

LEARNING STYLES AND SATISFACTION IN DISTANCE EDUCATION

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ABSTRACT

Although complex, controversial, and contradicting, learning styles is highly influential. Distance education (DE) has experienced tremendous growth in the last few decades. The popularity of learning styles and DE necessitates research. This correlational research study was conducted to determine if there is any evidence to incorporate learning styles in DE.

The following is the research question for this study. Are students' learning styles based on the visual, auditory, tactile model correlated to satisfaction of course format in an online undergraduate course? The participants of this study were students enrolled in three sections of the Contemporary Worldviews course at a private higher education institution (HEI). Learning styles were determined by a variant of the visual, auditory, read/write, and kinesthetic (VARK) framework. Satisfaction of course format was determined from one composite question with responses based on a Likert scale. The response rate was 53.5%. Statistical analysis determined that learning styles was not correlated to satisfaction of course format in this current study. There are implications from this study that curriculum can be designed for a single course that leaves students highly satisfied. Educators should saturate DE courses with as much variance as feasible given technology and cost limitations to account for possible learning style differences.

Keywords: Distance education, learning styles, satisfaction, VARK.

INTRODUCTION

In the last few decades, learning styles has become a highly influential area of tremendous interest (Pashler, McDaniel, Rohrer, & Bjork, 2008) comprised of a large body of research (Coffield, Moseley, Hall, & Ecclestone, 2004). However, this area of study remains complex and steeped in controversy with no consensus among scholars concerning research results or pedagogical implications (Coffield et al., 2004; Graf & Kinshuk, 2007; Santo, 2006).

Many issues contribute to the "opaque, contradictory and controversial" (Coffield et al., 2004, p. 2) nature of this field of study such as fragmented research, the continuum nature of learning styles, a vast number of classification models, the potential dynamic nature of individual learning styles, the potential bias of sample populations, and the commercialism of measurement instruments.

Additionally, there doesn't appear to be a single definition of learning styles (Beyth-Marom, Saporta, & Caspi, 2005; Graf & Kinshuk, 2007; Santo, 2006). However, the following definition provides a general understanding of what this construct is. Maushak, Chen, Martin, Shaw, & Unfred (2001) state that "Researchers agree that learning styles represent the ways in which individuals interpret, process, understand, and integrate information" (p. 126). Other scholars include the aspect of an individual's preference (Honey & Mumford, 1982), ease (Nilson, 2010), or even best (Drago & Wagner, 2004) way of learning in their definitions. The implication of these challenges concerning learning styles is that sound research in this area is still warranted. Contextually, the need to study learning styles in light of the conception of distance education (DE) has become greater than ever.

DE defined by Parsad and Lewis (2008) and adopted by the U.S. Department of Education is "a formal education process in which the students and instructor are not in the same place" (p. 1). DE can be synchronous or asynchronous. Synchronous DE occurs with real-time communication between the instructor and learner where asynchronous DE occurs with a time-delay (Hillstock, 2005). DE has experienced continuous growth (Neely & Tucker, 2010), global expansion (Eaton, 2004), and has been utilized by an enormous numbers of institutions and individuals. Scholars claim that DE is now "mainstream" (Sahin, 2008, p. 123) with others claiming that it has replaced traditional education (Spears, Fried, Olia, Manski, Craig, & Covington, 2008). This appears to be an educational process that is not diminishing, and remains dynamic (Buboltz, Wilkinson, Thomas, & Jenkins, 2001). Similar to learning styles, DE has a commercial aspect as a multi-billion dollar industry and the fastest growing market in education (United States Distance Learning Association, 2009) involving two-thirds of degree-granting postsecondary institutions with an estimated 12.153 million students nationally (Parsad & Lewis, 2008, p. 9). Graham and Essex (2001) contend that the popularity of DE in academic and corporate settings impels the need for study.

Fortunately, scholars began studying DE early after conception. Much research has been focused on comparison of DE against traditional education in what is known as the no significant difference phenomenon. Though challenged by some scholars as less successful based on failure rates (Rolfe, 2007), course grades (Edvardsson & Oskarsson, 2008), or a direct comparison of exams or tests (Bozkaya, 2001; Deka & McMurry, 2006), scholars have empirically demonstrated the no significant difference phenomenon (e.g., Glenn, 2001; Head, 2001; Hoban, Neu, & Castle, 2002; Spears et al., 2008).

In fact, many times studies report a significant difference in performance in favor of DE (e.g., Jones, 1999; MacFarland, 2006; Magagula & Ngwenya, 2004; Schoenfeld-Tacher & McConnell, 2001). Meta-analysis such as Shachar and Neumann (2003) also support that DE students outperform their traditional counterparts. With the apparent legitimizing of DE through the consensus of the no significant difference phenomenon, scholars began to focus attention on studying learning styles in the context of DE (e.g., Battalio, 2009; Beaumaster & Long, 2002; Eom, Wen, & Ashill, 2006; Offir, Bezalel, & Barth, 2007; Manochehri, 2008; Rothenberger & Long, 2001; Roy, 2006; Shaw, 2012; Zacharis, 2010). Education professionals must continue to critically evaluate whether learning styles should be considered and how it should be considered in DE.

The following review of literature demonstrates that existing research studies utilize satisfaction and performance as criterion variables in related research. The review of literature also demonstrates that while there are numerous studies that evaluate learning styles and satisfaction in DE, very few studies utilize Fleming and Mills' (1992) visual, auditory, read/write, and kinesthetic (VARK) framework for learning styles. This is the research gap that this current study attempts to address. This current study is significant as it adds to the pool of existing research literature available that helps to determine if there is any empirical evidence to incorporate learning styles based on the VARK in DE. If learning styles is correlated to course satisfaction, there could be empirical evidence in support of the "meshing hypothesis" (Pashler et al., 2008, p. 108) of matching instruction to students learning styles whether that is accomplished by saturating a course or varying instruction (e.g., adaptive hypermedia). Conversely, these recommendations may not be justified if there is no correlation between students learning styles and satisfaction or performance.

The specific purpose of this study is to determine the correlation (if any) of learning styles on student satisfaction with course format in DE. The scope of this study is restricted to learning styles and satisfaction of DE in the higher education context. The research question for this study is: Are students' learning styles based on the visual, auditory, tactile model correlated to satisfaction of course format in an online undergraduate course?

The following review of literature, methodology, results, discussion, and conclusion attempt to provide more clarity with this "vague" (Santo, 2006, p. 85) construct of learning styles.

REVIEW OF LITERATURE

This review of literature presents the origin of learning styles, existing controversies, existing research basis for the criterion variable, and current research gap being explored. Coffield et al. (2004) is utilized as the theoretical framework for the discussions of this current review of literature.

Coffield et al. (2004) describe learning styles as “controversial” (p. 2). The controversies concerning learning styles are multi-faceted and can be seen beginning with the origin of learning styles.

Origin of Learning Styles

There are conflicting accounts concerning the contemporary origin of learning styles. Pashler et al. (2008) traces the contemporary origin of learning styles to the Myers-Brigg Type Indicator (MBTI) test which started to be popular in the 1940s (Pashler et al., 2008). However, Buboltz et al. (2001) attributes the origin of learning or cognitive styles to Allport (1937). Regardless of the conflicting accounts of the contemporary origin of learning styles, it is ultimately rooted in ancient theories of medicine. Attributed by the second century A.D. to the ancient Greek Hippocrates, the four humors doctrine was further developed by Galen (Nutton, 2005). Although originally a medical doctrine, the four humors doctrine serves as the origin of the first temperament, trait, or type theory of learning styles.

Controversial Nature of Learning Styles

The controversy concerning learning styles extends beyond conflicts concerning the contemporary origin of learning styles. It involves a philosophical debate of whether learning styles are viewed as fixed or flexible. Coffield et al. (2004) is a literature review that identified 71 existing models of learning styles, evaluated in detail 13 of those models, and provided a theoretical framework to classify learning style models. Coffield et al.'s (2004) framework is a continuum based on how fixed or flexible learning styles are viewed. Coffield et al. (2004) group the identified models into the following five families in increasing order of flexibility: constitutionally-based learning styles and preferences; cognitive structure; stable personality type; “flexible stable” (p.12) learning preferences; and learning approaches and strategies.

Theoretically, the controversy in learning styles also involves whether the construct is viewed as dynamic and can change for an individual over time (Maushak et al., 2001). Pragmatically, another controversy of this field of study involves the every expanding theoretical frameworks, instruments, and resulting commercialism (Coffield et al., 2004; Pashler et al., 2008) of those measurement instruments. Perhaps the most controversial issue concerning learning styles is the tremendous conflict concerning the results of existing research studies as well as the implications of the research. Much of the controversy regarding research pertains to the meshing hypothesis previously introduced which is one of most common hypothesis (Pashler et al., 2008) or recommendations (Coffield et al., 2004) in related research.

The majority of studies involving learning styles and DE in the current review of literature pertain to the meshing hypothesis or recommendation (e.g., Battalio, 2009; Buboltz et al., 2001; Combs, 2001; Gee, 1990; Maushak et al., 2001; Rothenberger, & Long, 2001; Walls, 2005).

However, this meshing hypothesis is strongly contradicted by some contemporary scholars (e.g., Coffield et al., 2004; Pashler et al., 2008). Coffield et al. (2004) base this criticism on conflicting research, complexity of interactions between other constructs, complexity of the construct of learning, and the fact that it is pragmatically unrealistic. Pashler et al. (2008) also contend there is no empirical basis for this hypothesis. However, their criticism is primarily based on the lack of "methodologically sound studies" (Pashler et al., 2008, p. 105) that supports this hypothesis. Pashler et al. (2008) argue that causation has to be demonstrated by a crossover interaction shown through an experimental research design.

Existing Research Basis for Criterion Variables

In contrast to the controversies presented, there is consensus that the research basis for evaluating learning styles in DE is academic achievement and/or satisfaction. Researchers have stressed that the first and central issue that must be evaluated is student achievement (Eaton, 2001; Schoenfeld-Tacher & McConnell, 2001). Research concerning the construct of academic achievement is tremendously extensive (Winnie & Nesbit, 2010). However, existing research concerning learning styles and DE pragmatically utilizes a multiple of measurements for this construct including final grades, course completion rates, pre-test/post-test gains, grades on individual assignments, and grade point averages (GPA). Although not classified as Coffield et al.'s (2004) constitutionally-based learning styles, there are studies numerous (e.g., Battalio, 2009; Beaumaster & Long, 2002; Gee, 1990; Rothenberger, & Long, 2001; Shaw, 2012; Shih et al., 1998; Spears et al., 2008; Zacharis, 2010) that utilize achievement as a criterion variable. Interestingly, only Battalio (2009) and Gee (1990) report an association between learning styles and achievement in these cited examples.

Concerning student satisfaction, Eom et al. (2006) articulate that this variable is one of two outcomes "widely cited as measures of the effectiveness of online education systems" (p. 216). Although not classified as Coffield et al.'s (2004) constitutionally-based learning styles, there are numerous studies (e.g., Cook, Gelula, Dupras, & Schwartz, 2007; Manochehri, 2008; Miller, 1997; Shaw, 2012; Yunfei & Simpson, 2002) that utilize satisfaction as a criterion variable for research design. Interestingly, only Yunfei and Simpson (2002) based on Kolb's (1984) Learning Style Inventory reports a correlation between learning styles and satisfaction in these cited examples.

Constitutionally-based Learning Styles and Satisfaction

The following studies are discussed in more detail as they are based on the same family of learning styles from Coffield et al. (2004) as the current research study which is the constitutionally-based classification. This family views learning styles as fixed and "very difficult to change" (Coffield et al., 2004, p. 13). This current review of literature only resulted in three sources pertinent to learning styles and satisfaction in DE that were based on the VARK framework for learning styles.

The review of literature also confirms Graf and Kinshuk's (2007) allegations that there is a lack of consensus with results of research concerning learning styles in DE. The following studies report contradicting results regarding learning styles and course satisfaction.

Eom et al. (2006) is a quantitative research article that examines six independent variables including learning styles against the dependant variables of satisfaction and perceived learning outcomes.

Specifically, the hypothesis concerning learning styles is visual and read/write students would experience greater satisfaction (Eom et al., 2006). Most significantly, learning styles in Eom et al. (2006) is based on Fleming and Mills' (1992) VARK framework. Eom et al. (2006) sent surveys to 1854 online higher education students and received 397 responses. The data are analyzed statistically by the partial least squares methodology (Eom et al., 2006).

Eom et al. (2006) determine that all six independent variables including learning styles are significantly correlated to satisfaction, and only learning styles and instructor feedback are correlated to perceived learning outcomes. Drago and Wagner (2004) is another study that reports a correlation between learning styles and satisfaction. Drago and Wagner (2004) use a correlational design to determine if there is a relationship between learning styles and satisfaction. Drago and Wagner (2004) is also based on the VARK learning styles framework. Their sample for the study consists of graduate students in "11 MBA management courses" (p. 4) offered by "a large Midwestern university" (Drago & Wagner, 2004, p. 4).

In contrast to these two quantitative studies (Drago & Wagner, 2004; Eom et al., 2006), Roy (2006) is a qualitative study based on the VARK.

Additionally, Roy (2006) states "that it has not been proven that learning styles make a difference when considering interactions in an asynchronous e-learning environment" (p. 25).

Roy (2006) utilizes the following methods of research: a literature review, limited interviews, and a survey with a small sample size. Due to these conflicting results and the small number of studies utilizing the VARK, this study seeks to address this current research gap.

METHOD

This current study attempts to determine if students' learning styles based on VARK are correlated to satisfaction of course format in an online undergraduate course. The details concerning the methodology of this current correlational study are as follows. Specific details concerning the participants, outcome and instruments, and data analysis are subsequently described.

Participants

The participants of this study were selected from a population of a HEI. The pseudonym for this HEI was Western Private University (WPI). WPI is a private university located in the southeastern United States with a residential enrollment of 12,600 students and an online student population of over 80,000. WPI is a private, religious, co-educational, and comprehensive higher education institution. The population consisted of a diverse student body in terms of geographical location and gender. The online student body is 39% male and 61% female and is located in all 50 states and 95 countries. At WPI, DE is conducted in the form of online courses and residential intensives.

There are no hybrid courses or blended courses at WPI. The participants of this study were representative of the diversity of the population. Based on voluntary information provided by individual participants during a course introduction discussion board, the participants were diverse with respect to gender, marital status, age, and geography. Racial information was not readily available.

The socioeconomic status appeared to be the only homogeneous factor based on the introductory discussion board. Most of the participants appeared to be blue collar with professions such as law enforcement personnel, construction workers, truck drivers, clerical employees, enlisted military members, and spouses of enlisted military members. This study utilized a convenience sample.

The participants of this research study were undergraduate students enrolled in three sections of Contemporary Worldviews with WPI. The Contemporary Worldviews course included an introduction and application of critical thinking skills, a study of religious and philosophical worldviews, and the nature of tolerance and basic apologetic methodology. The asynchronous Contemporary Worldviews courses complied with the definition of DE provided by Parsad and Lewis (2008). The Contemporary Worldviews course was required for all undergraduate DE students, but not required for residential students. This course was not offered as a residential intensive. Consequently, all DE students in Contemporary Worldviews were online students and all online students in Contemporary Worldviews were DE students.

Outcome and Instruments

For this current study, learning styles was the predictor variable and satisfaction was the criterion variable. As introduced, a variant of the VARK model was selected due to Drago and Wagner's (2004) confirmation of the popularity of this learning styles model (as cited in Eom et al., 2006). Specifically, the "Learning Style Inventory" (Penn State University, n.d.) was a short online 24 question survey that determined whether a student was primarily an auditory, visual, or tactile learner. Additionally, this model was selected because of the ease of understanding the model and the speed with which the survey could be completed.

The ease of understanding the learning styles model was important as the participants of this research study were new undergraduate students who presumably would have little existing knowledge concerning learning styles. The speed of completing the survey was important as a high response rate was desired given the low number (43) of active students in these three sections of Contemporary Worldviews.

Satisfaction as the primary outcome of this study was measured through a single survey question sent to the participants. The researcher asked students how satisfied they were with how the course material and assignments had been formatted for the Contemporary Worldviews course.

Answers were requested based on the following Likert scale: Strongly Satisfied (1); Satisfied (2); neither Satisfied nor Dissatisfied (3); Dissatisfied (4); or Strongly Dissatisfied (5). Emphasis was placed on the format of the course material. One final conditional question assisted in determining whether participants correctly understood the limited scope of the satisfaction question. Participants who answered the satisfaction question with a 4 or 5 (Dissatisfied or Strongly Dissatisfied) were requested to explain why they felt this way and/or what suggestions they had for improvement of how this course was formatted. Additionally, the researcher gave all participants the opportunity to ask for any clarifications. The researcher explained that participation may benefit future academic pursuits by increasing self-awareness that could also lead to more effective study strategies. The researcher assured the participants that there was no right or wrong answer for this exercise. The researcher invited students to participate in the study during week 5 of the 8 week course, and offered extra credit as an incentive. The extra credit was offered in an attempt to increase the response rate. The timing of a mid course survey assisted in mitigation of academic achievement as an intervening variable in students' responses concerning satisfaction with the format of the course material. The invitation was sent electronically by email to every student and posted in the course management system (Blackboard). Participants had ten days to respond. The researcher requested two responses, the participants primary learning style indicated by the survey instrument and the answer to the previously discussed satisfaction of course format question.

Data Analysis

Due to the single predictor variable and the single criterion variable, the data of this current study were evaluated by the following statistical analysis. Data were analyzed with "the most common correlation coefficient-the Pearson product-moment correlation coefficient (r)" (Howell, 2011, p. 189) and evaluated with an alpha (α) of .05 based on a two-tailed significance test. The result was evaluated by comparison to a table of "Significant Values of the Correlation Coefficient" (Howell, 2011, p. 592). The null hypothesis of this experiment was that learning styles is not correlated to satisfaction of course format.

RESULTS

In order for the data to be statistically analyzed as previously described, the learning styles were assigned the following values: tactile learners

- visual learners
- auditory learners and
- unknown learners

These values were assigned based on maximizing the correlation coefficient which would result in the highest probability of rejecting the null hypothesis. The following were the descriptive and correlation results of this current study based on this assignment of values.

Descriptive Results

Out of 43 undergraduate students, 23 students participated in this study resulting in a 53.5% response rate. As shown by Figure: 1, fourteen of the respondents were visual learners, six were auditory; one was a tactile learner; one was a combination of visual and auditory; and one was unknown. The one respondent that was a combination of auditory and visual was represented in the data with a value of 2.5 (which was the median value of auditory learners represented by 3 and visual learners represented by 2). The numeric values of the x-axis corresponded to the previously identified values for learning styles. The mean of the learning styles was determined to be 2.326 with a standard deviation of 0.619. For satisfaction of course format, the mean was 1.478 with a standard deviation 0.511. Also, 52.17% of the respondents were very satisfied and 47.83% were satisfied with the format of Contemporary Worldviews.

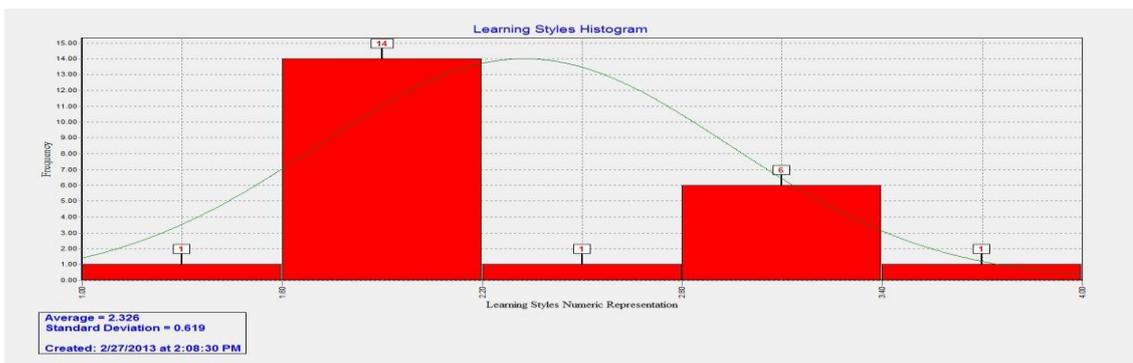


Figure: 1
Learning styles histogram (2012).
This figure illustrates the frequency distribution for the learning styles of the respondents.

Correlation Results

The data collected were represented in Figure 2 as a scatterplot of learning styles and satisfaction of course format. As shown by Figure 2, there appeared to be no correlation between learning styles and satisfaction of course format in this current study which was confirmed by the following statistical analysis.

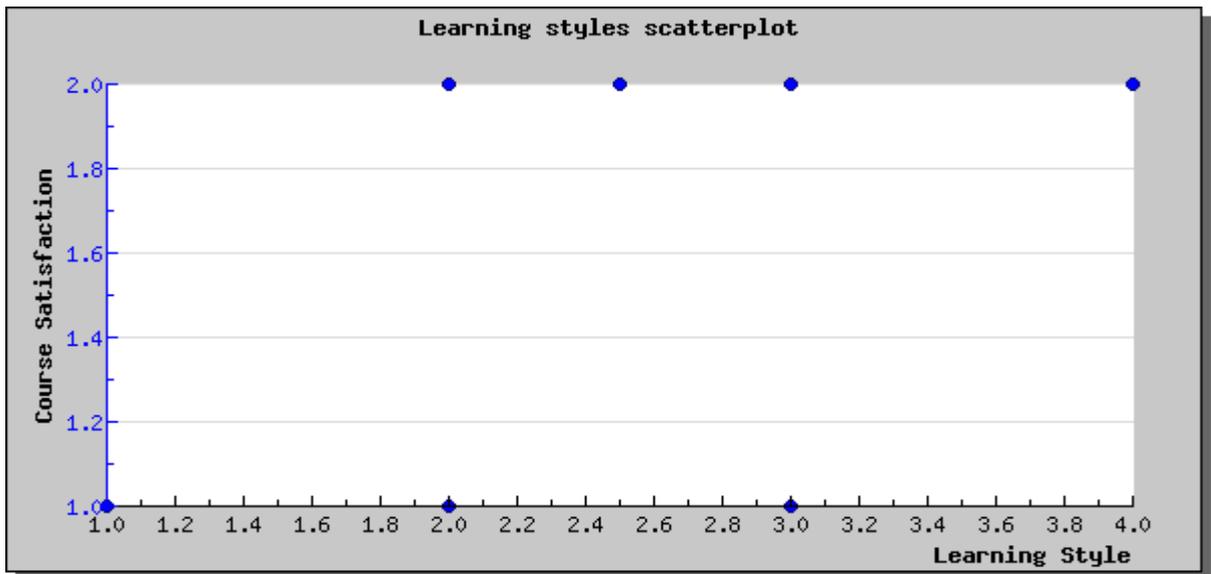


Figure: 2
Learning styles scatterplot (2012).
This figure illustrates the scatterplot of the learning styles and course satisfaction data.

With 23 respondents, the degrees of freedom (df) was calculated to be 21. Based on the learning styles and satisfaction of course format data collected, the r was calculated to be 0.269.

With a 21 df, the critical value of 0.413 was determined from a table of "Significant Values of the Correlation Coefficient" (Howell, 2011, p. 592). The r of 0.269 was less than the critical value of 0.413, so the null hypothesis could not be rejected at $\alpha = 0.05$. Consequently, learning styles was not correlated to satisfaction of course format in this study.

DISCUSSION

These results answer the research question of this current study which was whether students' learning styles based on the visual, auditory, tactile model are correlated to satisfaction of course format in an online undergraduate course.

The following interpretation of the findings, recommendations to educators, and recommendations for future research are derived from the results of this current study. However, it is critical to consider the limitations of this current study before presenting interpretations and recommendations.

LIMITATIONS

The primary limitation of this current study is its ability to be generalized due to three factors. For a quantitative study, 23 respondents is a small sample size. Secondly, there are some problems inherent to learning styles that potentially affect generalizing any findings.

Use of multiple frameworks for learning styles makes generalization difficult (Maushak et al., 2000), and learning styles may not even be stable over time (Graf & Kinshuk, 2007; Maushak et al., 2000).

Thirdly, the context of this study only included one course offering with WPI. Curriculum designs vary tremendously for DE courses often times even within the same institution.

Additionally, a single course offering means that subject matter is not considered as a variable of interest. Another limitation of this study concerns the validity and reliability. The validity of the "Learning Style Inventory" (Penn State University, n.d.) is a limitation of this current study. Penn State University (n.d.) overtly acknowledges this limitation in their inventory. Theoretically, Maushak et al. (2000) challenge the validity of many learning style inventories such as the one utilized by this study because of their bipolar measurement basis as opposed to measurement on a continuum. Unfortunately, there are no statistics available for the validity and reliability of both measurement instruments used in this current study.

INTERPRETATION OF FINDINGS

With the acknowledged limitations of this current study, readers should be careful in definitively concluding that learning styles are not correlated to satisfaction of course format. The results may have been different had another learning style framework been selected as the instrument of measurement. However, this seems unlikely given the data collected as shown by Figure 2 and the satisfaction of course format mean of 1.478. All respondents indicated that they were either very satisfied or satisfied with the format of the course. No respondents were neutral or dissatisfied with the format of Contemporary Worldviews. This lends to a discussion concerning curriculum design. These findings can be interpreted to support that APOL has excellent curriculum design based on the VARK framework. The format of course material for Contemporary Worldviews includes video podcasts, reading assignments, threaded discussion boards, written assignments, and online quizzes.

RECOMMENDATIONS FOR EDUCATORS

One of primary implications of these findings is as follows. Although the results of this study appear to lend support to scholars (Cook et al., 2007; Pashler et al., 2008) that contend there is little or no evidence to incorporate learning styles in education, this depends upon how learning styles is incorporated into curriculum design of DE courses. There are generally two reoccurring themes concerning how to account for learning styles in DE. Some scholars recommend assessing student learning styles and varying the course content (e.g., Combs, 2001; Rothenberger & Long, 2001; Walls, 2005). Other scholars recommend saturating a course with as much technology as possible (e.g., Bowen, 2006; Simonson, Smaldino, Albright, & Zvacek, 2012).

This study provides evidence there isn't a need to assess and vary course content as all students were satisfied with the course content of APOL regardless of their learning style. Alternatively, the implication is that it is possible to design curriculum for a single course that leaves students satisfied regardless of their learning styles irrespective of how their learning styles are assessed. Based on the VARK framework, educators should saturate DE courses with as much variance as feasible given technology and cost limitations to account for possible learning style differences. Threaded discussion boards are one of the most effective means of fostering interaction in DE (Simonson et al., 2012).

Consequently, use of threaded discussion boards would satisfy tactile learners. Use of video recorded lectures or "vodcasts" (Nilson, 2010, p. 261) would satisfy and be effective for visual and auditory learners. How much of each type of medium may need to be varied across disciplines as "optimal instructional method is likely to vary across disciplines" (Pashler et al., 2008, p. 116).

RECOMMENDATIONS FOR FUTURE RESEARCH

This leads to a major recommendation concerning future research. Subject matter should be considered as a mediating variable between learning styles and satisfaction and/or performance.

This would help to address Coffield et al.'s (2004) criticism concerning this "factor which is frequently neglected by the learning theorists" (p. 122). The following are other recommendations for future research.

A similar study could be conducted that requests course satisfaction feedback from additional course satisfaction questions instead of one composite question. For example, students could be asked how satisfied they were with the threaded discussion boards, "vodcasts" (Nilson, 2010, p. 261), or textbooks as separate mediums. Similar studies could be completed across all sections of Contemporary Worldviews in order to increase the sample size.

Also, some racial preferences could be incorporated into the design of future studies. Studies could also be completed from a population inclusive of multiple institutions which would contribute to results being able to be generalized.

Future studies could also utilize a different learning style framework than the variant of the VARK used in this current study. Future studies can be based on an experimental research design recommended by Pashler et al. (2008) to determine if a crossover interaction is revealed.

The options are almost unlimited and are bounded primarily by the creativity of scholars and willingness of educational institutions to endorse such research.

CONCLUSION

In contraction to other studies based on the VARK framework (Drago & Wagner, 2004; Eom et al., 2006), this current study has concluded that learning styles is not correlated to satisfaction of course format in Contemporary Worldviews.

This has an implication that there may not be empirical evidence to incorporate learning styles in DE as other scholars (Coffield et al., 2004; Pashler et al., 2008) contend.

Alternatively, there is also a potential implication that curriculum design for can be accomplished in such a way DE (e.g., threaded discussion boards, video recorded lectures, reading and writing assignments) that learners are satisfied with the format of course material based on the VARK regardless of individual learning styles.

With the controversy, complexity, and contradictions concerning learning styles and the tremendous growth of DE, it is imperative that researchers continue to explore this area of study in order to refine pedagogy for DE in order to maximize learning outcomes for students.

As previously discussed, future studies can be replication studies based on different measurement instruments, different populations, or different learning styles frameworks.

Alternatively, different research designs such as true experiments can be utilized to evaluate the meshing hypothesis. However, another existing research gap is the lack of studies that consider subject matter in their research designs (Coffield et al., 2004).

Perhaps instruction should be matched to subject matter rather than individual student learning styles in order to maximize the effectiveness of DE as measured by achievement and satisfaction.

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