Maushak, Schlosser, Anderson, Sorenson, and Simonsen, (1996), a plethora of comparison studies show that the distance courses are as effective or more effective than traditionally taught courses and should no longer be the focus of distance education research. Rather, an emphasis should be placed on methodological and student variables.

**COMPUTER LITERACY FOR EDUCATORS**

Most teacher education programs include an introductory computer literacy course based on productivity software such as an integrated package (word processing, databases, spreadsheets, and presentations), basic telecommunications (e-mail and the World Wide Web [WWW or Web]), and beginning authoring (*Hyperstudio*, web page, etc.). Computer-skills classes can be highly structured to insure that students work through each step of the learning process together. This method nearly guarantees that students will complete specified sets of tasks. However, this time consuming method is likely suitable for only a few students; most will be bored or will not be able to maintain the class pace. An alternative method is to provide an advanced organizer to demonstrate the skills students will be expected to master, followed by self-paced learning, typically accompanied by “cookbook” type materials. The second method better meets the diversity of student learning needs. If the course is properly organized and presented, and if students are attentive to active cognitive processing, the second method should lead to high level learning. Since self-paced learning allows students the ability to learn in the manner best suited to their individual talents and inclinations, it is an intuitively appealing method. Unfortunately, neither approach intrinsically motivates students to actively think about their tasks and, consequently, students often fail to learn efficiently. Even when an instructor places heavy and repeated emphasis on active processing, there is no guarantee students will become active learners. Learning to operate software programs is a skill and students must accept responsibility for their
learning through active mental processing and practice (Grabe & Grabe, 1998). Therefore, since both methods require student responsibility for active learning but the second method provides an advance organizer and self-pacing, the second method may be preferable. By teaching in a lab, instructors can use both methods as appropriate and provide time for student work, which allows individual attention while students play and experiment with new software features.

Little evidence can be found that courses with content typically perceived as best taught in a hands-on fashion, such as computer applications courses, are delivered effectively by way of distance delivery technology. As teacher education programs begin to be delivered through distance learning systems, computer skills courses, such as introductory computer literacy and multimedia/hypermedia authoring courses, must be included. Porting such courses to a standard but limited one-way video, two-way audio system prevents teaching in computer labs and eliminates hands-on time and student-teacher interaction.

**MOTIVATION AND LEARNING STYLES**

**Locus of Control**

*Locus of control and achievement.* Many educators view motivation as a crucial factor in learning. Students can be motivated by what they think causes their success or failure. Locus of control describes an individual’s beliefs about the placement of control, and responsibility of control over his or her life events (Jonassen & Grabowski, 1993). These causal attributions, which may include fate, luck, skill, knowledge, biases, ability, and competence, are not all or none, but may vary in degree. Internally oriented individuals believe that outcomes are the result of their own ability, skill, knowledge, competence, and other internal causes. Externally oriented individuals believe that outcomes are the result of fate, luck, biases, mood, and other external causes. Locus of control is best represented by a continuum of external to internal.

In an instructional setting, locus of control affects the learner through his or her expectations of success, resulting in motivation (Keefe, 1987). Weiner (1979) found that high-achieving students attribute success to ability and attribute failure to lack of effort. Low-achievers attribute success to fate or luck and attribute failure to lack of ability. In their review of 36 studies on locus of control and academic achievement, Bar-Tal & Bar-Zahor
Childress and Overbaugh (1977) identified 31 studies in which internals demonstrated greater achievement. This greater achievement was attributed to more persistence, effort, and better use of relevant information.

**Locus of control and instruction.** Numerous researchers have investigated the relationship between locus of control and instructional conditions. Hickey (1980) found that externals benefited more from teacher-centered instruction, while internals benefited more from instruction in which some of the course structure was left to the learner. Daniels and Stevens (1976), (as cited in Jonassen & Grabowsk, 1993) found that externals performed better in a teacher-controlled setting, while internals excelled under a contract-for-grade setting. The research of Janicki and Peterson (1981), Pascarella, Pflaum, Tanis, and Pearl (1983), and Anderson (1983) also show the internal’s preference for learner-controlled and individualized settings.

Locus of control is often associated with field dependence/independence and academic performance. According to Kletzing (1982), students who have an internal locus of control and field independence perform better academically.

**Group Embedded Figures Test**

The Group embedded figures test (Witkin, Oltman, Raskin, & Karp, 1971) was designed to delineate learning styles in terms of field dependence and field independence. These bipolar characteristics have several implications for higher education students, and preservice teachers in particular. Field dependent persons tend to be attracted to occupations that involve working with people (Rosenberg, Mintz, & Clark, 1977), (as cited in Whyte, Karolick, & Taylor, 1996). Field dependent students prefer teacher interaction and they have a proclivity for significant structure in their learning, (Canino & Chicchelli, 1988).

Miller (1997) provides a comparison chart of field dependence/independence for distance education agriculture students. Since the sample in that study was similar to the sample in the current study in terms of GEFT scores (mean scores within 1 point—12.50 SD 4.43 & 11.57, SD 4.8 respectively), Miller’s chart can be interpreted as germane to our sample.
The Relationship Between Learning Style and Achievement

Table 1
Characteristics of Field Dependent and Field Independent Learners

<table>
<thead>
<tr>
<th>Field Dependent</th>
<th>Field Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer externally defined goals and organization.</td>
<td>Can provide their own structure for learning activities.</td>
</tr>
<tr>
<td>Value positive reinforcement from the teacher.</td>
<td>Do not typically respond to positive reinforcement offered by teacher.</td>
</tr>
<tr>
<td>Have well-developed social skills and are more attuned to social cues.</td>
<td>Have poorly developed social skills and are more socially independent.</td>
</tr>
<tr>
<td>Favor extrinsic motivation.</td>
<td>Are intrinsically motivated.</td>
</tr>
<tr>
<td>Prefer collaboration.</td>
<td>Prefer competition.</td>
</tr>
</tbody>
</table>

This study looks at learning styles, as measured by the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) and the Internal-External Locus of Control Scale (Rotter, 1966) and their possible relationship with achievement in an introductory computer course delivered through a one-way video, two-way audio system. The course was originally a “regular” course taught in a computer lab that has been adapted to the distance medium.

Research questions. The following research questions were posed: (a) What is the relationship between learning style and demographics in a one-way video, two-way audio preservice teacher education computer literacy course? and (b) What is the relationship between learning style and achievement in a one-way video, two-way audio preservice teacher education computer literacy course.

DESIGN OF THE STUDY

Sample

The sample consisted of two groups of preservice education students, ages 19 to 47 ($M = 26.5$), enrolled in three sections of a two-way audio, one-way video introductory computer course at a mid-Eastern university of 18,000 students. Although Witkin (1976) and Highhouse & Doverspike
(1987) indicated that field dependent people tended to select fields like teaching, counseling, social sciences, and humanities, the sample in this study was similar to the national group mean with a mean of 11.57 (SD 4.80). Two hundred four students were involved in the study. Various N’s are less because of attrition and absenteeism.

**Independent Measures**

*Learning styles.* The Group Embedded Figures Test (GEFT) (Witkin, Olman, Raskin, & Karp, 1971) was used to identify students as field dependent, field independent, or mixed. There seems to be no standard method of using the GEFT for designating people as field dependent or field independent. Portis, Simpson, and Wieseman (1993) grouped learners with scores from 0-5 as field dependent, 6-12 as mixed, and 13-18 as field independent. Dwyer and Moore (1994) identified students who fell one-half standard deviation below the group mean as field dependent, those one-half above as field independent, and those in between as neither. Whyte, Karolick, and Taylor (1996) and Miller (1997) grouped military personnel according to quartiles, and Cano, Garton and Raven (1992) declared students who scored below the group mean as field dependent and those above the group mean as field independent. Others, such as Griffin and Franklin (1995-1996), Shih, Ingebritsen, Pleasants, Flickinger and Brown (1998), and Sullivan (1998) simply did not state how they used the instrument.

The Internal-External Locus of Control Scale (Rotter, 1966) consists of 29 items, six of which are fillers. These items measure the individual’s beliefs of reinforcement control potential in seven areas: (a) an individual’s influence in government decisions, (b) an individual’s ability to make his or her plans work, (c) job success, (d) belief in fate, (e) friendship, (f) respect, and (g) academic achievement (Jonassen & Grabowski, 1993). Scores on the Rotter scale can range from 0 to 23. The higher the score, the more external the individual. Reliability ratings of the scale are within the .6 and .9 range.

*Demographics.* Data were collected on demographics via an inclass form administered the first day of class including (a) gender, (b) age, (c) teacher education/not teacher education, (d) class standing, and (e) intended teaching level (preschool, elementary, middle, high school).
Dependent Measures

**Achievement.** *Final exam.* The final exam varied for the two groups. For one group, a two-part, final exam was used to assess achievement. The first part tested various levels of intellectual knowledge on various learning theories, and methods of classroom technology application and integration via a combination of 12 multiple choice, 8 fill-in, and 20 short essay items. The second part tested procedural computer operation and software application skills through two databases, one spreadsheet, one word processing, and one integrated problem. For the second group, a 60-item, multiple-choice final exam was used to assess achievement, which primarily required recall from class lectures and the course text.

**Course Grade.** The course grades used were the percent scores including various projects, weekly assignments, a mid-term exam, final exam and a final computer-based project.

Procedure

The GEFT and Locus of Control instruments were administered by the researchers. All administrative procedures specified by the instrument manuals were followed. Because the learner traits assessed are stable over time, the instruments were given mid-semester.

Treatment

**Content.** The single, two hour and 45 minute session per week (16 weeks), introductory computer course for preservice teachers was comprised of two major components. The first, the skills component, was based on standard productivity software (*ClarisWorks* or *Microsoft Office*), which includes (a) word processing, (b) database, (c) spreadsheet, and (d) presentation. *Netscape Navigator* was used for learning about and exploring the Web. Students were required to use the productivity package components and Web resources to create a complete and integrated project suitable for classroom use. In addition, e-mail and a dedicated listserv were used for communication between the professors and students, among students, and for disseminating course materials. Finally, students had access to a course-specific Web site to access class materials such as lecture outlines, weekly focus questions, files needed for exercises, and answers to quizzes. Theoretical
and classroom application components were based on the text, *Integrating Technology for Meaningful Learning* by Grabe and Grabe (1998), which presents classroom technology integration within a cognitive learning theoretical framework. Topics in the text include (a) cognitive learning and technology tools, (b) instructional software in content area learning, (c) using productivity software, (d) multimedia applications for learning, (e) knowledge as design, and (f) responsible use of classroom technology. Additional readings and examples (e.g., detailed readings on videodiscs and CD-ROMs, example AUPs) were supplied throughout the course. A sample course schedule is included as an appendix.

Based on student preferences identified by Silvernail and Johnson (1992), instruction was delivered in an instructor-oriented style that emphasized lecture, and attempted to place the primary responsibility for learning on the students. Assorted learning activities and instructional media were utilized weekly to promote student interaction as recommended by Schoenfelder, (1995). Interaction was encouraged more to build group dynamics than attend to individuals’ needs (Zhang & Fulford, 1994).

**ANALYSIS AND RESULTS**

**Analysis of Data**

*Learning style and demographics.* To answer question one, “What is the relationship between learning style and demographics in a one-way video, two-way audio preservice teacher education computer literacy course?” correlations were conducted for age, gender, and class standing with the Group Embedded Figures Test and Internal-External Locus of Control Scale. The only significant relationship was between age and Locus of Control (Table 2).

![Table 2](image)

| Pearson Correlation | -.245 |
| Sig. (2-tailed)     | .023  |
| N                   | 86    |

*Learning style and achievement.* To answer question two, “What is the relationship between learning style and achievement in a one-way video, two-way audio preservice teacher education computer literacy course?”, correlations were conducted between the (a) Group Embedded Figures Test
The Relationship Between Learning Style and Achievement

(GEFT) and the final exam and the semester course grade, (b) Internal-External Locus of Control Scale and the final exam and the semester course grade, and (c) between final exam scores and course grades. A significant relationship existed between (a) GEFT and final exam scores (Table 3) and (b) between exam scores and course grades (Table 4).

**Table 3**
Correlation Between Group Embedded Figures Test and Final Exam Score

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>.170</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>.031</td>
</tr>
<tr>
<td>N</td>
<td>161</td>
</tr>
</tbody>
</table>

**Table 4**
Correlation Between Final Exam Score and Course Grade

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>.798</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>181</td>
</tr>
</tbody>
</table>

**DISCUSSION**

**Learning Style and Demographics**

Locus of control and age. The significant relationship between Locus of Control and age is similar to the findings of previous researchers (Lefcourt, 1982); as age increases, so does internal locus of control. Other studies have indicated a positive correlation between internals and status in life/perceived confidence (Lefcourt, 1981). The authors believe that, although a significant relationship between Locus of Control and chronological age was found, this relationship may not be as important as the relationship between life status, confidence, and other influences. It seems logical to infer that, along with age, comes more success and confidence.

**Learning Style and Achievement**

GEFT and exam scores. Although a significant relationship was found between the GEFT and final exam grade, only a small percentage of the variance can be attributed to field dependence/independence in preservice
teacher education students enrolled in a one-way video, two-way audio distance education computer literacy course. This finding is similar to the study by Miller (1997), who found no differences among distance agriculture students. However, we believe that the significant relationship between the GEFT and final exam scores is interesting and may have some implications for the use and type of final exams as a reliable measure of overall knowledge. A common notion is that certain kinds of students have difficulties in certain test situations. Field independent learners may be more successful because of their ability to focus on relevant cues for solving problems. The results of this study indicate that field independent students were indeed more successful than field dependent students on the final exam, regardless of the type of exam (multiple choice vs. short answer/hands-on).

This idea is further supported by the lack of a significant relationship between overall course grade and the GEFT, and between course grade and the Internal-External Locus of Control Scale, which would indicate that, because a course grade is a composite of a variety of activities, the effect of learning styles might be diminished. This reflects Witkin, Moore, Oltman, Goodenough, Friedman, Owen and Raskin’s (1977) finding that only a very small relationship exists between field dependence/independence and achievement in higher education as measured by GPA. This also supports Witkin’s (1976) assertion that field dependence/independence is not related to intelligence.

Lastly, the strong correlation between exam grade and course grade indicates that a final exam may not be a necessary indicator of overall knowledge. One might suggest that since a final exam is typically the same as or very similar to the course grade, a final exam could be made optional for students.

**CONCLUSION**

Because of strong student support mechanisms, the authors believe that the diverse learning styles of the distance students were accommodated, which was reflected in the lack of significant findings in this study. For example, interaction with the course instructors was available through phone, e-mail and listservs. Structured exercises and course materials were available in hard copy, through the web, and in person. In addition, the distance sites provided student support and advocacy through site directors and personnel. The authors therefore believe the efficacy of a final exam as an indicator of course knowledge should be further investigated.
References


Appendix

COURSE SCHEDULE

Class 1
- Complete demographic and survey instruments
- Review syllabus
- E-mail accounts
- Introduction to Educational computing
- Introduction to Standards of Learning (SOLs) and Technology Standards for Instructional Personnel.
- Windows basics, formatting disks, introduction to word processing; Lynch & Lynch pages 1-22.

Class 2
- Discuss Standards of Learning (SOLs) and Technology Standards for Instructional Personnel
- Discuss Grabe & Grabe Chapter 1, Key Themes and Issues.
- How E-Mail works and netiquette.
- Introduction to Spreadsheets; Lynch & Lynch pages 71-86.
- Idea paper on meaning of SOLs and Standards of Technology due. Will be word processed and turned in to be mailed.

Class 3
- Lecture/Discussion Grabe and Grabe Chapter 2; Cognitive Learning and Technology Tools
- Spreadsheets continued, Lynch & Lynch pages 87-104

Class 4
- Lecture/Discussion; Grabe & Grabe Chapter 3 Instructional Software.
- Introduction to Data bases. Lynch & Lynch pages 44-57
- Spreadsheet assignments due. E-mail assignments as attachments by the start of class 4.

Class 5
- Lecture/Demo: Instructional Software continued, Grabe & Grabe Chapter 3.
- Quiz 1: Spreadsheets and written quiz covering reading and lecture material to date.
- Data Bases continued. Lynch & Lynch pages 58-70.

Class 6
- Data base assignment due. E-mail assignments as attachments by the start of class 6.
- Guest lecture: Graphing calculators.

Class 7
- Database quiz and written quiz covering . . .
- Guest lecture: Graphing calculators continued.

Class 8
- Graphing Calculators quiz.
- Using Netscape to find Math and Science resources on the World Wide Web

Class 9
- Lecture/Demo; Grabe & Grabe
- Word Processing; Lynch & Lynch pages 23-39
- Writing Process; Grabe & Grabe pages 168-173
Class 10  
Discuss Grabe & Grabe, Chapter 5  
ClarisWorks features integration; Word processor-Data base  
merge, Copy data from Spreadsheets to Database for merging,  
copying frames and charts to the word processor; Lynch &  
Lynch, pages 40-42.  
CD-ROM, Grabe & Grabe pages 220-222

Class 11  
Video Discs, Grabe & Grabe pages 214-220.

Class 12  
Presentations: Lynch & Lynch pages 136-140  
Hypermedia, Grabe & Grabe pages 211-214 & 222-248  
Synthesis/Classroom visits papers due.  
Student presentations and discussion session.

Class 13  
Graphics: Paint tools, Lynch & Lynch pages 130-135  
Hypermedia continued;  
Grabe & Grabe, Chapter 9 Learning from Student Projects:  
Knowledge as Design and the Design of Hypermedia.

Class 14  
Integrated Project Due  
Discuss Grabe & Grabe Chapter 10: Being a responsible user of  
technology  
Computer component recommendations for teacher purchase

Final Exam