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Do All Designers Think Alike? What Research Has To Say

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Abstract

The purpose of this study was to determine the learning style of undergraduate design students at a major land grant university. The Gregorc Style Delineator was administered to 568 undergraduate students. Frequency distributions were compiled to determine the dominant learning style of undergraduate design students. Chi-square analysis was conducted to determine if learning style differences existed between students in the various design disciplines. The most important finding in this study is the diversity of learning style among students. Not only were all learning styles represented in the sample, but 44.9% of design students exhibited dominance in more than one style.

Introduction

For many years, the study of student learning was separate from the study of teaching. Good teaching practices were assumed to be universals and did not depend on individual differences among students. There was little emphasis on teaching students to think and learn. Recent developments in educational and cognitive psychology have changed our views of the teaching-learning process. We now have conceptual and practical information about how students learn. Instructors can use this information to inform their teaching practices. Teaching-learning scholars have shown that it is the interaction of good instructional practices with students' strategic learning styles and skills that result in positive learning outcomes (McKeachie & Svinicki, 2006).

To provide optimum learning experiences for students, consideration must be given to individual differences among learners. Addressing learning styles and planning instruction accordingly, educators will meet student educational needs and will be more successful in meeting educational objectives. Though there has been research on learning styles, the majority of the studies have been conducted in the areas of nursing, engineering, agriculture, and marketing (O'Brien & Wilkinson, 1992; Stewart & Felicetti, 1992; Torres & Cano, 1994). After an extensive review of literature, no published research was found that assessed the learning styles of students pursuing undergraduate design degrees.

The specific objective of this study was to determine the dominant learning style of design students enrolled at a major land grant university as measured by the Gregorc Style Delineator. The researchers were curious to see if learning style differences existed between students in the various design disciplines. Would students in any one area have a distinctly

different learning style from those in another area? Results of this study will serve to inform faculty and student services staff so that a balanced and challenging environment can be achieved.

Review of Literature

Learning Styles

Learning styles can be defined, classified, and identified in many different ways (Cassidy, 2004; Claxton & Murrell, 1987; Dixon, 1985; Entwistle, 1981; Tharp, 1989). Generally, they are overall patterns that provide direction to learning and teaching (Felder, 1996). Learning style also can be described as a set of characteristics, behaviors, and attitudes that facilitate learning for an individual in a given situation (Cassidy, 2004). There is no one right way to learn, but there are certain styles that are more appropriate for a given situation. Thus, when an individual learns, the style may be unique to the task or it may duplicate a previous experience (Atkins, Moore, Hobbs, & Sharpe, 2001).

Styles influence how students learn, how instructors teach, and how students and instructors interact. Each person is born with certain tendencies toward particular styles, but these biological or inherited characteristics are influenced by culture, personal experiences, maturation, and development (Cornett, 1983). Style can be considered a “contextual” variable or construct because what the learner brings to the learning experience is as much part of the context as are the more salient features of the experience itself (Reiff, 1992).

Early education research looked for the one best teaching method for every learner but failed to get consistent results (Bonham, 1988). In the 1960s, researchers began to explore individual differences as the factor that decided the effectiveness of various teaching methods. Instructional concerns prompted a shift of focus from the more laboratory-based concepts of cognitive style to concern with the more practically oriented learning style (Dunn & Dunn, 1978).

The work of Dunn and Dunn (1978) includes a method for diagnosing learning styles as well as suggests options for teaching individuals with different learning styles. Dunns’ research looked at 24 elements of learning style. These included elements in the environment such as sound, light, temperature, and design and emotional elements such as motivation, persistence, responsibility, and structure. They also looked at sociological elements, such as whether the student prefers learning with adults or prefers learning through a variety of ways. The physical elements include auditory or visual preference, time of day the learner functions best, and need for mobility during a learning episode. Most of the Dunns’ work was with children.

Kolb’s research represented a break-through because it formulated learning style findings into modular form (McCarthy, 1980). He suggested that people approach learning situations in one of two ways, feeling or thinking. From this, he developed a model that

categorizes learners into four groups: imaginative learners (integrate experience and approach problems reflectively), analytic learners (develop theories based on what is known and are engrossed with ideas), common sense learners (integrate theory and practice and like to tinker and experiment with things), and dynamic learners (learn through trial and error and arrive at accurate conclusions, even in the absence of strong logic). The model includes, but also goes beyond, some of the bipolar opposites cited in the cultural style research based on the constructs of field sensitivity and field independence (Kolb, 1976). Kolb's experiential learning model is rooted in a theory of learning that affirms all major aspects of active learning, usefully accounting for an array of individual differences (Anderson & Adams, 1992).

Current discussion is centered strongly on thinking (James & Maher, 2004). Gregorc (1982a) discussed learning style as an indicator of systems of thought. He suggested individuals think either abstractly or concretely and their thoughts are organized either sequentially or randomly. Gregorc outlined four distinct patterns of thinking styles: (a) concrete sequential, (b) concrete random, (c) abstract sequential, and (d) abstract random. All learners exhibit all four patterns to a degree, but most people are stronger in one or two styles. Details concerning the distinguishing characteristics of persons dominant in each of the four styles are summarized briefly in the following paragraphs.

Concrete sequential learners derive information through direct, hands-on experience, or "seeing is believing." They appreciate order and logical sequence. They prefer touchable, concrete materials and a quiet atmosphere. Ordered, step-by-step presentations help these learners. Workbooks, computer-assisted instruction, and assembly kits are appropriate strategies for this type learner.

Concrete random learners are characterized by divergent experimental attitudes or seeing what "makes things tick." They are thought to have unconventional thinking because they use trial-and-error and risk-taking approaches while exploring unstructured problem-solving situations. They need guidance but not domination. They like games, simulations, independent study projects, brainstorming, and optional reading assignments.

Abstract sequential learners are characterized by excellent decoding abilities with written, verbal, and imagery symbols. They possess and like to use reading, listening, and visual skills. They like sequential and logical presentations such as slides and lectures. They appreciate extensive reading assignments, lectures, and analytical "thinking sessions." These students excel in organizing and analyzing research and debating ideas.

Abstract random learners are emotional and imaginative. They learn holistically and prefer unstructured learning experiences such as group discussions and webbing. They enjoy teaching. They like a busy environment and prefer freedom from rules and guidelines. This type of learner organizes material through reflection (Gregorc, 1982a).

Several studies have produced findings that indicated differences in academic performance by students manifesting different learning styles (O'Brien, 1994). Ginter, Brown, Scalise, and Ripley (1989) reported that learning style type did not differ in relation to university class standing or gender, but differed significantly in relation to age. Their most substantive finding was that type of learning style significantly affected students' grade point averages in remedial courses. Dunn, Deckinger, Withers, and Katzenstein (1990) diagnosed the learning styles of business-college students, assisted them in developing study skills compatible with their styles, and subsequently measured significant increases in academic achievement. O'Brien (1991), using the Gregorc Style Delineator (Gregorc, 1982a), reported findings indicating that an abstract sequential style was associated with higher degrees of academic success in college. Nelson, Dunn, Griggs, Primavera, Fitzpatrick, Bacilious, and Miller (1993) found that community college students who experienced a high-intensity learning style intervention manifested significantly higher grade point averages and higher retention rates than other students.

Dunn and Dunn (1978) suggested that instructors tend to teach the way they learn and special attention should be given to how their teaching style may affect their teaching and the students' learning. Gregorc and Ward (1977) claimed that if educators are to successfully address the needs of the individual, they have to understand what "individual" means. Educators must relate teaching style to learning style. When individual differences are considered and accommodated by classroom instructors, many researchers claim that students will have higher achievement, a more positive attitude, and an improved self-concept (Reiff, 1992).

Currently, researchers explore ways in which learning styles can be determined and mapped. The result is a profile of the learner. Learning style has become a way to describe what types of physical, social, environmental, and sociological elements or factors help an individual to learn effectively. Because there have been and will continue to be studies aimed at improving learning, design educators will have opportunities to increase their understanding of how people learn and become more aware of the wide array of individual learning styles, instrumentation, and implications of the individual learning styles to learning success.

Methods

Undergraduate students majoring in Apparel Design, Graphic Design, and Interior Design were tested to identify their learning style using a self-report instrument, the Gregorc Style Delineator. Reliability and validity of this instrument are relatively high. It is specifically designed for adults and has been used extensively in learning style research. The Gregorc Style Delineator was used to collect data from these subjects because the overall objective of the study

was to determine the dominant learning style of undergraduate design students enrolled in a major land-grant university.

Sample

The sample for this study included 568 incoming undergraduate students majoring in apparel design, graphic design, and interior design. Five years of incoming students (2003-2008) were tested during New Student Orientation held during the summers. 568 students voluntarily took part in the study and are representative of all undergraduate students enrolled in similar programs.

Instrument and Method

The Gregorc Style Delineator (Gregorc, 1982b) consists of 40 words in ten sets of four words each. Each word in a set is an indicator of one of the four learning styles: concrete sequential, abstract sequential, abstract random, and concrete random. Each subject ranks the words in each set starting with the word that best describes him/herself down to the word that is least descriptive. Subjects were asked to react to their first impression when ranking the words. The pre-arranged matrix in the instrument determines the total score for each learning style area. A total score of 27 to 40 points indicates a dominant learning style. Intermediate style scores range from 16 to 26 points, and low style scores range from 10 to 15 points. Internal reliability of the four subscores ranges from .89 to .93 (Gregorc, 1982b).

Data Analysis

Data from the completed Gregorc Style delineator were analyzed by the Statistical Package for the Social Sciences (SPSS). A simple frequency distribution was performed to determine the dominant learning style (CS,AS,AR,CR) of students enrolled in apparel design, graphic design, and interior design. An ordered arrangement of each style has been presented in Table 1. Chi square analysis was used to see if learning style differences existed between students in the various design disciplines.

Findings

The purpose of this study was to determine if a dominant learning style existed among undergraduate students majoring in apparel design, graphic design, and interior design. Subjects in the study were identified as dominant in a learning style if they scored a 27 or higher in that learning style. If dominant in more than one style, with a difference of less than five points, the subject was classified as bimodal. If bimodal, but the difference was greater than five, the subject was classified only in the learning style with the highest score (A.F. Gregorc, personal communication, May 15, 1997). Trimodal designation was assigned to participants who scored dominant in three categories (Thompson, Orr, Thompson, Park, 2002).

Frequencies indicate that of the 568 students, 313 were found to have a dominant learning style that fell into one of the four styles described by Gregorc. Results are shown in Table 1.

Table 1

Distribution of Dominant Learning Style Among Undergraduate Design Students

Dominant Learning Style	%	<i>n</i>
Concrete Sequential	22.5	128
Abstract Sequential	2.3	13
Concrete Random	19.9	113
Abstract Random	10.4	59
Bimodal	44.9	255

As shown in Table 1, 22.5% of the design students were dominant in the concrete sequential (CS) style, 2.3% in the abstract sequential (AS) style, 19.9 % in the concrete random (CR) style, and 10.4% in the abstract random (AR) style. Bimodal preferences were reported by 44.9% of the design students. Because a majority of the respondents were dominate in more than one learning style, data were examined to determine the bimodal combinations. Results are shown in Table 2.

Data from Table 2 report that the bimodal learning styles identified most frequently were abstract random/concrete random 19%, concrete sequential/concrete random 8.0%, concrete sequential/abstract sequential 6.5%, and concrete sequential/abstract random 6.1%.

Learning Style and Selection of Major

In the area of apparel design (See Table 3), 13.1% of the students were dominant in the concrete sequential style, 1.7% in the abstract sequential style, 23.7% in the concrete random style, and 11.4% in the abstract random style. Half of the clothing design students tended to be bimodal or dominant in more than one learning style. Table 3 reports 24.6% dominant in the combination of abstract random/concrete random, 3.5% in the combination of abstract sequential/concrete random, 8.8% in the combination of concrete sequential/abstract random, 6.2% in the combination of concrete sequential/abstract sequential, 5.2% in the combination of concrete sequential/concrete random, 1.7% in the combination of concrete sequential/concrete random/abstract random.

Table 2

Distribution of Bimodal Learning Style Among Undergraduate Design Students

Bimodal Learning Style	Percent	<i>n</i>
Abstract Random/Concrete Random	19.0	108
Abstract Sequential/ Abstract Random	0.4	2
Abstract Sequential/Concrete Random	1.8	10
Concrete Sequential/ Abstract Random	6.1	35
Concrete Sequential/ Abstract Sequential	6.5	37
Abstract Sequential/ Abstract Random/Concrete Random	0.2	1
Concrete Sequential./Concrete Random	8.0	46
Concrete Sequential/ Abstract Sequential/ Abstract Random	0.4	2
Concrete Sequential/ Abstract Sequential/Concrete Random	0.9	5
Concrete Sequential/Concrete Random/ Abstract Random	1.6	9
Total	44.9	255

Table 3

Distribution of Learning Style Among Undergraduate Design Students By Major

	Apparel Design	Graphic Design	Interior Design
Concrete Sequential (CS)			
Frequency	15	46	67
% within major	13.1	21.2	28.3
Abstract Sequential (AS)			
Frequency	2	7	4
% within major	1.7	3.2	1.7
Concrete Random (CR)			
Frequency	27	48	38
% within major	23.7	22.2	16.0
Abstract Random (AR)			
Frequency	13	23	23
% within major	11.4	10.6	9.7
AR & CR			
Frequency	28	44	36
% within major	24.6	20.3	15.1
AS & AR			
Frequency	0	1	1
% within major	0	0.5	0.4
AS & CR			
Frequency	4	1	5
% within major	3.5	0.5	2.1
CS & AR			
Frequency	10	5	20
% within major	8.8	2.3	8.4
CS & AS			
Frequency	7	11	19
% within major	6.2	5.1	8.1
CS & CR			
Frequency	6	21	19
% within major	5.3	9.7	8.1
AS & AR & CR			
Frequency	0	1	0
% within major	0	0.5	0
CS & AS & AR			
Frequency	0	2	0
% within major	0	1.0	0
CS & AS & CR			
Frequency	0	4	1
% within major	0	1.9	0.4
CS & CR & AR			
Frequency	2	2	4
% within major	1.7	1.0	1.7
Total (Frequency)	114	217	237

Data from Table 3 indicate that 21.2% of the graphic design students were dominant in the concrete sequential style, 3.2% in the abstract sequential style, 22.2% in the concrete random style, and 10.6% in the abstract random style. Results indicate that more than half (57.1%) of the students were classified as bimodal. Frequencies indicate that 20.3% of the graphic design students were dominant in the combination of abstract random/concrete random, 0.5% in the combination of abstract sequential/abstract random, 0.5% in the combination of abstract sequential/concrete random, 2.3 % in the combination of concrete sequential/abstract random, 5.1% in the combination of concrete sequential/abstract sequential, 9.7% in the combination of concrete sequential/concrete random, 0.5% in the combination of abstract sequential/abstract random/concrete random, 1.0% in the combination of concrete sequential/ abstract sequential/ and abstract random, 1.9% in the combination of concrete sequential/abstract sequential/concrete random, and 1.7% in the combination of concrete sequential,/concrete random/abstract random.

For interior design, frequencies indicate that 28.3% of the students identified themselves as being dominant in the concrete sequential style, 1.7% in the abstract sequential style, 16.0% in the concrete random style, and 9.7% in the abstract random style. 55.7% of the interior design students were bimodal. Of the bimodal respondents, 15.1% were dominant in the combination of abstract random/concrete random, 0.4 in the combination of abstract sequential/abstract random, 2.1% in the combination of abstract sequential/concrete random, 8.4% in the combination of concrete sequential/abstract random, 8.1% in the combination of concrete sequential/abstract sequential, 8.1% in the combination of concrete sequential/concrete random, 0.4 in the combination of concrete sequential/abstract sequential/concrete random, and 1.7% in the combination of concrete sequential/ concrete random/abstract random. Results are shown in Table 3.

Chi-square analysis was used to determine if learning style varied according to academic major. Comparisons were made between groups of respondents with dominance in each learning style and those showing no dominance in that style. Respondents classified as bimodal were represented in each of their dominant styles. The level of significance was set at .05. The analysis indicated that there was a significant relationship between choice of major and learning style ($p < .006$) for students entering from 2003 to 2008.

Summary and Implications

The most important finding in this study is the diversity of learning styles among undergraduate design students. Not only were all learning styles represented in the sample, but 53% of students exhibited dominance in more than one style. This number of bimodal students is interesting in that most studies report few, if any, bimodal students. One explanation may be that the education of design students demands a wide range of knowledge and skills including an understanding of the connection of environment and behavior, chemistry, technical aspects of buildings and interiors, aesthetics, history, and communication

skills. This broad range of content might explain the range in learning styles. Therefore, diversity in student learning styles anchor the argument for instructors to have a repertoire of diverse teaching methods. Because learning style affects the learning success of students in specific kinds of situations, instructors need to be sensitive to learning style differences.

Instructors need to balance instructional plans by selecting strategies and resources that cater to a variety of styles. This means moving beyond only those with which the instructor is comfortable to include the range of activities that meets the learning needs of students. Specifically, this means planning every instructional episode to include a variety of instructional strategies. For example, suppose an instructor in one of the design areas is introducing the design process. The educator may begin by describing the components that make-up the process and explain why these components are important. Next, he/she demonstrates through several scenarios how the design process works. A discussion follows on how these components are used, and how they may be modified. Students are then given a scenario and work individually or in small groups. The instructor moves around to help individuals as they request or appear to desire assistance.

Finally, the instructor provides written materials that summarize the content of the lecture. This type of varied presentation is likely to be effective because it builds on the principles of how students learn and the ways in which students learn best.

Instructional variety and student participation can also be increased by asking students to respond to questions within particular theoretical frameworks, ideologies, or their own personal experiences. Further variety can be introduced by asking students to debate an issue, role play situations, or engage in group activities. Involving students directly with the material to be learned not only varies instruction but also can enhance learning and retention of information.

Another strategy for meeting the individual learning styles of learners is to individualize instruction. This may mean allowing learners to select from among various activities in which they can participate or select their own projects, assignment topics, or assignment format. While it is not always possible to completely individualize instruction, there are many opportunities to allow personal choice in the instructional process. When given a choice, learners are likely to select an option that matches their particular learning styles. Table 4 summarizes the learning styles, characteristics, and preferred learning methods for learning styles represented by 10% or more of the total sample.

Table 4

Summary of Learning Styles, Characteristics, and Preferred Learning Methods for Learning Styles Represented By 10% or more of the Total Sample

Learning Styles	Characteristics	Preferred Learning Method
Concrete Sequential (22.5% of all students)	<ul style="list-style-type: none"> * direct, hands on learning, “seeing is believing” * methodical, structured; appreciate logical sequence * prefer quiet atmosphere * product oriented, rather than person oriented * concerned with practical aspects of situations * use rules, regulations, and literal interpretations 	<ul style="list-style-type: none"> * ordered, step-by step presentation * computer assisted instruction * workbooks * assembly kits * demonstration teaching
Abstract Random (10.4% of all students)	<ul style="list-style-type: none"> * emotional and imaginative * learn holistically * organize material through reflection * like to be colorful rather than perfect * search for proof * people oriented over product oriented * practical dreamer 	<ul style="list-style-type: none"> * prefer unstructured learning, group discussions, webbing * like busy active environment * prefer freedom from rules and guidelines * enjoy teaching
Concrete Random (19.9% of all students)	<ul style="list-style-type: none"> * unconventional thinking; divergent experimental attitudes, trial and error, risk - takers * like unstructured problem solving situations * impulsive, discriminating, critical thinking, rely on instinct and intuition * very persuasive; tend to influence change * concerned with multi-solutions and problem solving 	<ul style="list-style-type: none"> * need guidance but not domination * like games, simulations * independent study projects * brainstorming * optional reading assignments
Combination of Abstract Random/Concrete Random (19.0% of all students)	<ul style="list-style-type: none"> * imaginative, flexible, and global * attentive to human behavior, using their abilities to sense and decode nuances * work well in small groups or alone * experimental attitude and mode 	<ul style="list-style-type: none"> * short lectures followed by questions and answers * group discussion * time for reflection * use of computers * direct application problems * hands-on opportunities * programmed instruction

Knowledge of these different approaches also may help the instructor to explain puzzling student behavior. For example, when students ask extensive questions about an exam it might be easy to assume that these students do not want to study or are not interested in learning, and therefore want to be given answers (i.e. “spoon-fed”). However, in light of the research on learning styles, students may just be trying to find out what is expected of them so they can concentrate their efforts on the appropriate learning style necessary for success in each particular course and on each type of exam.

It is also important for students to know and understand their preferred learning style. Research has shown that learning style intervention programs have produced students with higher grade point averages and retention. During orientation programs or seminars early in their programs, students could be assessed for their preferred learning style and offered counseling on how to adapt their learning style to various teaching styles they are destined to encounter in college classrooms. As a result, students will gain confidence in their learning strengths and develop various strategies for handling challenging situations that arise. Students will begin to see how they learn most effectively and efficiently, allowing them to be better able to take responsibility for their own learning.

Understanding the diversity of learning styles also helps students to participate fully and effectively in group learning activities. Instructors can group students in diverse teams to take advantage of different learning styles or encourage students to choose team members with styles different than their own. Understanding that fellow students approach projects from different perception and ordering perspectives will help them appreciate the strengths of others and the value of synergistic teamwork.

Knowledge of learning styles is an important for design educators. Because learning style affects the learning success of students in specific kinds of situations, instructors need to be sensitive to learning style differences. Workshops on recognizing student learning styles should be offered to instructors where they can gain knowledge about learning styles by having their own learning style assessed. Because as Dunn and Dunn (1979) suggested, instructors tend to teach the way they learn, special attention should be given as to how their learning style may affect their teaching and the students' learning. Finally, instructors should be cognizant of research developments concerning learning style since many questions remain unanswered.

Based on the results and conclusions drawn from this study, further research should investigate the reliability of the current research reported and be expanded to other areas of design (i.e. art, architecture, and fashion). This research should consider the prevalence of bimodal students in each area of design.

Research should also be conducted to investigate if college modes of teaching tend to systematically favor one style of learning over another and how these modes of teaching relate to the completion-rates of students as a result of their preferred learning style. Additionally, research should be conducted to determine if students taught in their preferred learning style score higher on tests, assignments, and attitudes than those taught in a manner dissonant from their orientation.

As shown by this study, today's design students are diverse and require a variety of teaching approaches to maximize learning. The time is ripe for a closer examination of learning in university classrooms. Recent questioning of the value of higher education focuses on the worth of undergraduate education and on the quality of learning that takes place in university

classrooms. In response, many colleges and universities have focused on changes that center on improving teaching and learning. In the past decade, we have seen a focus on teaching techniques in college classrooms, a movement that emphasizes active learning, the value of service learning, and the importance of assessment on college campuses. We have addressed the all-important issue of learning by college students without focusing on the all-important question of “how” our students learn academic material. We need to know how college students learn, we need to understand barriers to students’ learning, and to develop classroom techniques that promote learning among college students.

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Barbara Martinson is an Associate Professor in Graphic Design at the University of Minnesota. Her teaching and research focus is color, human factors and design, and design education. Her design work has been exhibited nationally and internationally. She has an M.A. and Ph.D. in design.

An Examination of Learning Style Preferences among Egyptian University Students

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Abstract

The purpose of this research was to examine teacher students' learning style preferences and to examine the extent gender, seniority and academic major affect the students' preferences.

Introduction

Students learn in many ways – by seeing and hearing, reflecting and acting, reasoning logically and intuitively, and memorizing and visualizing. The ways in which an individual characteristically acquires, retains, and retrieves information are collectively termed the individual's learning style (Felder, 1995). Knowing the learning styles of the learners aids the designer or instructor to develop a curriculum to address various needs of the learners in a group or class (Pallapu, 2007).

Kirby (1979) mentioned that the term “learning style” came into use when researchers began to look for ways to combine course presentation and materials to match the needs of each learner. Diagnosing and interpreting learning styles provide important data as to how individuals perceive, interact with, and respond to the learning environment (Griggs, 1991). The literature seems to suggest that diagnosing students learning styles can be an easy and effective process because students can identify their own learning styles and score higher on tests when they are complimented with a teaching style that matches their learning style (Wilson-Hull, 2008).

Literature Review

Educational research has identified a number of factors that account for some of the differences in how students learn. One of these factors, learning styles, is broadly described as “cognitive, affective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment” (Reid, 1987, p. 87).

Dunn, Dunn and Perrin (1994) described learning styles as “the way in which each learner begins to concentrate on, process, and retain new and difficult information - that interaction occurs differently for each individual” (p. 2). Felder and Spurlin (2005) describe learning styles as “characteristic strengths and preferences in the ways they take in and process information” (p. 1). Learning styles are often influenced by heredity, upbringing, and current environmental demands. Individuals have a tendency to both perceive and process information differently (Gilbert, 2008). The concept of learning style can be best understood by taking a closer look at the process of learning itself. According to Kolb (1984), this process consists of four basic steps. These steps are outlined in Figure 1 below:

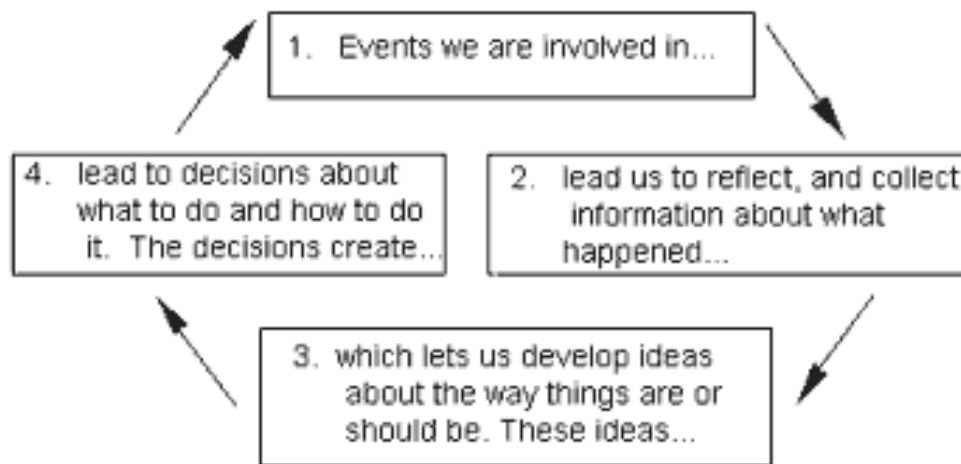


Figure 1

According Felder et al. (2002, p. 3), “people have different learning styles that are reflected in different academic strengths, weaknesses, skills, and interests. Understanding learning style differences is thus an important step in designing balanced instruction that is effective for all students.”

Learning styles refer to the concept that we, as individuals, process and perceive information in different ways. There are many different factors that can lead to the differences that arise within learning styles. These factors include, but are not limited to, personality, ability to process information, self-efficacy, sensory intake processes or some complex combination of these and other differences (Institute for Learning Styles Research, n.d.). Using a variety of assessment tools, individuals can gauge their own interest levels for a set of criteria to help establish the methods in which they obtain much of their information about the world around them. One assessment tool that can be used in establishing a person’s learning style is the Perceptual Modality Preference Survey (PMPS). This survey focuses on seven perceptual sensory intake methods that help shape how, we as individuals, view the world around us. There are seven perceptual styles: print, aural, visual, interactive, haptic, kinesthetic, and olfactory (Institute for Learning Styles Research, n.d.).

The Perceptual Learning Styles theory says that most of what we learn comes from our five senses. The Perceptual Learning Style theory defines the seven learning styles as follows (Davis, 2007):

- The print learning style individual prefers to see the written word.
- The aural learner refers to listening.
- The interactive learner refers to verbalization.
- The visual learner refers to seeing visual depictions such as pictures and graphs.
- The haptic learners refer to the sense of touch or grasp
- The kinesthetic learner refers to whole body movement.
- The olfactory learner refers to sense of smell and taste.

According to Eggen and Kauchak (2004), the concept of learning styles has at least three implications for teachers. It can remind educators that they need to vary instructions. It should remind educators of the need to help students become more aware of the ways they most effectively learn. In addition, it should remind educators that students are different and that they should increase their sensitivity to those differences.

Methods

The Perceptual Modality Preference Survey (PMPS) learning style survey was provided to a sample of ($N=221$) teacher education students in Ismailia College of Education in Egypt. The purpose of the study was to determine the learning style preferences among teacher education students in an Egyptian University and whether or not gender, seniority and department affect the learning style preferences.

The research questions addressed in this study were:

- What are the differences between males and females in relation to learning style preference?
- What are the differences between freshmen and seniors in relation to learning style preference?
- What are the differences in relation to learning style preference among teacher students based on department variable?

The null hypothesis was that gender, seniority and department do not have an effect on the learning style preferences. The alternative hypothesis was that gender, seniority and department do have an effect on the learning style preferences.

Participants

The participants in this study included teacher education students from Ismailia College of Education in Egypt. Table 1 presents the study sample demographics.

Table 1

Demographics

	Items	#	%
Gender	Females	176	79.6
	Males	45	20.4
Year	Freshman	104	47.1
	Senior	117	52.9
Majors	Arabic	69	31.2
	English	69	31.2
	French	12	5.4
	Social Studies	31	14.0
	Math	31	14.0
	Kindergarten	9	4.1
Total		221	
N=221			

Instrumentation

The Perceptual Modality Preference Survey (PMPS) (paper and pencil version) consisted of 42 questions with forced choice items with four options (Always, usually, seldom, or never). The participants were expected to select the appropriate answer for each question. The researchers designed the survey to also collect demographic information from the participants.

Results

Data were analyzed using SPSS 18.0. Means and standard deviations were used to describe subjects' learning style and personality type preferences (Tables 2-3). A 2X2X3 (Grade level, Gender, and Major) between-subjects multivariate analysis of variance (MANOVA) was conducted to determine if there was group difference on the seven learning styles (aural, haptic, interactive, kinesthetic, olfactory, print, and visual). No extreme scores, outliers, or statistically assumption violations were noted in the present data. The Box's *M* test was statistically significant ($p < 0.001$), indicating that the assumption of equal dependent variables covariance matrices was violated, thus, the Pillai's trace was used to assessing the multivariate effect.

With the use of Pillai's trace criterion, the linear combined dependent variables were statistically significantly related to the interaction effect of Grade level and Majors (Pillai's trace=0.35, $F(35,100)=2.16$, $p < 0.0001$) with moderate effect size (partial $\eta^2=0.07$).

Table 2

Participant Learning Styles by Grade Level and Gender

Learning Styles	Grade Level		Senior		Gender Male		Female		Total	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Aural	-3.19	8.44	1.15	9.58	-2.22	8.39	-.56	9.51	1.38	9.57
Haptic	6.11	8.79	2.62	10.11	3.71	9.41	4.40	9.73	2.01	7.29
Interactive	2.44	8.04	4.74	8.52	2.18	6.47	4.04	8.75	3.52	8.97
Kinesthetic	1.39	12.26	1.85	12.97	6.76	14.41	.33	11.81	.39	12.63
Olfactory	-6.76	11.02	-9.82	11.57	-5.51	11.46	-9.11	11.29	-8.41	12.42
Print	.00	7.61	5.17	12.23	2.44	8.64	2.81	11.09	6.36	10.72
Visual	8.21	11.10	7.54	9.91	4.33	8.63	8.76	10.72	4.51	10.30

Table 3

Participant Learning Styles by Majors

Learning Styles	Arabic	English	French	Social Studies	Math	Kindergarten
Aural	-1.38 (9.49)	1.38 (9.57)	2.83 (11.50)	-3.16 (8.49)	-4.42 (7.42)	.33 (6.04)
Haptic	2.80 (10.14)	2.01 (7.29)	-1.50 (14.07)	9.97 (7.65)	8.45 (9.78)	6.33 (8.70)
Interactive	4.77 (7.38)	3.52 (8.97)	4.33 (9.78)	3.68 (7.51)	5.06 (6.09)	-9.56 (8.83)
Kinesthetic	1.90 (12.03)	.39 (12.63)	.75 (11.29)	-.90 (11.17)	8.94 (14.21)	-6.00 (8.83)
Olfactory	-7.13 (11.53)	-8.41 (12.43)	-7.33 (11.87)	-12.03 (8.42)	-8.97 (10.02)	-4.56 (14.32)
Print	2.81 (10.06)	6.36 (10.72)	4.42 (12.37)	-2.52 (6.47)	-1.29 (11.80)	4.11 (9.29)
Visual	7.28 (10.97)	4.51 (10.30)	6.42 (7.19)	14.19 (9.42)	9.77 (6.46)	11.56 (15.44)

The main effect of Grade level, of Gender, and of Majors also reached statistically significant with moderate effect size (Grade level: Pillai's trace=0.08, $F(7,196)=2.48$, $p=0.018$, partial $\eta^2=0.08$; Gender: Pillai's trace=0.07, $F(7,196)=2.18$, $p=0.038$, partial $\eta^2=0.07$; Majors: Pillai's trace=0.45, $F(35,100)=2.79$, $p<0.0001$, partial $\eta^2=0.09$).

The Univariate ANOVAs were conducted on each dependent measure separately to determine the locus of the statistically significant multivariate interaction effect between Grade level and Majors. The results indicated that there were statistically significant on Aural, Olfactory, Print, and Visual learning styles with moderate effect size (Aural: $F(5,202)=3.45$, $p=0.005$, partial $\eta^2=0.07$; Olfactory: $F(5,202)=5.41$, $p<0.001$, partial $\eta^2=0.11$; Print: $F(5,202)=3.47$, $p=0.005$, partial $\eta^2=0.08$; Visual: $F(5,202)=3.41$, $p=0.006$, partial $\eta^2=0.08$).

As for the Grade Level main effect, the results indicated that there were statistically significant difference on Kinesthetic learning style between freshmen and seniors with small to moderate effect size ($F(1,202)=6.28$, $p=0.013$, partial $\eta^2=0.03$). Further investigation on the Grade Level group means revealed that the seniors ($M=1.85$) had higher scores than the freshmen did ($M=1.39$). For the Gender main effect, the results indicated that there were statistically significant differences on Haptic and Kinesthetic learning styles between male and female students with small to moderate effect size ($F(1,202)=4.98$, $p=0.027$, partial $\eta^2=0.02$, $F(1,202)=6.45$, $p=0.012$, partial $\eta^2=0.03$, respectively). An inspection of gender group means showed that female students ($M=4.40$) had higher scores on Haptic, while male students had higher scores on Kinesthetic ($M=6.76$).

For the Majors main effect, the results indicated that there were statistically significant group differences on Haptic, Interactive, and Kinesthetic learning styles among students with different majors with moderate to large effect size ($F(5,202)=5.13$, $p<0.001$, partial $\eta^2=0.11$, $F(5,202)=6.29$, $p<0.001$, partial $\eta^2=0.14$, $F(5,202)=4.32$, $p=0.001$, partial $\eta^2=0.10$, respectively). LSD post hoc test suggested that Arabic, English, and French majors had lower scores on Haptic learning style than social studies and math majors. On the other hand, the kindergarten majors had lower scores on Interactive learning styles than all other majors. In addition, the math majors had higher scores on Kinesthetic learning style than all other majors (see Table 4).

Conclusion

As a general conclusion from the data presented, it would be in the best interest of instructors to maintain a constant awareness of the variety of learning styles represented throughout the student body. Delivery and assessment methods which recognize the diverse array of learning preferences would foster a grounded learning environment.

Table 4

LSD Post Hoc Test on Learning Style by Majors

Learning Style	Comparison	Mean Difference	p-value
Haptic	Arabic vs. Social Studies	-7.17	0.000
	Arabic vs. Math	-5.65	0.003
	English vs. Social Studies	-7.95	0.000
	English vs. Math	-6.44	0.001
	French vs. Social Studies	-11.47	0.000
	French vs. Math	-9.95	0.001
	French vs. Kindergarten	-7.83	0.045
Interactive	Kindergarten vs. Arabic	-14.32	0.000
	Kindergarten vs. English	-13.08	0.000
	Kindergarten vs. French	-13.89	0.000
	Kindergarten vs. Social Studies	-13.23	0.000
	Kindergarten vs. Math	-14.62	0.000
Kinesthetic	Math vs. Arabic	7.04	0.007
	Math vs. English	8.54	0.001
	Math vs. French	8.19	0.044
	Math vs. Social Studies	9.84	0.001
	Math vs. Kindergarten	14.94	0.001

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