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Learning Styles Assessment Diagnostics (LAMP-D) Framework: Accounting Students' Preferred Learning Styles & Course Learning Assessment

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Abstract

This study outlines students' perceptions of their cognitive learning mode relative to assessment methods and class activities to support meaning-making in accounting. It builds on Barsch's (1996) learning styles inventory, on Grasha-Riechmann's (Riechmann & Grasha, 1974) learning style scale, and Kolb's (1984, 1985) learning modalities. The study yielded some important results: (1) A Learning Styles Assessment Modalities Preferences Diagnostics (LAMP-D), created to determine learning modalities and preferred assessments; (2) Accounting students have similar learning aptitudes within various learning modalities and contexts, which correlate positively or negatively with different assessments; (3) Regardless of preferred learning styles, students' assessment preferences correlate positively to individual case study, and negatively to multiple-choice assessments; (4) As Faculty understand how accounting students learn, they should make flexible, proactive decisions about teaching methods, modalities and contexts. They should simultaneously reduce their reliance on ineffective techniques such as objective or passive assessments. Moreover, routine, traditional, or mundane assignment modalities and contexts, such as multiple-choice exams may not be the most effective techniques.

Key words: Learning Styles Assessment Modalities Preferences Diagnostics (LAMP-D); Preferred Learning Styles; Learning Assessments

Introduction

Several years ago, Professor Tony Garcia of the University of Cincinnati gave a talk at Ohio State University (OSU n.d.) which he entitled, "How can I Teach You if I Don't Know How You Learn?" The question is very interesting and important, but difficult to answer. Research has been conducted to answer this question and to understand how students learn. Brookfield's (1995) suggestion that understanding how students learn is a means for improving college teaching relates to the question posed by Professor Garcia and indicates conversations about effective teaching must begin with an understanding of effective learning. Keefe (1979), and Mooney and Nowacki, (2011) also note,

> We seek to understand, often in the context of being taught and coming to learn, that which others have previously wondered about. We are all in some ways teachers and learners, yet our understanding of what goes on in coming to understand or in teaching or in being taught or in learning are themselves objects of wonder. (p. 9)

In recent years, the American Accounting Association's Pathways Commission and its related Conference on Teaching and Learning in Accounting have highlighted the importance of researching concepts related to teaching and learning in accounting. Yet, in the field of accounting, teaching and learning as theoretical concepts, as well as the research and study of teaching and learning in accounting practice are still lacking in importance. This is

evidenced by the limited number of journals dedicated to teaching and learning in accounting. Moreover, reviewing the listings and rankings of journals dedicated to accounting research, using sources such as the Australian Business Deans Council's (2016) list of business journals, resulted in identifying only one 'A' rated journal (indicating a top ranked journal) dedicated to teaching and learning.

According to the OECD-Center for Educational Research and Innovation, dynamic changes in our global environment and economy require that the science of learning adapt to and incorporate

> empirical research on how people learn, how the mind and brain develop, how interests form, and how people differ in all these has expanded tremendously, and requires rethinking what is taught, how it is taught, and how learning is assessed. (Dumont, Istance, & Benavides, 2010, p. 2)

Several studies related to this scientific process of learning, including Cassidy (2004), and Riding and Dyer (1983), have offered frameworks to explain how students learn. Such studies, including those related to the cognitive approach, have remained popular and have been applied to teaching/learning in university settings, where knowledge acquisition is considered complex (see for example, Cobb, 2001; Swanson, 1995; Willingham, Hughes, & Dobolyi, 2015). However, it is important to note researchers who study learning styles and preferences distinguish between learning based on cognition as related to psychology and preferred learning styles. Cognitive psychologists focus on memory, reasoning, critical thinking, and problem solving to understand how students make meaning of new information. Further, cognitive learning is described as a process of accommodating new information into existing frameworks that learners establish as they piece information together (Casazza & Silverman 1996; Svinicki 1991). Others believe that learning styles are independent of cognition (Duff 2004) but related to students' strengths and the way they process information (Felder & Silverman 1988). Still other theorists (Cassidy, 2004; Hartley, 1998) note that cognition and learning styles are interchangeable or related.

Nonetheless, several researchers, such as Dr. Jeffery Barsch (1996), believe and focus their studies on preferred learning. He developed a learning style inventory (BLSI) to test the sensory receptors which affect learning. He noted that students' cognitive development leads to different learning styles. Therefore, the cognitive approach has been evaluated, tested, and linked to students' preferred learning assessments using various learning styles inventories or scales. For example, Richard Felder and Linda Silverman (1988) created a learning inventory model used to understand engineering students' learning styles and to increase instructor awareness of learning styles as they work to improve their course designs. Likewise, Rollins and Yoder (1993, p. 19) note, "Research has demonstrated that learning style preferences and the consideration educators give to learning styles are closely related to learning achievement." Dunn, Dunn, and Price (1989) suggested that students' preferred learning styles are linked to instruction preferences. Grasha-Riechmann's learning modalities (Reichmann & Grasha 1974) are used to assess students' preferred learning modalities and link to students' preferred learning assessments. These studies imply the notion of how students learn and make meaning should also be important to accounting professors and instructors. Accounting instructors need to understand the link between students' preferred learning styles and the preferred learning assessments needed in the accounting classroom to help students learn the concepts they are trying to teach.

Therefore, the purpose of this paper is to demonstrate the results of an analytical study testing whether students' preferred learning assessments can be predicted by their preferred learning styles. Specifically, can a better understanding of what students determine is their cognitive or preferred learning style predict linkages or correlations between learning styles and preferred course activities and assessments in accounting courses? The study expands on Barsch's (1991) BLSI, extending its applicability to accounting students (Appendix A). Based on the results of the study, the author created a Learning Styles Assessment Modalities Preferences Diagnostics (LAMP-D) tool (Appendix B). This framework shows correlations among student learning styles preferences and the contextual learning modalities in which the learning styles are revealed. It also shows students' learning assessment preferences within the moderating learning contexts. The results are discussed considering prior major contributions on cognitive or preferred learning styles, such as Grasha-Riechmann's learning modalities (Reichmann & Grasha 1974); and Kolb's (1984, 1985) learning styles. One surprising result is that regardless of students'

preferred learning styles, such learning styles are negatively correlated to multiple-choice based learning assessments. The author finds this result concerning because multiple-choice assessments are usually the primary form of testing and exam assessments in most accounting courses. The paper offers suggestions on how accounting educators can approach teaching by reviewing the correlations between learning styles and multiple teaching/learning assessments implemented in the accounting classroom.

Literature Overview and Conceptual Framework

Teaching and learning are not mutually exclusive; they are intertwined. Understanding and cognition evoke overlap between the activities of the teacher and the learner (Mooney & Nowacki 2011). Teachers must explicitly or implicitly contend with five basic concerns (Grasha 1996, 2002), which are expressed in five questions: (1) How can I help students acquire and retain knowledge? (2) What can I do to enhance the ability of students to concentrate in class? (3) How can I help students to think critically? (4) What will help me motivate my students? And (5) How can I help them become self-directed learners? (Grasha 2002 p. 208). While teachers who ask themselves, such questions are critically reflective practitioners, the concept of teaching and learning remains somewhat elusive. Brookfield (1995), suggests that cultural, psychological, and political complexities of learning, and the ways in which power complicates all human relationships—including those between students and teacher—confound our best intentions. This section outlines some of the extant literature related to the supporting and opposing views in the literature on cognitive preferred learning styles, followed by an overview of the conceptual framework for this study.

Proponents of Cognitive or Preferred Learning Styles and Modalities

The idea of individualized learning styles became popular in the 1970s. Learning styles refer to a range of competing and contested theories that aim to account for differences in individuals' knowledge acquisition (King, 2011). Several approaches and theories support the notion that cognition affects learning and learning preferences, and individuals differ in how they learn (Cobb, 2001; Swanson, 1995; Willingham, Hughes, & Dobolyi, 2015). The cognitive approach to learning has been favored as an explanation for how people learn in settings such as colleges, where knowledge is complex and the process of thinking critically is as important as recalling facts.

In 1988, Felder and Silverman designed a learning inventory for use in understanding engineering students' learning styles. The objective was to increase instructor awareness of learning styles and improve their course designs. Their study concluded that students have one or more learning style preferences within four dimensions: sensing/intuitive, visual, active, and sequential. Since its inception, the instrument has been tested and modified by several researchers to determine its validity. For example, Felder and Solomon (2007) modified the first model and have since created the Inventory of Learning Styles survey.

Learning styles are labeled in some literature as learning modalities. For example, Barbe, Swassing, and Milone (1979), identified three learning styles, which they noted as learning modalities. These modalities include visualizing, auditory, and kinesthetic (VAK). They argued that the most frequent modality strengths lie in visual learning or a mix of visual and one other modality, concluding that learning can be based on one modality, or a combination. They suggested that learning modality strengths are different from learning preferences and note a person's self-reported learning preference may not correspond to their empirically measured learning modality strength. Thus, they proposed learning modality is cognitive, while learning preference is not. Fleming (1995) suggested there are multi-modalities of learning, expanding the concept of VAK modalities by adding a read/write component. Consequently, he favored using the term learning styles, categorizing them as: visual learning, auditory learning, read/write learning, and kinesthetic learning, or VARK. Fleming claimed students could use the model to identify their preferred learning style and, in turn, maximize their learning by focusing on the mode that is most beneficial. Visual learners prefer learning through visual aids that represent ideas without using words, including graphs, charts, diagrams, or symbols. Auditory learners learn best through listening (e.g. lectures, discussions, or tapes). And tactile/kinesthetic learners prefer to learn via experience—moving, touching, or doing (e.g. active exploration of the world, science projects, or experiments; Flemming 1995; Leite, Svinicki, & Shi 2010).

Other seminal studies have shown that learning styles are contextual (Cassidy 2004; Curry 1983; King 2011; Swanson 1995). Learning styles can be grounded in the application, modality, or context of the learning situation, based on the individual's typical modality of solving problems or making decisions, or on perceiving and remembering information. For example, Svinicki (1991) offered six approaches to learning based on cognitive theory and noted that each has its own implications for the teacher. These approaches include the beliefs that (a) transfer of learning to new contexts is not automatic but results from exposure to multiple applications; and (b) learning is facilitated when learners are aware of their learning strategies and monitor their use. Curry (1983) conducted a meta-analysis of 46 studies of various concepts of learning styles in general education, and a second analysis of 16 additional studies in the professional field of education. These studies showed that when positive results of learning styles are found, they generally indicate that students' learning can be improved by adapting various instructional modalities as much as possible to each student's learning style or preference. This was the goal of this study.

Criticisms of Cognitive/Preferred Learning Styles and Modalities

Peterson, Rayner and Armstrong (2009) noted the concepts of learning styles have been criticized by psychologists, educators, neuroscientists, practitioners, and others, some of whom question the validity of students' learning due to orientations of the brain. For example, Coffield, Moseley, Hall and Ecclestone (2004), Greenfield, (n.d), and Willingham, et al. (2015), all argue that the notion of learning styles is a complete myth, fad, or utter nonsense. Likewise, Hattie and Yates (2004) suggested it is naïve to classify some students as visual learners, and others, within the same class, as auditory learners. They suggest there is simply no valid method of making such classifications based on either neurology or genuine behavioral performance.

Sadler-Smith (2001) noted the term learning style is used widely in education and training to refer to a range of constructs from instructional preferences to cognitive style. The author explored criticisms of learning style construct validity as operationalized in the Learning Style Inventory and its correlations to cognitive style as measured by the cognitive styles analysis. In addition, Sadler-Smith examined the relationship between styles and learning preferences to determine whether there is an overlap. The author concluded that learning styles are used to assess comprehension and transformation. He further concluded that while learning styles and cognitive styles are independent, there is a relationship between the two factors which is mediated by gender. Keefe (1979) also suggested that learning styles are characteristic of cognition, affect, and physiological behaviors relative to how learners perceive and interact with the learning environment.

Peterson et al. (2009) reported on an extensive global survey of 94 researchers who studied learning styles. The authors' objective for the study was to determine why validity is still credited to the concept of learning styles, despite criticisms included in such research as the Coffield et al. (2004) report. They noted that the 94 researchers acknowledged wide criticisms about learning styles, such as lack of theory from mainstream psychology or cognition and overlapping or confusing definitions of learning styles. Yet, they concluded there is considerable agreement over the value and future direction of learning style research.

Linking Preferred Learning Styles to Preferred Learning Assessments

Cognitive learning style is described as a process of accommodating new information into existing frameworks that learners establish to piece information together. This explanation, has led to various studies on the effects learning styles and or modalities exert on students' learning and preferred learning assessments, indicating they have greatly influenced education and learning in general (Felder & Spurlin, 2005; Gee 1990; Klein 2003; Swanson 1995). Montgomery and Groat (1998) suggested that student preferred learning styles are directly linked to their learning and to course assessments. They noted that regardless of teaching disciplines faculty should incorporate learning styles into their teaching for the following reasons: (1) making teaching and learning a dialogue, (2) responding to a more diverse student body, (3) communicating our message, and (4) making teaching more rewarding. Adams and Anderson (1992), Dunn et al. (1989), and Keefe and Monk (1986), have also acknowledged and established the

validity of students possessing varying learning styles and that those learning styles are linked to instructional assessments.

One study relating specifically to accounting education is Duff's (2004) analysis of accounting students' cognitive learning styles. The study contrasted different models of operational learning style inventories in accounting students and examined the future of learning style vs. cognition. He investigated whether there is a cognitive technique to develop students' learning competencies to counter the myriad criticisms of learning styles and cognitions. He analyzed various learning style instruments, including David Kolb's (1984; 1985), to determine which most effectively identified whether cognitive or preferred learning styles are linked to students' quest for learning. Duff subsequently proposed five suggestions for educators which can be used to further the cognitive learning styles assessments of accounting students in order to help them learn. Duff found that some instruments are more reliable than others. Regardless, he concluded that some learning style inventory results and construct validity are reliable and can be used to help students determine their cognitive or preferred learning styles. The learning style can then, in turn, be used to determine the quality of learning outcomes.

Other studies support the notion that within certain sub-groups learning styles are specific and are related to students' readiness to use that learning style preference to their advantage in learning. Issues such as perceived individual academic achievement, attitudes toward the learning environment, and course completion rates have been examined using these studies (Bruning 1994; Casazza & Silverman 1996; Keefe 1979; Murphy, Gray, Straja, & Bogert, 2004). Keefe (1979) suggested learning styles are characteristic of cognition, affect, and physiological behaviors relative to how learners perceive and interact with the learning environment. Learning styles have also been described as particular sets of behaviors and attitudes related to learning contexts (Brown 2003; Coffield et al., 2004).

Murphy et al. (2004) concluded in their study with dental students using the VARK learning style/preference instrument, "that read/write and visual preferences ranked highest (4.1 and 4.0 mean scores per respondent respectively), followed by aural (3.2) and kinesthetic (1.7) preferences" (p. 861). They noted that, "forty-four percent of the students (n=100) surveyed showed a single dominant learning preference. The remaining 56 percent of the students (n=128) displayed multimodal preferences (bimodal preference strength or greater, no single dominant style)" (p. 862). This compares very closely to the results of the seminal work by Fleming (1995), author of the VARK instrument, whose study comprised 31,243 entries in his VARK website database and showed a 42/58 percent distribution comparing single and multimodal preferences.

In 2007, Prasanthi Pallapu used The *Index of Learning Styles* by Richard M. Felder, and Barbara A. Soloman (2000) to determine the visual and verbal learning styles of on campus learners as correlated with their academic progress. They found that "learners' grades had significant statistical difference between visual and verbal learners, F (1,20) = 40.151, p<0.001. When the means were compared, visual learners (M=164.267, SD=14.71) achieved higher scores than verbal learners (M=115.714, SD=20.70)" (p. 36).

Whittington and Raven (1995), in their study linking learning styles and learning assessments, suggested that faculty could use informal observations or standardized instruments (such as the BLSI used in this study) to identify learning styles. They concluded that learning styles are a natural predisposition yet can be understood and used to assist educators when planning and utilizing teaching techniques and assessments related to various learning styles. This should lead to an increase in student achievement and prove rewarding for the faculty when assessing teaching.

Conceptual Framework

The major cognitive theories used to establish the conceptual framework for this study are a combination of Barsch's (1996) BLSI, and an adaptation of both Grasha-Riechmann' learning style scale-GRLSS (1974, 1995), and Kolb's learning modalities (1984, 1985). For this study these concepts were adapted to create and simplify the mediating modalities between Barsch's learning styles and the preferred learning assessments (see Figure 1). Prior

studies such as Montgomery and Groat (1998), and Whittington and Raven (1995) have offered a link among these conceptual frameworks.

Barsch's Learning Style Inventory

Barsch (1996) suggested that students' four cognitive sensors and development lead to different learning styles and allow learning to occur. He used these sensors to identify the following four styles of learning. *Visual learners* learn best by reading or responding to visual cues, such as the chalkboard or overhead transparencies. *Auditory learners* prefer to learn by listening; lecturing is the teaching approach that works best for them. *Kinesthetic* or *whole-body learners* learn through experiential activities. *Tactile learners* like to manipulate objects. Laboratory or hands-on methods of learning are most appropriate for them because they prefer simulations, exploratory activities, and problem-solving. The emphasis with sensory modality preferences is not matching learning and teaching styles, but on extending the strengths of learners and expanding their range of modalities. Faculty can accomplish this by using a range of activities and having students complete assignments in a variety of formats.

Barsch subsequently tested these learning styles by developing a learning style inventory scale. The BLSI is a publicly available self-assessment learning styles inventory scale. It has been used extensively in education research to determine and compare teaching and learning aptitudes, preferences, and styles for undergraduate students (Nelson, 2015). For example, the University of Wisconsin (n.d.) developed its teacher training manual using the BLSI. Valencia College (n.d.) also promotes the use of the BLSI to analyze student learning success. Other important studies, such as Halsne 2002 and Nzesei, 2015, have been based on the BLSI. It has been found to be a reliable test and was used in this study. In 2000, Doyran studied teachers' preferences for teaching and learning English and used the reliability test-retest approach to determine the validity of the BLSI. He produced a coefficient of -0.621 reliability in the alpha-internal consistency. Krätzig and Arbuthnott (2006), and Stahl (1999) also conducted research to test the reliability and validity of the BLSI. They found that the BLSI was valid and reliable when used to understand students' visual, audio, tactile, and kinesthetic learning preferences. Their results generated Cronbach's alphas for the present sample and observed reliability measures of: .54 for visual, .56 for auditory, and .38 for kinesthetic items. Krätzig and Arbuthnott (2006), also suggest that the BLSI is a standardized test of memory, rather than a self-reported learning style instrument. Therefore, they observed some limitations and criticized the lack of published psychometric measures for this instrument. The most notable criticism was that there were no significant relationships between learning styles measured by the BLSI and objective memory. While the BLSI has been criticized in some ways, the empirical results of this study are contingent on the validity of this theory.

Grasha-Reichmann Learning Style Scale (GRLSS)

Although as noted in the literature review some authors use learning modalities and learning styles interchangeably, for this study learning modalities are used to describe a learning context or medium for learning as expressed by Riechmann and Grasha (1974; Grasha 1996). They developed the Grasha-Reichmann learning style scale (GRLSS), which consists of six primary learning modalities: avoidant, participative, competitive, collaborative, dependent, and independent. They suggested these are present in each learner with varying degrees of cognitive aptitude.

Kolb Learning Modalities

David Kolb (1984; 1985) identified four mannerisms, which learners possess and further described four related typologies of learning modalities or contexts, as being dependent on learners' mannerism preferences. The following outlines these preferences and related modalities: (a) *convergers*—rely most on abstract conceptualizing and active experimenting, learning by creating concepts and theories to describe and explain observations; (b) *assimilators*—rely most on abstract conceptualizing and reflective observation, learning through watching others or through thinking about their own or others' experiences; (c) *divergers*—rely on concrete experience and reflective observation, learning through direct involvement in a new experience, and (d) *accommodators*—rely on concrete

experience and active experimentation, learning by using the theories and concepts derived to solve problems and make decisions.

Barsch's learning scales—the preferred learning styles, independent variables, and the adaptation and modification of the GRLSS and Kolb's mannerisms and modalities were used to develop the second data collection instrument—a survey for the study. This instrument includes questions related to the mediating modalities or contexts—mediating variables (MV), and the preferred learning assessments—dependent variables (DV; see Appendix A). Thus, the conceptual framework for the study is derived from these theories and is outlined in the mediating effect modalities model in Figure 1. This model demonstrates the mediating effects present in the learning modalities model. It outlines the relationships among: (a) the exogenous predictor (IV)—dominant/preferred learning styles, (b) endogenous (MV)—learning modalities/contexts, and (c) endogenous (DV)—preferred learning assessments, in order to predict students preferred assessments for making meaning in accounting courses.

Methodology

The methodology is modeled after Fraenkel et al.'s (1993) design methods in education research, as a predictive study. Junior and senior accounting students in two upper level cost accounting courses at a major state university in Texas were solicited to participate in the study. Students were told of the voluntary nature of this study, were not promised any compensation for their participation and were told they could withdraw at any time without penalty. Of the 143 students in two courses, 124 (87%) participated. The study did not focus on learning preference based on gender or other demographical attributes of the participants.

Data were collected in three stages, using the BLSI and a preferred learning assessment survey (PLAS) developed by the author: (1) students were given a description of the purpose of the study and an explanation of Barsch's four main learning styles and modalities and learning assessments which comprised the BLSI and on which this study was based; (2) students were given a thorough explanation of the BLSI including how to navigate the questions, take the test, and understand their results. Once it was determined students had a full understanding of the BLSI survey and how to score and analyze their results, they were directed to complete, calculate, and rank their learning styles; and (3) students were told they would be asked to complete a second instrument, a preferred learning assessments survey (PLAS). This assessment was scheduled two weeks later, giving students time to think about their BLSI learning styles results, their preferred learning assessments (multiple choice, essays, quantitative assessments, etc.), and various modalities or contexts, (teamwork, etc.). This was necessary to determine which modalities and assessments they recognized as most effective to demonstrate their understanding of an accounting concept. Therefore, students were explained the learning modalities/contexts and preferred assessments, such as comprehensive essay, short essay, small team activities, large team activities, etc. The PLAS instrument was developed by the author by making adaptations to the Grasha-Reichmann Learning Style Scale (GRLSS) and Kolb's learning assessments. As outlined in the literature review, these authors have studied and created various learning assessments, which they link to students' cognitive learning attributes, learning modalities, and contexts. It was easy to determine that all students who completed the BLSI also completed the PLAS and to match each the two instruments by student because both were coded with the same number. The survey is outlined in Appendix C.

Figure 1 demonstrates the conceptual framework. This outlines the link between the four main learning styles espoused by the BLSI, and the preferred learning assessments outlined in the survey as mediated by the effects of the Grasha-Reichmann Learning Style Scale (GRLSS) and Kolb's learning assessments. The overarching questions guiding this study were:

1. Can students' preferred learning styles, predict linkages or correlations between preferred course assessments and activities in accounting courses?

2. What are the learning modalities or contexts, which students perceive are the mediating effects of their cognitive preferred learning styles and preferred learning assessments?

3. Is there a specific preferred assessment that could be used to gather the necessary knowledge that students should attain, despite their preferred learning style and modalities or contexts?

Data Analysis

The data analysis, results, and discussions are based on the overarching questions guiding the study. The data were analyzed in two steps discussed below— (1) an initial MANOVA, and (2) Structural Equation Mediating Modeling (SE[m]M)—to determine the predictive validity of the Barsch's learning styles instrument scores and the survey constructed by the author. STATA version 13.1 was used for the analysis.

Step One

The initial multivariate analysis (MANOVA) was used to establish if an assumption could be made that there were correlations between the preferred assessment that could be used to gather the necessary knowledge that students should attain, despite their preferred learning style and modalities or contexts. Using MANOVA, the typical statistical measures, including correlations, *Z* scores, and *p* values were calculated. Those results revealed the following interesting correlations about modalities and contexts: (a) visual learners' strongest preference context/modality is to work in small teams (r = .386), while their least favorite modality is to lead others (r = -.112); (b) auditory learners prefer to lead others (r = .256), hence they dislike following others (r = -.157); (c) kinesthetic learners' preference is to lead others (r = .241), and they dislike being a passive participant (r = -.118); and (d) tactile learners expressed a preference for passive participation (r = .299), and a dislike for leading others (r = -.425).

Step Two

The results of the MANOVA in step one led to step two, which was an expansion of the analysis to assess the mediating effects each of the learning styles and learning contexts/modalities exerts on preferred learning assessments, using structural equation mediating modeling (SE[m]M) functions in STATA. The model included multiple independent, exogenous predictor and mediator variables, which led to the endogenous, preferred learning assessments. Accordingly, the SE[m]M was designed using one equation for each related pair (UCLA, n.d.) yielding the following symbolic model: (MV1 ≤ IV1) (MV2 ≤ IV2) …. (DV ≤ MV1 IV1 MV2 IV2….). Refer to Figure 1 for a reminder of these variables.

Results and Discussions

With N=124 and a confidence interval = 95%, these results indicate that accounting students are arbitrarily visual, auditory, kinesthetic, or tactile only when they can determine how they learn and participate with others within their modalities or contexts of learning. The students were very eager to participate in this study and to determine their learning styles using a cognitive learning inventory. Some students noted verbally they already had a learning style preference but wanted to determine if their assumed learning style could be verified by completing the BLSI. Table 1 describes the BLSI learning styles results, which shows 63% (n = 78) identified as visual learners, 21% (n = 26) as auditory learners, 12% (n = 16) as kinesthetic learners, and 4% (n = 4) as tactile learners.

These results are not surprisingly different from prior studies, which specify a general population percentage distribution for learning styles preferences. Studies by Buşan (2014), Mindtools (2009), Sebora (2008), University of Illinois Extension (2009), Parker and Parker (2007), Murphy et al. (2004), and Pallapu (2007), acknowledge most of the general population identifies as either visual or auditory learners. Although the results of those studies are not conclusive, they estimate the range of percentage distributions within the general population as follows: 60 - 65% learn visually, while on the opposite extreme, only about 5% are tactile (read/write learners). The auditory (10 - 30%) and kinesthetic categories (5 - 50%) have the most inconsistent results, producing the greatest range variations in percentages. The studies also conclude that such percentage distributions will never add to 100%, since there are varying thoughts, especially when learning styles are combined, or when students have more than one style of learning.

LAMP-D Results and Discussions

The author created a learning styles assessment preferences diagnostics tool designated a (LAMP-D) framework for each of the four learning styles: visual, auditory, kinesthetic, and tactile. See Appendix B for the comprehensive results of LAMP-D. These frameworks predict the positive and negative correlations between the endogenous DV (assessment preferences) and the exogenous IV, learning styles, mediated by the endogenous MV (learning contexts or modalities). The LAMP-D reveals that students' learning styles are positively or negatively correlated to various learning modalities or contexts, and those modalities mediate between learning styles and the DV, preferred assessments. Tables 2 - 9 outline synopses of the statistical results of the most positive and negative correlations between each learning style, their related learning modalities, and the assessment preferences within contexts. The tables are followed by a discussion based on the overarching questions guiding the study and outlined in the methodology. Further a discussion connecting these results to the conceptual frameworks, Barsch, Riechmann and Grasha, and Kolb's understanding of learning is outlined for each learning style.

Overall, the between subjects effects outlined in Tables 2 - 9 suggest that regardless of their learning styles, students learn best in a supported and participative learning modality/context. The results also suggest that 'individual case study' is the assessment that would most effectively engage students despite their preferred learning style, while 'multiple-choice' is the least effective, in all instances.

The visual LAMP-D predicts that the most statistically positive and significantly correlated learning modalities/contexts for visual learners occur when they work in small teams and function as active participants. There is precedence to support this finding. For example, Martin (2000) offered a cognitive explanation for why visual learners may find it problematic to learn in large groups. He suggested that visual learners learn best with other visual learners. Hence, when they try to communicate with others who have different learning styles, such as auditory or kinesthetic learners, the problem of communication is exasperated in larger groups where a mixture of styles is inevitable. He suggested that trainers and teachers should compensate for this issue. The results also predict that visual learners will be most negatively correlated to learning modalities or contexts that involve leading others and when they are subjected to passive participation. These results from the SEmM are supported by the preliminary analysis of the MANOVA results which indicated that visual learners' strongest preference is to work in small teams ($r = .386$), while their least favorite modality is to lead others ($r = -.112$).

Although the model predicts that visual learners learn best in small team contexts, overall, visual learners also have assessment preferences when working in large teams, with team leaders. The most positively significantly correlated assessment preferences for visual learners are qualitative-short essay and individual case studies when mediated within team-based modalities or contexts which promote active engagement and participation. The model also predicts that visual learners will be significantly negatively correlated to completing multiple choice-based assessments, even when mediated by learning contexts that involve leading others. Qualitative short essay is not a preference for visual learners, specifically when working within passive participation mediation contexts. In addition, quantitative problem-based assessments are also not a preferred mode of assessment specifically when visual learners are subject to learning contexts which allow them to be passive participants.

Barsch (1996) acknowledged that visual learners learn best by reading or responding to visual cues, graphs, notes, drawings, etc. Riechmann and Grasha (1974) would describe these learners as having a participative modality. Kolb (1985) would designate the learning mannerisms of these learners as assimilators; their process (modality) of learning would relate to abstract conceptualization—learning by creating concepts and theories to describe and explain observations**.** These results show that visual learners learn within various modalities and contexts but want to be actively engaged; they are not passive learners. The results suggest that visual learners may not correlate positively or significantly with multiple choice, objective and passive based assignments, as preferred modes of assessment. Prior studies show that students do not always express a level of confidence in multiple choice-based testing. This is important because most accounting courses usually use multiple choice as the preferred mechanism for exams, quizzes, etc., (see for example Bergner, Filzen, & Simkin, 2015; Swartz, 2006; Wood, 1998). Working in

teams offers the best modality/context of learning for these individuals. Students can then engage in step-by-step demonstrations to solve exercises and problems while others follow along.

The Auditory LAMP-D predicts that for auditory learners there is some positive leaning toward statistical significance when leading others within their learning modalities/contexts occurs. The results also predict that auditory learners will be most negatively correlated to contexts and learning modalities when following others. These results are supported by the preliminary results derived from the MANOVA. Those results suggested that auditory learners prefer to lead others (r = .256); hence, dislike following others (r = -.157). Leading and following may mean that students are learning in team-based modalities. This finding is supported by prior studies related to training in business and corporations. These studies agree that auditory learners benefit from discussions and learn more by talking about what they know with others (Weichel, 2016). However, the challenge is when there is not enough room for dialogue or verbal exchanges in the training system. Perhaps a larger sample could provide more statistically significant results.

The model predicts auditory learners' most statistically significant and positively correlated assessment preferences are working with individual case studies and within active participation mediation contexts. Auditory learners also have a preference for working in teams with team leaders. The model also predicts that auditory learners will be significantly negatively correlated to individual projects and when subjected to working within passive participant mediation contexts. This is also true when working with qualitative short-essay and in a passive participant context.

Barsch (1996) noted that auditory learners learn best by listening, (e.g. lectures, discussions, tapes, etc.). It is notable these results show that auditory learners are very positively and significantly correlated to learning modalities which promote leading or following others. Working in teams offers the best context of learning; students can solve exercises and problems together by engaging in discussions and listening to others. Yet, such students will likely want to lead the discussions. Riechmann and Grasha (1974) would perhaps describe these learners as having a participative, collaborative, but competitive, modality. Kolb (1985) would probably designate the learning mannerisms of these learners as convergers; their process (modality) of learning would be reflective observation—learning through watching others or through thinking about their own experiences or those of others. Perhaps surprising, these students do not like to pursue learning assessments within passive participation contexts. Auditory learners want to pursue case studies and projects, which are subjective assessments, but they want to do so as active participants.

For kinesthetic learners, the LAMP-D predicts the most statistically significant and positively correlated learning modality is leading others. The results also predict that kinesthetic learners will be most negatively correlated to the modalities/contexts which provide a passive learning atmosphere. The preliminary findings from the MANOVA tests also support these results. Based on the MANOVA results, kinesthetic learners' preference is to lead others (r = .241) and they dislike being a passive participant (r = -.118). Prior studies agree with these findings and suggest that these students remember things better when they can associate an action with what they are learning. They can also inspire others to participate since they are many times the first to get going on the project. Kinesthetic learners are often misunderstood, because they appear to be fidgety, distracted, or unable to focus when they just cannot wait to get started (Martin, 2000; Weichel, 2016).

The Model predicts kinesthetic learners will be positively and statistically significantly affected by several assessment preferences within the mediating context. The most significant are quantitative problem-based assignments, working with large teams, and (2) individual case studies, while leading others mediates effects. These learners also prefer working in teams with team leaders. The model also predicts that kinesthetic learners will be significantly negatively correlated to qualitative short essay within passive participant mediating contexts and multiple choice-based assessments as evidenced by these statistics. For, these learners, multiple choice instruments represent passive assessments, which do not work well with their preferred style of learning.

Barsch (1996) recognized that kinesthetic learners learn best through experiential activities. It is significant then that these results show that kinesthetic learners are very positively and significantly correlated to learning modalities

which promote teamwork using a team leader and active participation. Riechmann and Grasha (1974) would perhaps describe these learners as having a participative, collaborative, but dependent modality. Kolb (1985) would probably designate the mannerisms of these learners as accommodators; their process (modality) of learning would be concrete experience—learning through direct involvement in a new experience. Working in teams and taking a leading role offer the best contexts of learning for kinesthetic learners. Using case studies, problem-based exercises, and comprehensive essays are the most effective methods of assessment.

The tactile LAMP-D results predict that tactile learners will be most positively and statistically significantly correlated to the passive participation learning context/modality. Following others is also a statistically significant modality. The results also predict that tactile learners will be most negatively correlated to the modality/context when leading others and actively participating. The MANOVA results also showed that tactile learners expressed a preference for passive participation (r = .299) and disliked leading others (r = -.425). Hence, the results of the SEmM were supported in this respect.

The model suggests that working alone or in small teams are probably the best methods of learning for these students. Other studies and learning models support these findings and have shown that these learners like to use various modalities of learning; they often learn inductively rather than deductively. They make meaning by abstract thinking, and prefer personal connections to topics, while following directions they have written themselves or that they have rehearsed (Gardner, 1993; Sarasin, 1999; Sims, 1995).

The results predict that tactile learners' most statistically significant correlated assessment preference is, individual case studies while learning within passive participant contexts; the model also predicts that tactile learners will be significantly negatively correlated to multiple-choice based assessments also within large teams' mediation effects. These learners were neutral about team leaders, as no statistically significant correlations, positive or negative, were identified.

Barsch (1996) admits that tactile learners learn best by manipulating objects; laboratory or hands-on methods of learning are most appropriate for them. Riechmann and Grasha (1974) would perhaps describe these learners as independent learners. Kolb (1985) would probably designate the learning mannerisms of these individuals as convergers, whose process (modality) of learning would be active experimentation—learning by using the theories and concepts we have derived to solve problems and make decisions.

Those results revealed interesting differences: visual learners' strongest preference is to work in small teams (r = .386) while their least favorite modality is to lead others (r = -.112). Auditory learners prefer to lead others (r = .256) hence dislike following others (r = -.157). Kinesthetic learners' preference is to lead others (r = .241) and they dislike being a passive participant (r = -.118). Tactile learners expressed a preference for passive participation (r = .299) and disliked leading others (r = -.425).

Conclusions, Implications, and Limitations

This study used Barsch's (1996) learning style inventory and a survey developed by the author to understand students' learning style preferences and their aptitude for assessment preferences in accounting courses. The results suggest that regardless of their preferred learning styles, students learn best in a sustained and participative context and environment. The results also suggest that despite their preferred learning style, 'individual case study' is the assessment that students note helps them garner the most knowledge, while 'multiple-choice' is the least effective assessment to determine what was learned, in all instances.

This study correlates with Duff's (2004) study of accounting students which also suggested that regardless of cognitive learning style or preference, students' learning outcomes are dependent on context and discipline. This study also agrees with two of Svinicki's (1991) six approaches to learning based on cognitive theory: (a) the transfer of learning to new contexts is not automatic but results from exposure to multiple applications; and (b) learning is facilitated when learners are aware of their learning strategies and monitor their use.

As a result of the study, the author created a predictive learning styles assessment modalities preferences diagnostic (LAMP-D) framework to help faculty determine context and content in the classroom and the related learning assessments best suited to students' learning style preferences. The results suggest that accounting students have similar learning aptitudes compared to other undergraduate students, within various learning modalities and contexts. Visual learners learn best within team modalities and contexts and their most significant assessment preferences are qualitative short essays and individual case studies. Auditory learners can also work well in teams but want to lead; they prefer individual case study to assess learning. Kinesthetic learners learn best within teams, with team leaders, and through active participation. Their preferred assessments are quantitative based tools, individual cases, and comprehensive essays. Tactile learners are the most passive learners; they learn individually or in small teams where they prefer to follow, rather than lead. Their preferred learning assessments are individual case studies and quantitative based problems.

Implications

As noted in the literature review in this study, some researchers argue that learning styles are a fallacy and that even if it were possible to determine students' learning styles, it is not realistic to accommodate all students' dominant or preferred learning styles and relate those to assessment preferences. This paper argues the contrary and suggests that faculty can implement assessments which accommodate various preferred learning styles, if they understand how their accounting students learn. The argument is supported by Romanelli, Bird, and Ryan (2009), who reasoned that knowledge of learning styles can be of use to both educators and students, and that faculty members who have knowledge of learning styles can tailor their pedagogy so that it best coincides with learning styles exhibited by the majority of students. They base their conclusions on their review of theory, application, and best practices related to learning styles and assessments. Nevertheless, the results of this study reveal the following four important implications:

- The first major implication of the study is that students benefit from self-discovery of their learning styles prior to beginning a challenging course such as accounting, while accounting educators benefit from consideration of the students' perspective. In other words, students who have knowledge of their own preferences can be empowered to use various techniques to enhance learning, which in turn may impact overall educational satisfaction

- The second major implication is that assessments, used to test/measure what students learned during a given period, relate to learning. Therefore, faculty implement quizzes, exams, case studies, etc., to measure what students can recognize from what they learned in the form of an assessment. The results of this study reveal that regardless of students' preferred learning styles they are most positively correlated to 'individual case studies' and negatively correlated to objective yet passive learning assessments such as 'multiple-choice' instruments. Since the results indicate that for all learning styles, students are statistically correlated to using individual case studies to test their learning, it is incumbent upon faculty to modify their assessment methods—quizzes, exams, etc.—to include simple, and concise concept-related case study or simulation exercises.

- The third implication is that faculty should not adopt assignment modalities and assessments, such as multiple-choice based assessments, simply because they are easy or practical to accommodate most students. Those may not prove to be the best assessments of students' understanding of the theories of accounting or of students' learning. Nonetheless, multiple choice-based assessments are usually the preferred method faculty use to test student learning within universities; presumably because it is convenient, easy to prepare, and easy to grade.

- The fourth implication of the study is that faculty must proactively decide to be flexible with the level and type of assessments they use to measure learning and should consider how to mediate learning constructs using a combination of assessments and by leveraging contextual modalities.

Limitations and Future Studies

Lack of a conceptual framework for both learning style theory and learning assessment and measurement is a common and central criticism of studies relating to learning styles and related learning assessments. For example, Curry (1983), described instructional learning preferences as a person's preferred learning environment, yet suggested that this preference is one of the hardest things to measure because it is the most susceptible to external influence. DeCapua and Wintergerst (2005) suggested that, any instrument—even paper and pencil—which is used to evaluate learning styles is subject to questions of validity and reliability. Castro and Peck (2005), in their study on learning styles and the correlated learning difficulties encountered by foreign language students at the college level, suggested that students' preferred learning style(s) can help or hinder success in the foreign language courses. They found that an analysis of grades distribution using Kolb's learning style resulted in no significant correlations.

However, DeCapua and Wintergerst (2005) concluded that learning styles instruments and constructs do explain certain differences between individuals and how they learn. Likewise, Engels and de Gara (2010), also used the experiential learning theory developed by David Kolb to pursue a study of medical students' learning styles and related assessments. The purpose of the study was to elucidate the way in which medical students, surgical residents, and surgical faculty learn. They concluded that the study demonstrated the importance of medical students knowing their individual learning styles and that this knowledge improved their learning efficiency with respect to positive effects on time utilization and outcome. Duff (2004) found that some instruments are more reliable than others, when trying to determine accounting students' learning styles and their relationship to assessments of students' learning. Regardless, he concluded that some learning style inventory results and construct validity are reliable and can be used to help students determine their cognitive or preferred learning styles.

Accordingly, all three of the learning styles scales used to create the conceptual framework guiding this study have advantages and disadvantages. The primary instrument used in this study to determine learning styles is the BLSI, which is publicly available and has been used by several researchers in prior studies. While the BLSI was used in this study and was found to be a reliable test, it is nonetheless, a self-assessed instrument. As a result, some may argue that using the numeric values from the BLSI to determine a specific learning style could be a limitation of the study. The literature on teaching and learning in accounting is limited compared to teaching and learning in other fields. This is especially true regarding learning style, whether cognitive or preferred. Therefore, the validity of the results of the study is dependent, since the numeric value relates to students' specific learning style. Hence, further study on accounting students' learning styles, aptitude, and related preferences should be an ongoing process. Faculty seek to improve teaching and assessments by understanding students' preferred learning styles and how they learn. Therefore, the author encourages scholars to test the viability of the LAMP-D model in accounting as well as other areas of academia, using the scores in the framework.

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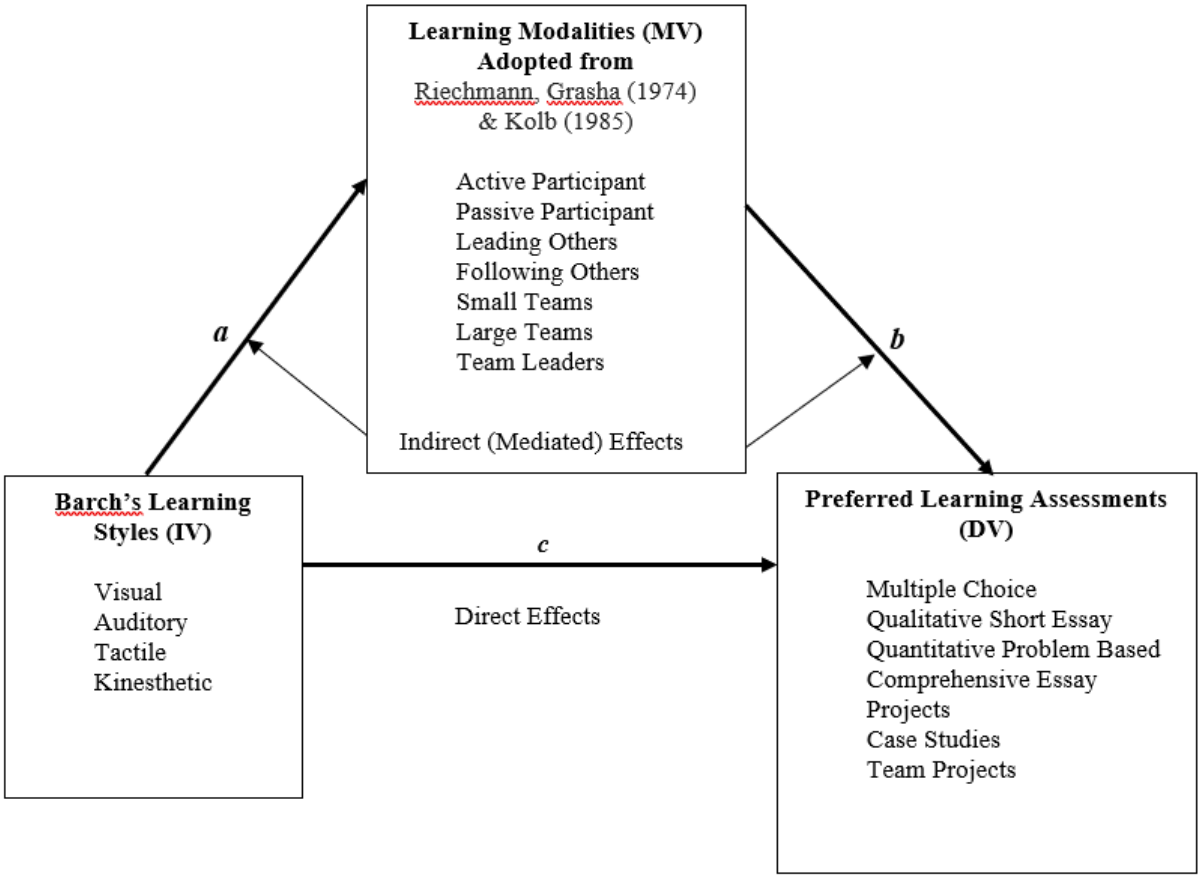
Figures

Figure 1. Mediating Effects of Learning Modalities or Context Model[1]



[1] Key: (IV) the exogenous predictor—dominant/preferred learning styles, (b) (MV) endogenous—learning modalities/contexts, and (c) (DV) endogenous—preferred assessments

Tables

Table 1
Results of the BLSI Learning Style Survey

Learning Style	N =124	Percentage
Visual	78	63
Auditory	26	21
Kinesthetic	16	12
Tactile	4	4
Total	**124**	**100%**

Table 2
Visual Learners: Correlated Learning Modalities/Contexts and Related Preferred Learning Assessments

Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Small Teams	0.6070175	0.1302979	4.66	0.000
Active Participant	0.2824561	0.1623968	1.74	0.082
Leading Others	-0.1929825	0.1531952	-1.26	0.208

Table 3
Synopsis of Visual Learners' Mediating Learning Contexts and Preferred Learning Assessments

Assessment Style Preferences	Mediating Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Qualitative Short Essay	Active Participant	0.1382268	0.0645672	2.14	0.032
Individual Case Studies	Large Teams	0.2372143	0.1064241	2.23	0.026
Multiple Choice	Leading Others	-0.166363	0.0251383	-0.66	0.508

Table 4
Auditory Learners: Correlated Learning Modalities/Contexts and Related Preferred Learning Assessments

Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Leading Others	0.4782609	0.3532191	1.35	0.176
Following Others	-0.6304348	0.3413113	-1.85	0.065

Table 5
Synopsis of Auditory Learners' Mediating Learning Contexts and Preferred Learning Assessments

Assessment Style Preferences	Mediating Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Individual Case Studies	Active Participant	0.4522546	0.1637657	2.76	0.006
Assistant or Team Leader	Leading Others	0.4047745	0.1500905	2.70	0.007
Individual Projects	Passive Participant	-0.3234792	0.1354694	-2.39	0.017

Table 6
Kinesthetic Learners Correlated Learning Modalities/Contexts and Related Preferred Learning Assessments

Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Leading Others	0.2252934	0.0815863	2.76	0.006
Passive Participant	-0.1178618	0.0888578	-1.33	0.185

Table 7
Synopsis of Kinesthetic Learners' Mediating Learning Contexts and Preferred Learning Assessments

Assessment Style Preferences	Mediating Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Individual Case Studies	Large Teams	0.2265908	0.1060091	2.14	0.033
Multiple Choice	Passive Participant	-0.008002	0.0227859	-0.35	0.725
Qualitative Short Essay	Passive Participant	-0.0653248	0.0639758	-1.02	0.307

Table 8
Tactile Learners Correlated Learning Modalities/Contexts and Related Preferred Learning Assessments

Correlated Learning Modalities	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Passive Participant	0.2978056	0.0854819	3.48	0.000
Following Others	0.2272727	0.0848979	2.68	0.007
Leading Others	-0.3981191	0.0761601	-5.23	0.000
Active Participant	-0.3025078	0.0854843	-3.54	0.000

Table 9
Synopsis of Tactile Learners' Mediating Learning Contexts and Preferred Learning Assessments

Assessment Style Preferences	**Mediating Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Individual Case Studies	Passive Participant	0.1346537	0.0942706	1.43	0.153
Multiple Choice	Large Teams	-0.0240391	0.0272683	-0.88	0.378

Appendix A
Barsch's (1996) Learning Style Inventory

Barsch Learning Style Inventory
Jeffrey R. Barsch, EdD

Name:
School:
Grade or Year:
Date:
Counselor/Teacher/Examiner:

To gain a better understanding of yourself as a learner you need to evaluate the way you prefer to learn. We all should develop a style that will enhance our learning potential. The following evaluation is a short, quick way of assessing your learning style.

This is not a timed test. Try to do as much as you can by yourself. You surely may, however, ask for assistance when and where you feel you need it. Answer each question as honestly as you can. There are thirty-two questions.

When you are finished, transfer each number to its proper place on the last page. Then, total each of the four columns on that page. You will then see very quickly what your best method of learning is, i.e., whether you are a visual, auditory, tactile or kinesthetic learner. By this we mean, whether you as an individual learn best through seeing things, hearing them, through the sense of touch, or through actually performing the task.

For example:

- If you are a visual learner, that is, if you have a high visual score, then by all means be sure you *see* all study materials. Use charts, maps, filmstrips, notes, and flashcards. Practice visualizing or picturing spelling words, for example, in your head. Use brightly colored markers to highlight your reading assignments. Write out everything for frequent and quick visual review.
- If you are an auditory learner, that is, if you have a high auditory score, then be sure to use tapes. Sit in the lecture hall or classroom where you can hear lectures clearly. Tape your class or lecture notes so that you can review them frequently. After you have read something, summarize it on tape. Verbally review spelling words and lectures with a friend.
- If you are a tactile learner, that is, if you have a high tactile score, you might trace words, for example, as you are saying them. Facts that must be learned should be written several times. Keep a supply of scratch paper just for this purpose. Taking and keeping lecture notes will be very important.
- If you are a kinesthetic learner, that is, if you have a high kinesthetic score, it means you need to involve your body in the process of learning. Take a walk and study your notes on flashcards at the same time. It is easier for you to memorize school work if you involve some movement in your memory task.

If several of your scores are within 4 or 5 points of each other, it means that you can use any of those senses for learning tasks. *When you are in a hurry, use your best learning styles. When you have extra time, improve your weak sensory areas.* Discuss the results of this test with your teacher or counselor. You will develop through conversation other helpful ways to study more efficiently. Good luck in your efforts to identify and use a more effective study pattern.

Place a check on the appropriate line after each statement.

		Often	*Sometimes*	*Seldom*
1.	Can remember more about a subject through listening than reading.			
2.	I follow written directions better than oral directions.			
3.	Once shown a new physical movement, I perform it quickly with few errors.			
4.	I bear down extremely hard with a pen or pencil when writing.			
5.	I require explanations of diagrams, graphs, or visual directions.			
6.	I enjoy working with tools.			
7.	I am skillful with and enjoy developing and making graphs and charts.			
8.	I can tell if sounds match when presented with pairs of sounds.			
9.	I can watch someone do a dance step and easily copy it myself.			
10.	I can understand and follow directions on maps.			
11.	I do better at academic subjects by listening to lectures and tapes.			
12.	I frequently play with coins or keys in my pocket.			
13.	I enjoy perfecting a movement in a sport or in dancing.			
14.	I can better understand a news article by reading about it in the paper than by listening to the radio.			
15.	I chew gum, smoke, or snack during studies.			
16.	I feel the best way to remember is to picture it in my head.			
17.	I enjoy activities that make me aware of my body's movement.			
18.	I would rather listen to a good lecture or speech than read the same material in a textbook.			
19.	I consider myself an athletic person.			
20.	I grip objects in my hands during learning.			
21.	I would prefer listening to the news on the radio rather than reading about it in the newspaper.			
22.	I like to obtain information on an interesting subject by reading relevant materials.			
23.	I am highly aware of sensations and feelings in my hips and shoulders after learning a new movement or exercise.			
24.	I follow oral directions better than written ones.			
25.	It would be easy for me to memorize something if I could just use body movements at the same time.			
26.	I like to write things down or take notes for visual review.			
27.	I remember best when writing things down several times.			
28.	I learn to spell better by repeating the letters out loud than by writing the word on paper.			

Dr. Barsch can be contacted at Ventura College, 4667 Telegraph Road, Ventura, CA 93003 for more information regarding this survey.

29.	I frequently have the ability to visualize body movements to perform a task, e.g., correction of a golf swing, batting stance, dance position, etc.	_____	_____	_____
30.	I could learn spelling well by tracing over the letters.	_____	_____	_____
31.	I feel comfortable touching, hugging, shaking hands, etc.	_____	_____	_____
32.	I am good at working and solving jigsaw puzzles and mazes.	_____	_____	_____

Scoring Procedures:

OFTEN = 5 points
SOMETIMES = 3 points
SELDOM = 1 point

Place the point value on the line next to its corresponding item number. Next, add the points to obtain the preference scores under each heading.

VISUAL		AUDITORY		TACTILE		KINESTHETIC	
No.	**Pts.**	**No.**	**Pts.**	**No.**	**Pts.**	**No.**	**Pts.**
2	_____	1	_____	4	_____	3	_____
7	_____	5	_____	6	_____	9	_____
10	_____	8	_____	12	_____	13	_____
14	_____	11	_____	15	_____	17	_____
16	_____	18	_____	20	_____	19	_____
22	_____	21	_____	27	_____	23	_____
26	_____	24	_____	30	_____	25	_____
32	_____	28	_____	31	_____	29	_____
VPS =		APS =		TPS =		KPS =	

VPS = Visual Preference Score
APS = Auditory Preference Score
TPS = Tactile Preference Score
KPS = Kinesthetic Preference Score

How to Use This Information:

This form is to be used in conjunction with other diagnostic tools to help you determine some of the ways you are best able to learn. Discuss your scores with someone who is qualified to interpret them in order to make the best use of the time and effort you have invested.

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Barsch Learning Style Inventory
Effective Study Tips

You have now completed the Barsch Learning Style Inventory and have four totals: Visual, Auditory, Tactile, and Kinesthetic.

Primary Visual Learners

Those with high visual scores tend to get the impact of material by seeing the information. This begins the processing, organizing and storage for later retrieval. The following list is essential for visual learners.

1. Take good notes in lectures; reorganize them into small cards that can be carried with you and reviewed at odd moments.
2. Read an assignment for 25 minutes (no more, you lose 85% of your input after the first 25 minutes). When beginning a textbook assignment, first read the summary at the end to get a general idea of the information. Then begin the reading.
3. Underline main points in an eye arresting color.
4. At the end of 25 minutes, take a 1-5 minute break. Disconnect totally from your reading – exercise – relax – snack – do that which is comfortable for you.
5. Review your underlined material.
6. Repeat steps 1 – 5 until reading is completed.
7. When reading is completed, review from beginning of underlined material.

Primary Auditory Learners

Those with high auditory scores tend to prefer material to which they can listen. The following suggestions are designed for primary auditory learners.

1. Tape your lectures and take your notes from your tape. This gives you a double auditory input. Some students find that taking notes from the lecture interferes with accurately catching all the verbal material. Put notes on cards that you can carry and review them *out loud*.
2. Read an assignment for 25 minutes (no more, you lose 85% of your input after the first 25 minutes). When beginning a textbook assignment, read the summary at the end to get a general idea of the information. Then begin the reading.
3. Underline main points in an eye arresting color.
4. At the end of 25 minutes, take a 1-5 minute break. Disconnect totally from your reading – exercise – relax – snack – do that which is comfortable for you.
5. Read aloud all underlined material. If you take notes instead of underlining in the book, read your notes aloud.
6. Try to form a study group with classmates. Talk with them about the central ideas you discovered in your assignment.
7. Review aloud from beginning of notes.

Dr. Barsch can be contacted at Ventura College, 4667 Telegraph Road, Ventura, CA 93003 for more information regarding this survey.

Primary Tactile Learners

Primary tactile learners would benefit from finding their secondary learning mode and using the directions for either visual or auditory *in conjunction with the following:*

1. Auditory or visual number 1.
2. Read an assignment for 25 minutes (no more, you lose 85% of your input after the first 25 minutes). When beginning a textbook assignment, read the summary at the end to get a general idea of the information, then begin the reading.
3. Underline main points in an eye arresting color.
4. At the end of 25 minutes, take a 1-5 minute break. Disconnect totally from your reading – exercise – relax – snack – do that which is comfortable for you.
5. Review your underlined material aloud if auditory is secondary.
6. Using your finger, trace the words you are learning in the air in front of you. Look at the words while you are tracing them.
7. You may wish to learn the alphabet signs used in the American Sign Language for the hearing impaired. These alphabet signs are easy to use and help reinforce tactile skills.
8. Keep something in your hand that is malleable. Knead or tap to a rhythm (4/4 background music) as you study. As much as is possible, translate what you're learning into something that can be touched. Typing is helpful. If possible, type your notes onto cards.

Primary Kinesthetic Learners

Primary kinesthetic learners would benefit from finding their secondary learning mode and using the directions for either visual or auditory *in conjunction with the following:*

1. Whenever possible, use manipulatives that create whole concepts, including appropriate games.
2. Put your favorite music on the stereo, then try to move on the beat and repeat the information you are studying while you are moving with the music.
3. Seek group interactions.
4. Rely on the arts (dancing, singing, poetry, crafts, etc.).
5. Ask for assignments involving experiments and/or constructing things.
6. Look for opportunities to perform with dialogue and reality-based sets and costumes.
7. Study and review notes and materials while walking or jogging.

If all of your scores are fairly close, use the methods outlined for all 4 types of learning styles. All learners will increase their efficiency by learning some simple steps:

1. *Learn a Relaxation Technique.* Sit in a comfortable chair and consciously "let go" of your muscles and tensions. Begin to breathe in and out to the count of four slowly (find your own best rhythm). Concentrate only on your breathing process. Do this for five minutes or until you are relaxed. (Inhale four counts, hold four counts, exhale four counts.)

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2. *Quiet Background Music.* Much of our learning has rhythm that is indigenous to each one of us. Background music with a 4/4 beat enhances and helps maintain the relaxed state achieved in your relaxation technique.
3. *Use Your Olfactory Sense.* One of your most primary learning modes is your sense of smell. Studying in an environment that has a pleasant odor (i.e., perfume, peppermint candy, etc.) that can be repeated during exams stimulates the recall process.
4. *Use Natural Timing.* When studying lists and facts, read them and say them, counting to eight between each input. This allows time for processing and integrating one fact before the input of the second.

Dr. Barsch can be contacted at Ventura College, 4667 Telegraph Road, Ventura, CA 93003 for more information regarding this survey.

Appendix B

Learning Styles Assessment Modalities Preferences Diagnostics (LAMP-D)

Table A. Visual Learning Style: Learning Assessment Modalities Preferences Diagnostics (LAMP-D)

Positively Correlated Learning Modalities		Correlation Coefficient	Std. Error	*Z*	*p*
Small Teams		0.6070175	0.1302979	4.66	0.000
Active Participant		0.2824561	0.1623968	1.74	0.082
Following Others		0.2403509	0.1585416	1.52	0.130
Large Teams		0.145614	0.1389901	1.05	0.295
Negatively Correlated Learning Modalities		**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Leading Others		-0.1929825	0.1531952	-1.26	0.208
Passive Participant		-0.1614035	0.1634877	-0.99	0.324
Preferred Assessment	**Mediation Effects of Positively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Multiple Choice	Active Participant	0.0064537	0.023634	0.27	0.785
	Following Others	0.0084684	0.0234522	0.36	0.718
Qualitative Short Essay	Small Teams	0.0404364	0.078963	0.51	0.609
	Active Participant	0.1382268	0.0645672	2.14	0.032
Quantitative Problem Based	Small Teams	0.0946984	0.104868	0.90	0.367
	Following Others	0.0931438	0.0850899	1.09	0.274
	Large Teams	0.2100845	0.0996169	2.11	0.035
Comprehensive Essay	Small Teams	0.0135927	0.0402312	0.34	0.735
	Active Participant	0.0188964	0.0328966	0.57	0.566
	Following Others	0.023507	0.0326436	0.72	0.471
Individual Projects	Active Participant	0.0931993	0.0910027	1.02	0.306
	Following Others	0.0147369	0.0903028	0.16	0.870
	Large Teams	0.108943	0.1057197	1.03	0.303
Individual Case Studies	Active Participant	0.0328289	0.091609	0.36	0.720
	Following Others	0.132502	0.0909044	1.46	0.145
	Large Teams	0.2372143	0.1064241	2.23	0.026
Team Projects	Active Participant	0.091078	0.0906364	1.00	0.315
	Following Others	0.0035276	0.0899393	0.04	0.969
Team Leader or Assistant	Small Teams	0.0343292	0.1069371	0.32	0.748
	Active Participant	0.179819	0.0874413	2.06	0.040
Preferred Assessment	**Mediation Effects of Negatively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Multiple Choice	Leading Others	-0.166363	0.0251383	-0.66	0.508
	Passive Participant	-0.0080439	0.0235557	-0.34	0.733
Qualitative Short Essay	Passive Participant	-0.0556618	0.0646058	-0.86	0.389
Quantitative Problem Based	Passive Participant	-0.0595109	0.0868259	-0.69	0.493
Individual Projects	Passive Participant	-0.0017747	0.0910563	-0.02	0.984
Individual Case Studies	Leading Others	-0.0097679	0.0998819	-0.10	0.922
	Passive Participant	-0.0248116	0.0935937	-0.27	0.791
Team Projects or Cases	Passive Participant	-0.0049208	0.08904	-0.06	0.956
Assistant or Team Leader	Passive Participant	-0.0701823	0.0877236	-0.80	0.424

Appendix B cont'd.

Table B. Auditory Learning Style: Learning Assessment Modalities Preferences Diagnostics (LAMP-D)

Positively Correlated Learning Modalities		**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Leading Others		0.4782609	0.3532191	1.35	0.176
Large Teams		0.1086957	0.2200919	0.49	0.621
Negatively Correlated Learning Modalities		**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Following Others		-0.6304348	0.3413113	-1.85	0.065
Passive Participant		-0.1086957	0.3528844	-0.31	0.758
Assessment Style Preferences	**Mediation Effects of Positively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Multiple Choice	Large Teams	0.0222812	0.0908419	0.25	0.806
Qualitative Short Essay	Leading Others Active Participant	0.0241379 0.1724138	0.1189519 0.1195573	0.20 1.44	0.839 0.149
Quantitative Problem Based	Leading Others	0.0005305	0.1582676	0.00	0.997
Comprehensive Essay	Leading Others Large Teams Small Teams	0.1047745 0.0015915 0.035133	0.0482401 0.0866022 0.0656607	2.17 0.02 0.53	0.030 0.985 0.594
Individual Projects	Leading Others Active Participant	0.2039788 0.2427056	0.1600218 0.1608362	1.27 1.51	0.202 0.131
Individual Case Studies	Active Participant	0.4522546	0.1637657	2.76	0.006
Team Projects or Cases	Leading Others	0.204244	0.1660199	1.23	0.219
Assistant or Team Leader	Leading Others	0.4047745	0.1500905	2.70	0.007
Assessment Style Preferences	**Mediation Effects Negatively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Qualitative Short Essay	Following Others Passive Participant	-0.0947075 -0.1501483	0.1024984 0.0991369	-0.92 -1.51	0.355 0.130
Individual Projects	Following Others Passive Participant	-0.0891365 -0.3234792	0.1400629 0.1354694	-0.64 -2.39	0.525 0.017
Individual Case Studies	Passive Participant	-0.1526642	0.1458639	-1.05	0.295
Team Projects or Cases	Passive Participant	-0.1806092	0.1395367	-1.29	0.196
Assistant or Team Leader	Following Others Passive Participant	-0.1949861 -0.0624495	0.1387287 0.134179	-1.41 -0.47	0.160 0.642

Appendix B cont'd.

Table C. Kinesthetic Learning Style: Learning Styles Assessment Modalities Preferences Diagnostics (LAMP-D)

Positively Correlated Learning Modalities		**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Leading Others		0.2252934	0.0815863	2.76	0.006
Active Participant		0.222425	0.0873607	2.55	0.011
Large Teams		0.0388527	0.0760345	0.51	0.609
Small Teams		0.0088657	0.077003	0.12	0.908
Negatively Correlated Learning Modalities		**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Passive Participant		-0.1178618	0.0888578	-1.33	0.185
Following Others		-0.0529335	0.0871074	-0.61	0.543
Assessment Style Preferences	**Mediation Effects of Positively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Multiple Choice	Active Participant	0.0161795	0.0254572	0.64	0.525
Qualitative Short Essay	Leading Others Active Participant	0.0856403 0.1060309	0.0734657 0.0707962	1.17 1.50	0.244 0.134
Quantitative Problem Based	Leading Others Large Teams Small Teams	0.0311586 0.2118627 0.1182524	0.0973403 0.0996457 0.0978829	0.32 2.13 1.21	0.749 0.033 0.227
Comprehen-sive Essay	Leading Others	0.075894	0.0368154	2.06	0.039
Individual Projects	Active Participant Large Teams Small Teams	0.1153829 0.1313597 0.0730556	0.1007065 0.1069789 0.1050864	1.15 1.23 0.70	0.252 0.219 0.487
Individual Case Studies	Active Participant Large Teams	0.0554922 0.2265908	0.0997936 0.1060091	0.56 2.14	0.578 0.033
Team Projects or Cases	Leading Others Active Participant Small Teams	0.1310681 0.0667826 0.0222088	0.1041033 0.1003205 0.1046836	1.26 0.67 0.21	0.208 0.506 0.832
Assistant or Team Leader	Active Participant Large Teams	0.1577245 0.0602843	0.0942982 0.0983994	1.67 0.61	0.094 0.540
Assessment Style Preferences	**Mediation Effects Negatively Correlated Learning Modalities**	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Multiple Choice	Passive Participant	-0.008002	0.0227859	-0.35	0.725
Qualitative Short Essay	Passive Participant Following Others	-0.0653248 -0.032862	0.0639758 0.0652614	-1.02 -0.50	0.307 0.615
Individual Projects	Passive Participant Following Others	-0.0417433 0.0388956	0.0910155 0.0928444	-0.46 0.42	0.646 0.675
Individual Case Studies	Passive Participant	-0.0447488	0.0901709	-0.50	0.620
Team Projects or Cases	Passive Participant	-0.0712534	0.0901017	-0.79	0.429
Assistant or Team Leader	Passive Participant Following Others	-0.0799561	0.0848783	-0.94	0.346

Appendix B cont'd.

Table D. Tactile Learning Style: Learning Assessment Modalities Preferences Diagnostics (LAMP-D)

Positively Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Passive Participant	0.2978056	0.0854819	3.48	0.000
Following Others	0.2272727	0.0848979	2.68	0.007
Small Teams	0.031348	0.0770261	0.41	0.684
Negatively Correlated Learning Modalities	**Correlation Coefficient**	**Std. Error**	***Z***	***p***
Leading Others	-0.3981191	0.0761601	-5.23	0.000
Active Participant	-0.3025078	0.0854843	-3.54	0.000
Large Teams	-0.0464995	0.0760695	-0.61	0.541

Assessment Style Preferences	Mediation Effects of Positively Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Multiple Choice	Following Others	0.0088446	0.0239234	0.37	0.712
Qualitative Short Essay	Small Teams	0.011418	0.0738824	0.15	0.877
Quantitative Problem Based	Passive Participant	0.0518873	0.0879222	0.59	0.555
	Following Others	0.1049989	0.0880142	1.19	0.233
	Small Teams	0.1076118	0.0975055	1.10	0.270
Comprehensive Essay	Passive Participant	0.0074339	0.0335812	0.22	0.825
	Following Others	0.0194735	0.0336163	0.58	0.562
Individual Projects	Following Others	0.0348809	0.0947047	0.37	0.713
	Small Teams	0.0841853	0.1049175	0.80	0.422
Individual Case Studies	Passive Participant	0.1346537	0.0942706	1.43	0.153
Team Projects or Cases	Following Others	0.0725168	0.0927551	0.78	0.434
	Small Teams	0.0546875	0.1027577	0.53	0.595
Assistant or Team Leader	Following Others	0.041451	0.0881291	0.47	0.638
	Small Teams	0.0968263	0.0976328	0.99	0.321

Assessment Style Preferences	Mediation Effects of Negatively Correlated Learning Modalities	Correlation Coefficient	Std. Error	*Z*	*p*
Multiple Choice	Leading Others	-0.0148967	0.0280726	-0.53	0.596
	Large Teams	-0.0240391	0.0272683	-0.88	0.378
Qualitative Short Essay	Large Teams	-0.0444435	0.0749921	-0.59	0.553
Quantitative Problem Based	Active Participant	-0.0380165	0.0933536	-0.41	0.684
Comprehensive Essay	Active Participant	-0.0100148	0.0350314	-0.29	0.775
	Large Teams	-0.0478798	0.375039	-1.28	0.202
Individual Case Studies	Leading Others	-0.0570374	0.1093727	-0.52	0.602
Team Projects or Cases	Large Teams	-0.0111081	0.1057503	-0.11	0.916
Assistant or Team Leader	Leading Others	-0.040478	0.1028638	-0.39	0.694
	Large Teams	-0.0382528	0.0999168	-0.38	0.702

Appendix C
Students' Preferred Learning Analysis Survey (PLAS)

Purpose: Based on completion of the Barsch's Learning Inventory Survey, students have determined that they have different learning styles and or preferences. This study is to help us analyze learning style and assessment preferences in order to understand how I can better serve you and facilitate your learning.

1. **Learning Style Inventory:** Now that you have completed the Barsch's Learning Inventory Survey, please indicate the style (s) that matched your scores by placing a check mark next to the style.
   I am a visual learner _____

   I am an auditory learner_____

   I am a kinesthetic learner_____

   I am a tactile learner_____

2. **Learning Modality/Context Inventory (based on Kolb and Riechmann and Grasha):**

   I am a silent Observer _____

   I am a quick Observer _____

   I am an active participant_____

   I am a passive participant_____

   I learn by leading others_____

   I learn by following directions and others_____

   I like working with small teams_____

   I like working with large teams_____

4. **Assessment Preference Inventory:** Please select the assessment method (2) that you would prefer, if given the choice, by placing a check mark next to the style, you can choose as many as you think.
   I do _____ do not_____ like multiple choice tests/exams

   I do _____ do not_____ like qualitative short essay (written) questions

   I do _____ do not_____ like quantitative (aka word) problem based questions

   I do _____ do not_____ like comprehensive essay (long expanded written) questions

   I do _____ do not_____ like Projects

   I do _____ do not_____ like case studies

   I do _____ do not_____ like doing projects or cases with a team

   I would_____ would not_____ like to be a team leader or assistant leader