

THE RELATIONSHIP BETWEEN LEARNING STYLES, LEARNING ENVIRONMENTS, AND STUDENT SUCCESS

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Abstract

The purpose of this study was to investigate the relationship between Extension employees' learning styles and their performance in three different types of learning environments: traditional face-to-face instruction, minimally interactive online instruction, and highly interactive, multimedia-rich online instruction. Keith Golay's Learning Pattern Assessment and a ten-question post-test were used to gather data for this study. A 4 x 3 factorial ANOVA was used to test the data at the .10 level of significance. Results indicate that participants in the traditional face-to-face and the multimedia-rich, highly interactive online environment had statistically higher post-test scores than those participants in a minimally interactive online environment. Further, it was discovered that a participant's learning style had no statistically significant effect on their final post-test scores in any of the three instructional methods; and no significant interaction was found between the learning style and instructional method.

Introduction

Online learning, what Rogers (1998) refers to as distance learning, has increased exponentially in the past decade with the development of the Internet and a commitment by universities and other institutions to reach out to clientele outside of their local influence. The trend towards learning at a distance is especially evident in the Extension System where face-to-face instruction is slowly being replaced by distance education in an effort to reach the rural client and county personnel. Thus, instructors and program facilitators have had to adapt lessons originally developed to be presented in a traditional face-to-face classroom to that of a virtual one. This adaptation poses many different challenges, not the least of which is the consideration of the student's learning style (Harriman, 1989; Rogers, 1998).

This study investigated the impact of differing types of instructional designs on Extension employees' achievement. This study also examined how the relationship between instructional design and learning style affects employees' achievement as measured by the score on a post-test

administered following an in-service training workshop.

Theoretical Framework

There is a growing demand in the Extension Service for offering off-campus classes (Sexton, 2000). However, there is minimal and contradicting research available to determine if an employee's learning style is related to his or her performance in a distance-education setting.

Instructional Design

The term instructional design often refers to the process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation. This often involves a detailed planning process with the goal to solve a number of educational objectives or problems (Smith & Ragan, 1999). This type of design is distinguished from other forms of instructional planning by the level of expertise that is involved in the planning, development, and evaluation process. Often, factors that may affect or be affected by the resulting plan must be considered

before implementation. Thus, instructional designers must be diligent to ensure that the goals, instructional strategies and evaluations all match within the classroom environment (McKeachie, Chism, Menges, Svinicki, & Weinstein, 1994).

When instructional design is used in the context of computer technology, after participants have been allowed to acquire the necessary Internet competencies, an instructor can use the Internet as a teaching tool. Indeed, the most interesting and powerful uses of technology in education and in training appear to be those that clearly fit within integrated curriculum designs (Kizzier, 1995). The term "computer-aided instruction" often refers to the use of computers as an aid to the learning process as opposed to the more traditional printed text and pictures. Smith and Ragan (1999) note that due to its flexibility, a computer also can be programmed to generate and administer remedial lessons and resources to assist weaker learners.

In this study, two types of online environments were developed. Individuals that were assigned to the minimally interactive online environment were asked to access a website to complete an in-service training session. The instructor was available via e-mail if the participant had questions, but they were required on their own to access PowerPoint presentations online and perform self-guided tasks utilizing their computer. Those individuals assigned to the multimedia-rich, highly interactive online environment were asked to access a similar website to complete their in-service training. This group, however, was taught using audio- and video-animated screen captures of programs that they were required to use, short movies with the instructor showing tasks in more detail, online chat groups, and Internet bulletin boards. The instructor was also available via e-mail for specific questions or concerns.

Learning Styles

It has been well documented that human beings have their own "style" for collecting and organizing information into useful knowledge that is often shaped by their educational background and personality

needs. Introverted students, for example, often find it easier to communicate via computer-mediated communication rather than in face-to-face situations. In addition, a course delivered online with a less formal hierarchical structure can appeal to those learners who do not approach new information in a systematic or linear fashion. Online learning environments then, are used to their highest potential when multiple learning styles are considered that can adapt to the specific needs of the learner (Learning Styles, n.d.).

By utilizing one of many learning style classification schemes, the instructor can develop learning modules that cater to these various styles of learning to aid in the comprehension and retention of information. The Golay Learning Pattern assessment was utilized to determine these learning styles. This assessment defined four types of learners based up on the work of David Keirse, and four personality styles. Golay's descriptions concentrated on the learner's behavior and their resulting pattern of learning. The four types that he identified were the Actual-Spontaneous Learner, the Actual-Routine Learner, the Conceptual-Specific Learner and the Conceptual-Global Learner.

Golay (1982) describes the actual-spontaneous learner as "action people". They like their environment such that they are free to act spontaneously; they dislike planning and organizing. These learners prefer games and hands-on projects, but have short attention spans and are difficult to motivate. The traditional face-to-face classroom is best suited to individuals of this nature, Golay notes, for they do not prefer the formal learning experiences.

In contrast to the spontaneous learner, actual-routine learner is considered more task-oriented (Golay, 1982). They like lessons to be clearly structured and planned. They are not comfortable with spontaneity and do not feel they are creative. He notes that the more traditional face-to-face classroom environment works well for them, for they are often quiet and excel in an organized environment.

The conceptual-specific learner has a serious nature and is happy that way (Golay, 1982). They find great self-satisfaction in

their own achievements and don't need the approval from others as the actual-routine learner does. Their greatest difficulties, however, lie in accepting their own limitations. Often, Golay notes, these learners will become frustrated if they cannot succeed in solving a problem or attaining their goals. They also often neglect subjects and responsibilities outside of their narrow frame of interest. Instructors of actual-routine learners should realize that they will need help and encouragement in keeping their shortcomings in perspective, and they often require outside accountability to insure all responsibilities eventually are completed with an acceptable level of competency.

The final type that Golay (1982) describes is the conceptual-global learner. He notes that these are considered by many "people-oriented". They are the socialites that look for meaning and significance in both their education and their lives. These learners are often interested in concepts rather than details. They prefer integrated studies, where they can connect the personal aspect into understanding their world. In general, Golay notes that they are considered high-achievers, and do well academically. But often, they set high standards for themselves. They prefer to function in a group, especially when that group is their audience, and are often a communicator and a performer. Golay adds that they need to be known, recognized and acknowledged by others, especially by the instructor.

Instructional Design and Learning Style

Over 40 studies were found in the initial research into instructional design and learning styles. Four studies were noted in the context of this study that investigated the variables of learning style and instructional design. Cano and Garton (1994) conducted a study that followed 82 preservice teachers who were majoring in Agricultural Education at The Ohio State University. These authors were interested in the relationship between preferred learning styles and their success in a college level course. Cano and Garton utilized the Group Embedded Figures Test created by Oltman, Raskin & Witkin in 1971 to determine the

preferred learning style of the subjects. Results indicated that there was indeed a low positive relationship between learning style and their achievement in the course.

Neuhauser's (2002) research was focused on the learning styles and outcomes of students that were enrolled in two sections of the same course, one section online and one taught face-to-face. Her results showed that there was no significant difference between the type of course delivery and the student's learning style. Thus she concluded that equivalent learning activities could be equally effective for online and traditional classroom learners. She encouraged instructional designers, however, to find ways to expand the use of the Internet in online learning, specifically focusing on more highly interactive exercises and interactions as compared to strict print and graphic media, noting that qualitative data suggested that students were interested in a more engaged atmosphere when learning online.

Aragon, Johnson and Shaik (2002) investigated the differences between the academic performance and satisfaction levels of distance education in a videoconferencing atmosphere, as opposed to that in a more traditional on-campus course. Their study population included on-campus students and students at a distance, who were enrolled at Pike's Peak Community College. Results showed that there was no significant difference in the performance outcomes between the two groups. Females were found to enroll in distance education classes at a higher rate than males, and tended to score higher grades than their male counterparts as well. All distance learners, however, reported that they felt that they had learned just as much as those in the on-campus portion of the course.

Finally, Burkman (1994) conducted a study that followed 54 students who were enrolled in two high school psychology classes. He was interested in the relationship between achievement, attitude, and individual learning styles and their effect on success in an ITV course. Burkman utilized a learning style inventory that was created by Dunn and Dunn, and results indicated

that there was indeed a significant difference in the achievement of the on-campus students as compared to those at a remote location.

As was noted previously, these four studies are just a few of the over 40 articles that were found during an initial search on this topic. While the four referenced studies were chosen because of their sample size, timeframe, and/or type of subject studied, there are others with differing designs that should be noted as well. For example, Baker (1995) performed a qualitative study involving instruction across a video conferencing network. She was interested in what strategies would promote interaction with students that were participating at remote sites. Her study found a significant difference in the achievement of on-campus students as compared to off-campus students. She noted that when students have an opportunity to give and receive explanations from the instructor and each other, they are more likely to experience higher achievement.

Another study of note was conducted by Freeman (1995) with several hundred medical students enrolled in distance education courses. Her results indicated that there was no significant interaction between the type of instructional design and the student's learning style. However, qualitative data indicated that students might need to adjust their learning strategies when taking distance education courses that may be inconsistent with their learning style.

It can be noted that this review of the literature has found many contradictory statements and discrepancies. Some studies have found that there is no statistically significant difference in the achievement of those who take classes via distance education verses those who opt for more traditional arenas, while still other studies indicate a significant difference. Similarly, there are conflicting conclusions on the effect that learning style has on achievement. This study, therefore, intended to investigate if the learning styles of Extension personnel that are enrolled in distance education courses at a land grant university relate to academic performance. Additionally, the study sought to find if

there is any difference in the academic outcome of distance education students enrolled in differing delivery formats taught by the same instructor.

Purpose and Research Questions

Utilizing the variables that were identified in the literature review, this study attempted to determine the relationship between Extension employees' learning styles and their performance in a course taught in three different instructional modes. Specific research questions for this study were:

1. Is there a difference in the post-test scores of Extension personnel participating in an in-service training session based upon their learning style?
2. Is there a difference in the post-test scores of Extension personnel participating in an in-service training session based upon the instructional method?
3. Is there an interaction between learning style and instructional method based upon the post-test scores of Extension personnel participating in an in-service training session?

Methods

The target population for this study was employees of the Extension Service at Mississippi State University. The sample for the study was comprised of 53 4-H agents, program associates and secretaries who voluntarily elected to enroll in an in-service 4-H registration system training session. The session was offered in three distinct environments: a minimally interactive online environment; a highly interactive, multi-media rich online environment; and a face-to-face environment. There were 18 participants in the minimally interactive online environment, 18 participants in the highly interactive, multi-media rich online environment, and 17 participants in the face-to-face environment. The same instructor taught all three sections.

This study was conducted utilizing a post-test-only control group design. Campbell and Stanley (1963) note that this is a true experimental design that allows for the random assignment of individuals to treatments and treatments to groups. This random assignment is the best utilized when equivalent treatment groups is desired. According to Campbell and Stanley, this design controls for history, maturation, testing, instrumentation, regression, selection, mortality, and interaction of selection and maturation, as sources of internal invalidity. In addition, the design controls for interaction of testing and treatment, as a source of external invalidity.

Two independent variables and one dependent variable were studied. The first independent variable, instructional method, had three levels: minimally interactive online instruction, multimedia-rich, highly interactive online instruction, and face-to-face instruction. Learning style was the second independent variable and had four levels: actual-spontaneous learner, actual-routine learner, conceptual-specific learner and conceptual-global learner. This was measured utilizing Golay's Learning Pattern Assessment (LPA). The dependent variable was the participant's score on the knowledge post-test.

Learning Pattern Assessment

The Learning Pattern Assessment (LPA) was developed by Keith Golay, Professor Emeritus of California State University. It consisted of 40 questions, and "assist(ed) in determining a employee's natural style of learning" (Golay, 1982, p. 99). This was achieved by answers given on the inventory, which were then scored by the researcher using the provided profile sheet.

Golay's assessment was developed to provide an efficient way to identify an individual's learning pattern. It was intended to be used for grade school students, but was later adapted for use with adults as well. Golay (1982) noted that a study was implemented to test the reliability of the instrument. In the first study, a group of 46 individuals were administered the LPA, which was then re-tested two weeks later. The highest score in each of these two tests was compared to each individual. It was

found that 70% of the participants were rated as having the same learning pattern in the second assessment as in the first. In a follow-up study, 50 participants were similarly tested with an independent rater scoring the assessments. When a comparison was made between the two assessments, 71% of the participants were rated as having the same learning pattern in the second assessment as in the first.

Validity of the test was conducted at California State University (Golay, 1982). The author notes that, "one approach to determining the validity of a new instrument is to compare it with an instrument which is considered to be valid for assessing the same general area of behavior" (p. 50). It is this approach that Golay used to examine the validity of the LPA. An initial investigation was conducted to compare the LPA to the Myers Briggs Type Indicator (MBTI). This was done, Golay explains, because the MBTI is considered valid for assessing the same general area of behavior. This instrument was developed utilizing the same dimensions of Keirsey's personality theory that Golay used when developing his Learning Pattern Assessment. Golay notes however, that Isabel Briggs Myers analyzed the relationship between these dimensions from a different frame of reference than did Keirsey.

In the validity study, a group of 90 graduate-level students was administered both the MBTI and the LPA. A comparison between the two instruments revealed that in 80% of the sample, the LPA identified participants as having the same learning styles. While these results are by no means conclusive, Golay (1982) explains, they do suggest that the LPA measures what it purports to measure.

Knowledge Post-test

The post-test was designed by a team of curriculum experts within the Extension arena to measure the knowledge level of the participants following the completion of a one-day in-service training session. Since this post-test had been successfully used in the years prior to this study, the same instrument was used for assessment in this study. Covering several levels of Bloom's taxonomy, the test consisted of ten

questions, and required the user to answer both basic knowledge level questions as well as higher-level application and synthesis questions. These higher-level questions required the participant to use the knowledge they acquired in the in-service training to accomplish a similar task as what they may be required to do on the job.

Instructional Methods

The in-service training session utilized for this study was pilot tested in three different instructional modes. In the multimedia-rich, highly interactive online instruction section, randomly assigned individuals were asked to access a website to complete their training. This group was taught using audio- and video-animated screen captures of programs that they were required to use, short movies with the instructor showing tasks in more detail, online chat groups, and Internet bulletin boards. The instructor was also available via e-mail for specific questions or concerns.

Individuals that were randomly assigned to the minimally interactive online instruction group were asked to access a website to complete their in-service training. The instructor was available via e-mail if the participant had questions, but they were required on their own to access PowerPoint presentations online and perform self-guided tasks utilizing their computer. Thus, the instructor functioned more as a learning facilitator, rather than the traditional information giver.

Finally, those individuals that were randomly assigned to a face-to-face environment were taught using the traditional face-to-face lecture technique. Participants were provided with a computer and were taught using PowerPoint slides. They were asked to perform tasks on the computer and had the aid of the instructor at all times.

Data Analysis

Inferential and descriptive statistical procedures from the SPSS v.11 software package were used for data analysis. The sample size of Extension personnel who agreed to participate in the study was limited

and less than desired to achieve an ideal statistical power. Sexton (2000) notes that the choice of an alpha is "dependent upon the considerations of a statistical power or the probability of rejecting the null hypothesis" (p. 46). GPOWER, a statistical program that can calculate power for given sample sizes, was used to determine the power for the test. With a sample size of 53 divided between the three treatment groups, a medium effect size and an alpha level of .05 for the F test, the resulting power was .49. In order to increase this statistical power, an alpha level of .10 a priori was used.

Cohen (1977) notes that the researcher should set their beta level (or Type II error) at four times their alpha (or Type I error) level. Thus, in this study the beta level was set at .40. Power is derived by taking this beta level and subtracting it from one (1 - .40). Thus, an acceptable power for this study was .60. GPOWER calculated that for a sample size of 53 among the 3 groups, a medium effect size and an alpha level of .10 for the F test, the resulting power was .62. With the alpha level of .10 determined, a 4x3 factorial analysis of variance (ANOVA) was conducted to evaluate the research questions.

Results and Conclusions

The results of the Learning Pattern Assessment were determined to closely match the estimated distribution proposed by Golay (1982). He observed that in the normal learning environment, 38% of individuals could be characterized as an actual-routine learner, and this same percentage could be characterized as a conceptual-global learner. The actual-spontaneous and conceptual-specific learner should each make up 12% of the population. In this study, 13.2% of participants were characterized as actual-spontaneous and conceptual specific learners, while 43.5% were characterized as actual-routine and 30.2% were characterized as conceptual-global. Because the sample closely matches the stated population percentages, generalization of the results of this study outside the bounds of the targeted population is enhanced.

A 4 (type of learning style) x 3 (method of instruction) full factorial ANOVA was performed to investigate the three research questions of this study (Table 1). Research question one sought to determine if there was a difference in the post-test scores of Extension personnel participating in an in-service training session based upon their learning style. Results revealed no statistically significant difference in the mean post-test scores of participants among the four groups, $F(3,41) = 0.18, p > .10, \eta^2 = .01$. Homogeneity of variance was assumed, with a Levine's statistic equal to .23.

This result supports the findings of Neuhauser (2002), and indicates that training can be just as effective for all types of learners, regardless of their particular style of learning. While the finding does not imply that an individual's learning style has no effect on their learning potential in a classroom or online environment, it does indicate that future courses delivered within the Extension system do not have to be altered to meet the needs of each individual learning style group.

Table 1
Analysis of Variance Source Table

Source	SS	df	MS	F	p	η^2
Corrected Model	921.24	11	83.75	1.09	.392	.226
Intercept	307474.11	1	307474.11	4006.63	.000	.990
Type of Learning Style	42.38	3	14.13	0.18	.907	.013
Type of Instruction	430.57	2	215.29	2.81	.072	.120
Learning Style * Instruction	456.99	6	76.17	0.992	.443	.127
Error	3146.40	41	76.74			
Total	4067.63	52				

The second research question sought to determine if there is a difference in the post-test scores of Extension personnel participating in an in-service training session based upon the instructional method. The 4 x 3 ANOVA in this case revealed a statistically significant difference in the mean post-test scores of participants between the groups $F(2,41) = 2.81, p < .10, \eta^2 = .12$. Homogeneity of variance was assumed, with a Levine's statistic equal to .46. Post-hoc Tukey HSD tests were performed to determine the statistically significant differences between individual groups. Results indicated that the minimally

interactive online environment group ($M = 84.36$) was statistically significantly lower than the face-to-face environment ($M = 90.56$) and multimedia-rich, highly interactive online environment ($M = 90.12$).

This result adds weight to the finding of Burkman (1994), who observed a statistically significant difference the performance of participants in various different distance learning environments. In the case of this study, it was found that Extension employees who enrolled in a multimedia-rich, highly interactive online environment did significantly better than

their counterparts in a minimally interactive environment. While these same participants did not outperform those that attended a traditionally face-to-face taught workshop, their scores were not statistically significantly lower. This implies that this type of online instruction is comparable to traditional face-to-face instruction.

The final research question sought to determine if there was an interaction between learning style and instructional method based upon the post-test scores of Extension personnel participating in an in-service training session. The 4 x 3 factorial analysis of variance in this case indicated no statistically significant interaction between the learning style and the method of instruction based upon post-test scores, $F(6,41) = 0.992$, $p > .10$, $\eta^2 = .13$. This result is consistent with the findings of Neuhauser (2002), and indicates that equivalent learning activities can be equally effective for online and traditional classroom learners.

Discussion

The findings of this study imply that online instruction can be just as effective as the more traditional face-to-face instruction that is currently being used within the Extension system. This conclusion is borne up by numerous studies, more specifically those of Neuhauser (2002) and Aragon et al., (2002). However, this study found that online instruction should also include a number of highly interactive components. Interestingly, this is the same conclusion that Neuhauser found in her study of students enrolled in differing types of online courses. As discussed previously, her qualitative data suggested that highly interactive components such as exercises, activities, animations, and video tended to help engage the student in the learning process, as opposed to more static print and graphic media.

The idea that highly interactive components should be included in online media is not new. A recent study conducted by Roblyer and Wiencke (2004) found that the degree of interaction among participants in distance learning courses is a strong

indicator of the overall success of the learning experience. This is because interaction has been found to contribute both the achievement and student satisfaction. Indeed, the authors note that although the number of distance learning opportunities continues to expand, the critics of distance learning continue to express concern about the lack of direct interaction between instructors and students found in the more traditional face-to-face environment. Thus, they suggest that providing highly interactive components in the distance learning environment is the key to addressing these concerns and assuring the equivalency of the quality of these courses.

An additional study of note was done by King and Doerfert (1995). They performed a descriptive experiment that followed 112 agricultural education students aged 19 to 57 who were enrolled in courses delivered by videotape, interactive video and face-to-face. Results indicated that all students in the study desired high quality interaction within their distance education technology. Indeed, the authors conclude that a highly interactive environment should be an integral part of the learning design for any distance education course that is to be taught, noting that such an environment can only increase the chance of a successful outcome for consumers of distance education.

Beyond these studies, it can be observed that integrating highly interactive components into distance learning in the Extension arena makes intuitive sense as well. Extension has always been a hands-on arena, from the experiment farm to the classroom workshop. By creating activities that allow the learner to think, ask questions, and explore concepts further in ways they cannot in more stagnant print-based or graphic media, instructors can ensure that interest is not lost. Additionally, by integrating video and/or audio conferencing or some type of online discussion board, distance education providers allow the student to ask and receive answers to questions from the instructor or experts, just as they would in the more traditional face-to-face environment.

Recommendations

The conclusions of this study were based on research that investigated two types of web-based courses and similarly taught face-to-face course. The author believes that research into the effectiveness of distance learning via the interactive video classroom should also be considered. Many Extension units at land-grant universities are currently offering a number of courses and training seminars via this delivery method, and further research would be beneficial to determine if the level of achievement of participants in the remote classroom is similar to those located in the onsite, face-to-face environment.

Additional qualitative research may be extremely beneficial to program developers and instructors of distance learning material within the Extension system. The researcher suggests that a similar study should be conducted among participants within the traditional face-to-face and online environments with a concentration on the participant's feelings and overall satisfaction with the learning environment and quality of instruction. This would add an additional dimension to the findings of this study.

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