A Repeated Measures Study of the Short-Term Influences of High-Impact Practices on College Students' Learning Styles

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Abstract

In this study, we present a quantitative, repeated-measures component of a larger mixed-method case study. Using Kolb's Learning Style Inventory (2007), repeated measures were taken to test the stability of experiential learning style and learning mode of 33 College of Agriculture and Life Sciences students enrolled in a semester-long high-impact learning field experience. A one-group pretest-posttest design was used to test the effect of learning environment on students' experiential learning mode between pretest and posttest measures during the fall 2012 semester. A single pretest measure was taken at the beginning of the semester and a single posttest measure was taken at the conclusion of the semester. Results indicated the greatest pretest score was active experimentation and the least pretest score was concrete experience. The highest posttest score was concrete experience and the lowest posttest score was in abstract conceptualization. In determining if high-impact learning experiences and environments changed students' preferred learning style during a semester, results indicated significant differences ($p \leq 0.05$) existed between pre- and post-measures of the learning modes concrete experience and active experimentation.

Introduction

The underpinnings of experiential learning in agricultural education can be traced back to Stimson (1919) and Dewey (1938) who, among others, noted the importance of establishing connections between education and experience. The relatively extensive integration of experiential learning into agricultural courses and curriculum has been noted for decades (Roberts, 2006). Student participation in experiential learning is essential to the learning process and deepens students' understanding and sensitivity to the outside world (Dewey, 1933; Kolb, 1984).

Numerous approaches and examples of integrating experiential learning into post-secondary courses exist in the literature, for example, business (Prussia and Weis, 2004), marketing (Craciun and Corrigan, 2010) and community building (Arnold and Paulus, 2010). Many of the noted approaches include laboratory work, project-based activities and field trips. However, it is important to further note that not all experiential learning is equal in implementation or outcome (Roberts, 2006). Similarly, the diverse population and backgrounds of students pursuing post-secondary education in the United States would suggest that not all approaches to experiential learning are equally effective or result in the same outcomes for each student.

Ensuring student success and positive educational outcomes was noted as a priority for the Association of American Colleges and Universities (AACU) in its 2008 report by Kuh.

According to Kuh (2008), cohesively integrating multiple types of experiential activities into a course or series of courses increases the likelihood of students reaching greater academic goals and standards. Therefore, faculty members in Texas A&M University's Department of Agricultural Leadership, Education and

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Communications developed and implemented a semester-long course with an integrated field experience to provide students an opportunity to engage in real-world experiences and interact with people and situations they may not have encountered before. The course and its associated activities and the general approach to the field experience were developed in line with the theoretical foundations noted by Kolb (1984), Knowles et al. (2005), Roberts (2006) and other relevant literature (e.g., Hickcox, 2002; Blackburn, 2008; Matusevich et al., 2009).

Literature Review

Learning is the process of gaining knowledge through the transformation of experience (Kolb, 1984). Roberts (2006) noted that experiential learning is a cyclical and on-going process that enables learners to directly experience the phenomenon being studied. In his Model of the Experiential Learning Process, Roberts (2006) proposed, "[the process] begins with an initial focus of the learner, followed by an initial experience. After the experience, learners reflect on their observations and then formulate generalizations" (p. 22). As the sequential process continues, the learner progressively tests, reflects and refines his or her generalizations through additional experiences and experimentation (Roberts, 2006).

Researchers have suggested that some learning style characteristics are obtained biologically (Restak, 1979); whereas, others have suggested some individuals develop learning styles through experience (Dunn et al., 1996). Additionally, learning styles have been noted to change in various environments (Lidon et al., 2011; Nulty and Barrett, 1996) and over time (Nulty and Barrett, 1996); however, the amount of time needed for changes to occur is not evident in the literature.

Environment

Among researchers accredited with the advancement of experiential learning, Kolb (1984) suggested that genetic qualities as well as environmental conditions contribute to stable learning styles. When students find themselves in a particular learning environment with different influential factors, their learning style preferences change (Nulty and Barrett, 1996). If students are exposed to stable factors, then their choice of learning style appears to be stable (Nulty and Barrett, 1996). Conversely, students' choice of learning style becomes less stable when the student is exposed to more personal and environmental changes. "*[Because] both kinds of influence co-exist, the choice of learning style at any given time depends on the balance between the different factors and the students' own preferences*" (Nulty and Barrett, 1996, p. 333). Thus, it is reasonable to believe that environment may influence how people learn.

Time

Nulty and Barrett (1996) supported the concept that learning styles change between learning environments. "*A preferred learning style reflects a tendency rather than an absolute and students may adopt different learning styles in different situations*" (Marriot, 2002, p. 46). After completing a cross-sectional study between college students, studies found that individuals who are exposed to an increase in changes in content material will, over time, develop changes in their learning preferences (Nulty and Barrett, 1996; Pinto and Geiger, 1991). According to Baker and Robinson (2011), research by Sims and Veres (1989) showed that learning styles can change within a short period of time. When considering students' adaptation in preferences, the point in time at which learning styles change is unknown. Moreover, the literature does not contain an obvious answer to whether constant, concentrated learning demands (i.e., environment) will influence students' learning styles to change from the beginning of the school semester to the end (i.e., time).

Conceptual Framework

This study draws from two conceptual bases: Kolb's (1984) experiential learning theory and Kuh's (2008) High Impact Educational Practices. Kolb (1984) noted that well-rounded learning progresses through all four phases of the learning cycle. Each phase has a beginning and an ending point associated with a learning mode: concrete experience (CE), abstract conceptualization (AC), reflective observation (RO) and active experimentation (AE). Kolb (2007) suggested the learning cycle may begin at any learning mode, but progresses sequentially. Concrete experience and abstract conceptualization are the two learning modes a learner phases through to take in experience. In the concrete experience mode, learning occurs through a specific experience and when the learner is being sensitive to feelings and relating to people. Abstract conceptualization is the ability to get things done through actions by taking risks and influencing people. For learners to progress from concrete experience to the abstract conceptualization, they must go through the reflective observation mode. Similarly, learners must experience active experimentation to proceed from abstract conceptualization to concrete experience. When a learner reflects on experiences by viewing issues from different perspectives, they are going through the reflective observation stage. The active experimentation mode involves the learner's ability to learn by thinking and logically analyzing ideas.

Individuals can be categorized by one of four learning styles: diverging, assimilating, converging and accommodating (Kolb, 2007). The diverging style combines the concrete experience and reflective observation learning modes. People who learn through the diverging style tend to prefer to observe situations and use different points of view to approach concrete situations. Individuals who use the assimilating style typically combine the reflective observation and abstract conceptualization modes and use a wide range of abstract ideas and concepts to put information into a concise, logical form (Kolb, 2007). Combining the abstract conceptualization and active experimentation modes, individuals who learn in a converging style use practical ideas and theories to find the best solutions to questions or problems. When using the accommodating style, learners combine active experimentation and concrete experimentation modes and prefer to be involved in a hands-on activity to carry out plans (Kolb, 2007). Conversely, Kolb (2007) stated, "not everyone falls into one of the four dominant styles" (p. 6). Students can also have a balance between each of the learning modes creating another style of learning referred to as balancing. In the balancing style, students are more likely to be "comfortable with a variety of learning modes" (Kolb, 2007, p. 6). Kolb's learning styles provide "promising policies and effective educational activities and practices" to increase student engagement and success (Kuh, 2008).

High-impact experiences are a form of experiential learning that "*...challenge[s] students to develop new ways of thinking about and responding immediately to novel circumstances as they work side by side with peers on intellectual and practical tasks, inside and outside the classroom, on and off campus*" (Kuh, 2008, p. 15). According to Kuh (2008), high-impact experiences require students to spend more time and effort to complete tasks assigned and place students in situations where it is mandatory that they interact with faculty and peers. The different forms of high-impact learning that are used to increase rates of student retention and student engagement are first-year seminars and experiences, common intellectual experiences, learning communities, writing-intensive courses, collaborative assignments and projects, undergraduate research, diversity/global learning, service learning/community-based learning, internships and capstone courses and projects (Kuh, 2008).

The forms of high-impact experiences that were used in this study were common intellectual experiences, learning communities, writing-intensive courses, collaborative assignments and projects, diversity/global learning and service learning/community-based learning. Kuh (2008) explained common intellectual experiences as a set of required common courses and/or required participation in a learning community that combine broad themes with a variety of curricular or co-curricular options. Learning communities involve students working closely with faculty and other students by taking two or more linked classes as a group. Furthermore, linked classes should be closely related, allowing students to integrate learning across courses as well as an opportunity for students to gain information and form questions across disciplines that matter beyond the classroom. Writing-intensive courses emphasize writing at varying levels of instruction and across the curriculum; they also enhance students' ability to produce various forms of writing for different audiences throughout different disciplines. Collaborative assignments and projects allow students to learn to accept and understand varying opinions and problem solving techniques to gain skills in working with individuals from different backgrounds (Kuh, 2008).

The diversity/global learning form of high-impact experience allows students an opportunity to deal with issues such as racial, ethnic and gender inequality in a study abroad or through experiential learning in a community (Kuh, 2008). Service learning, or community-based learning, provides students with field-based experiences to apply knowledge learned in a classroom setting to a real-world setting and then in turn reflect on the experiential learning experiences (Kuh, 2008).

A similar study was conducted by Lindon et al. (2011) where activities were developed to enhance individual and group learning in relation to their environment. According to Strong et al. (2012), students' learning environment is highly correlated to student motivation and the social presence construct. Lindon et al. (2011) suggested that further research should be conducted in this area in other contexts to improve the theory's functioning. Although there is limited research regarding changes in learning styles, it could be argued that students' learning style preferences are likely to change as they are exposed to diverse teaching styles and high-impact experiences; however, the amount of time needed for these changes to occur is unknown.

Purpose

Researchers have noted learning style changes during the college years, i.e., freshman to senior year; however, it is unclear how much time is required for changes to occur (Nulty and Barrett, 1996). Perhaps a more perplexing issue is whether learning environment influences changes in learning style. Long-term implications of environmental influences on learning style and, more importantly, the prospective learning

outcomes are expansive. However, studies of learning and learning environment related to high-impact practices are not overtly evident in the literature. Further, baseline or normative data are not readily available and are likely to vary greatly based on environmental factors. Therefore, this study investigated the short-term influences of high-impact practices on college students' learning styles. Additionally, this study will provide a basis of comparison for future studies to better understand the short- and long-term relationship among learning styles, high-impact practices and environment.

Research investigating various learning environments has been common and ongoing in agricultural education literature; however, much of the agricultural education research is relatively focused on classroom (Ball and Garton, 2005) and distance education environments (Strong et al., 2012) and does not specifically investigate high-impact learning environments. Further, as Danielson (1996) noted in a description of her teaching framework, "*As educators study the components and consider them within individual context, they can determine which components and elements are applicable and which are not. ...Only educators in that setting can make those determinations*" (p. 5). Thus, concern regarding contextual differences, i.e., general secondary education versus agricultural education, substantiates the need for inquiry into high-impact learning environments in agricultural education. Therefore, this study was guided by two research questions:

RQ1: Do students' Kolb Learning Style Inventory (LSI) mode scores change during a semester (pretest vs. posttest)?

RQ2: Do high-impact learning experiences and environments change students' preferred learning style during a semester?

Method

Design

In this study we present a quantitative, repeated-measures component of a larger mixed-method case study of 33 students enrolled in a semester-long course at Texas A&M University. In the College of Agriculture and Life Sciences, students are encouraged to enroll in classes that provide a high-impact experience (Sams, 2010). This semester-long course included a ten-day field experience through the Midwest and Southern United States. Students participated in high-impact experiences and experiential learning activities related to agriculture, culture, global society, diversity, American resilience and youth development.

Ideally, social science experiments will randomly assign individuals to equivalent samples; one serving as a baseline to which another sample will be compared to test the effects of the experimental variable (Campbell and Stanley, 1963). Although a randomized experimental design is ideal for determining cause and effect, in some situations, including those presented in this study, a randomized experiment is not practical or feasible because the size of the population is a limiting factor. Therefore, a one-group, pretest-posttest design was used to test the effect of learning environment on students' experiential learning phase between pretest and posttest observations. A single pretest observation was taken on a group of subjects (O1) at the beginning of the fall 2012 semester. During the course of the semester, the intervention (X) occurred. Then, a single posttest observation was taken again (O2) at the conclusion of the fall 2012 semester.

Subject Characteristics

Subjects included in this case study consisted of 30 undergraduate and three graduate students who were enrolled in ALEC 380 at Texas A&M University during the fall 2012 academic semester. Among the students, nine were male and 24 were female; five were Hispanic and 28 were Caucasian; they ranged in age from 18 to 30 years, with grade-point-averages that ranged from 2.3 to 4.0 on a four-point grade scale.

Instrumentation

The commercially available, paper version of Kolb's Learning Style Inventory (LSI) was used to collect data for this study. According to Kolb and Kolb (2005), the LSI was created for individuals to understand how they learn from experience and the approaches they take in the learning process. By understanding their own learning process, learners are more equipped to make the best decision that will enhance their ability to learn in different learning styles (Kolb and Kolb, 2005). Kolb and Kolb (2005) identified an additional use of the LSI as "*a research tool for investigating experiential learning theory (ELT) and the characteristics of individual learning styles*" (p. 8).

External validity of the LSI was established using age, gender, educational level and educational specialization. Results from various studies with large populations have deemed the instrument valid. According to Platsidou and Metallidou (2009), reliability of the LSI was estimated using Cronbach's (1951) alpha coefficients for each learning mode: concrete experience (CE; $\alpha = 0.81$), reflective observation (RO; $\alpha = 0.72$), abstract conceptualization (AC; $\alpha = 0.76$) and active experimentation (AE; $\alpha = 0.76$). Interpretations of alpha coefficients differ in the literature. Nunnally (1967)

proposed that estimates of reliability greater than .80 were often wasteful for basic research. Conversely, Field (2009), suggested that estimates of reliability should exceed .80. Given the widespread use and acceptance of Kolb's (2007) LSI, reliability estimates were considered acceptable.

Procedure

The data collection process began after receiving approval from the Institutional Review Board at Texas A&M University (Protocol Number: IRB2013-0109) and followed the requirements and specifications set forth in the approval notice. Data were collected by direct administration of the LSI at two points; once at the beginning of the 2012 semester (August) and once at the conclusion of the semester (December). Data from the paper questionnaires were entered into and analyzed using IBM® SPSS® Statistics version 21.0. To address research question one, μ and σ were reported for pre- and post-measures by LSI construct. Additionally, changes in pre- and post-measures were also reported by LSI construct.

To address research question two, a one-way repeated measures analysis of variance (ANOVA) was used to test the effect of measure on each of the LSI construct scores. For each analysis, LSI construct score (AC, AE, CE, or RO) was used as the dependent variable and measure (pre vs. post) was used as the independent variable. The alpha level was set a priori at .05. Degrees of freedom, F ratio, p-value, effect size (ηp2) and power (1 – ß) were reported for each analysis, when appropriate. Effect sizes were interpreted according to Tabachnick and Fidell (2013) who noted ANOVA guidelines for small (ηp2 = .10), medium (ηp2 = .25) and large (ηp2 = .40) effects.

Results and Discussion

The first research question of the study was to investigate the effect of time by testing if high-impact learning experiences and environments changed students' LSI scores between the pretest and posttest during a semester. Descriptive statistics for student LSI scores are reported in Table 1. The greatest pretest score was in AE (μ = 38.97; σ = 4.82) and the least pretest score being in CE (μ = 26.27; σ = 6.95). The highest posttest score was in CE (μ = 37.15; σ = 6.80) and the lowest posttest score was in AC (μ= 26.27; σ = 6.19). Concrete experience exhibited the greatest increase between pre- and post-mean comparisons (Δ = 2.36) and AE indicated a decrease among pre- and post-mean comparisons (Δ = 1.82). The least change occurred in RO (Δ = 0.52).

Most frequently, students preferred AE and CE as their learning modes, which suggests students had an accommodating learning style. Although there was a shift in posttest scores, these scores indicated the class used AE and CE as their preferred learning modes, meaning the students maintained an accommodating learning style throughout the semester.

The second research question of the study was to determine if high-impact learning experiences and environments change students' preferred learning style during a semester. Significant differences ($p < 0.05$) existed between pre- and post-measures of the learning modes CE ($p = .004$) and AE ($p = .044$). Despite the significant results, it is important to note that satisfactory power of analysis (1 - ß ≥ .80) was only reached for CE, which reflected a small effect size (ηp2 = .232). Therefore, significant results for AE may be due to chance or error. Results of the ANOVA are noted in Table 2.

Summary

Based on these findings, one could argue that students' preferred learning style may change as students are exposed to high-impact experiences and diverse environments. Although the amount of time needed for students learning styles to change is undetermined, this study supported Nulty and Barrett's (1996) findings that changes in learning style preferences occur. The findings suggested concrete experience (CE) exhibited the greatest increase between pre- and post-mean comparisons. Does this suggest that high-impact experiences have the

Table 1. Parametrics and Descriptive Statistics of Students' Pre- and Post-Measures of Learning Modes from the LSI (n = 33)

	Pre		Post		Δ	
Learning Mode	μ	σ	μ	σ	M	SD
Abstract Conceptualization (AC)	27.33	7.43	26.27	8.00	-1.06	4.85
Active Experimentation (AE)	38.97	4.82	37.15	6.80	-1.82	4.99
Concrete Experience (CE)	26.27	6.95	28.64	7.48	2.36	4.37
Reflective Observation (RO)	27.42	6.25	27.94	6.19	0.52	4.84

Table 2. One-Way Repeated Measures Analysis of Variance for the Effect of Measure on Four Dependent Variables: Kolb's LSI Construct Scales (n = 33)

Scale		df	SS	MS	F	*p*	η_p^2	1 - ß
Abstract Conceptualization (AC)								
	Between	1	18.56	18.56	1.58	.218	.047	.230
	Error	32	375.94	11.75				
Active Experimentation (AE)*								
	Between	1	54.55	54.55	4.38	.044	.120	.528
	Error	32	398.46	12.45				
Concrete Experience (CE)*								
	Between	1	92.18	92.18	9.65	.004	.232	.853
	Error	32	305.82	9.56				
Reflective Observation (RO)								
	Between	1	4.38	4.38	0.37	.545	.012	.091
	Error	32	375.12	11.72				

Note. * Indicates significant results ($p \leq .05$)

greatest potential for initiating change in learning style? This warrants additional investigation. Conversely, AE showed the greatest decrease among pre- and post-mean comparisons. Did this group of undergraduate students fail to make the connection between active experimentation and the other learning modes proposed by Kolb? Is this true for similar groups of students engaged in high-impact learning experiences? Further inquiry is needed to investigate these trends.

Findings revealed shifts in learning mode, but no change in learning style. This has many practical implications for post-secondary agricultural educators. When conducting a high-impact learning experience, curriculum, teaching, assessment/evaluation and learning outcomes may require more in-depth planning and scrutiny by the instructor. This requires more resources such as faculty time and effort, potentially higher investment cost in curriculum and materials and additional personnel to deliver instruction, whether it be faculty or teaching assistants. This supports Kuh's (2008) notion that high-impact experiences require more time and effort for all parties involved.

Sims and Veres (1989), as cited by Baker and Robinson (2011), suggested learning styles change in a short period of time. This aligns with results of this study in that significant differences were found between pre and posttest scores within a semester. It can also be concluded that high-impact experiences may influence time as a variable in experiential learning style and mode. The group learning style scores experienced a shift in posttest scores in AE and CE. However, the shift in learning modes did not move from the accommodating learning style. Although the shift in modal scores was toward experiencing, the final group score remained in the accommodating quadrant. This supports Kolb's (2007) posit that using the accommodating style helps learners combine active experimentation and concrete experimentation modes which involve hands-on activities. The experiential learning activities that the students participated in were focused toward experiencing and doing. This substantiates Dunn et al. (1996) work that suggested some individuals develop learning styles through experience. This may account for the lack of significant change in learning styles.

Recommendations

Recommendations for Practice

Future recommendations for practice target students, professors and Colleges of Agriculture. A recommendation of this study is for students to participate in high-impact-learning experiences with open minds to reap the full benefits of different learning situations and environments. Another recommendation is to encourage professors to move away from the traditional classroom and lecture method of teaching and implement high-impact experiences to explore the effect of high-impact learning within the learning styles of students. Coupled with changing learning environments, high-impact experiences could be used within the College of Agriculture and Life Sciences to promote differences in learning styles.

Recommendations for Research

Based on the findings of this study and the current literature base, many opportunities exist for further research. The researchers suggest conducting randomized experiments or quasi-experiments to examine larger samples, utilizing random assignments to treatment and control groups. This would provide a more robust analysis of data and provide greater generalizability of results. Additionally, we recommend additional qualitative studies be conducted to better understand high-impact experiences and experiential learning styles.

Finally, further research is needed to determine if demographic differences, school classes and specific high-impact activities are required to have a change in learning style. This research would further contribute to a more substantial foundation to determine if changing learning styles are a result of high-impact experiences and learning environments.

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