Patterns of Similarities between the Learning Style Inventory (LSI) and the Productivity Environmental Survey (PEPS)

Sonia Maldonado Torres
Hostos Community College (CUNY)

Abstract

The purpose of this study was to determine if a relationship exists between the Learning Style Inventory (LSI) developed by Kolb (2000), and the Productivity Environmental Preferences Survey (PEPS) developed by Dunn, Dunn, and Price (2003). These two (2) inventories are used to determine individuals' preferences in learning. To understand this relationship results from studies conducted by Maldonado Torres (2011, 2014, 2016) were used. A correlation was found between seven of the elements of the PEPS and the Kolb modalities of learning. The PEPS element of Tactile correlated negatively with the Kolb Reflective Observation (RO) modality of learning (r = -.181, p = .006). Late Morning (r = .115, p =.20) positively correlated with the Abstract Conceptualization (AC) modality of learning. Four of the elements on the PEPS–– Persistence (r = .161, p = .015), Structure (r = .144, p = .030), Alone (r = .158, p = .017), and Kinesthetic (r = .134, p = .043) positively correlated with the Active Experimentation (AE) learning modality.

Introduction

The purpose of this study was to determine if a relationship exists between the Learning Style Inventory (LSI) developed by Kolb (2000), and the Productivity Environmental Preferences Survey (PEPS) developed by Dunn, Dunn, and Price (2003). These two (2) inventories are used to determine individuals' preferences in learning. To understand this relationship results from studies conducted by Maldonado Torres (2011, 2014, 2016) were used. In her study Maldonado Torres (2011, 2014, 2016) explored the relationship between learning styles, country of origin, academic performance, gender, and language spoken at home of a group of Latino students in an urban community college in the northeastern part of the United States. The study identified relationships between Latinos' academic performance, their learning styles, and demographic factors in order to develop strategies for helping this group of students to successfully perform in college.

As previously mentioned, in order to determine students' learning styles, the two learning styles inventories used were; the Learning Styles Inventory developed by Kolb (2000), and the Productivity Environmental Preference Survey (PEPS), developed by Dunn, Dunn, and Price (2003). The purpose of establishing these patterns of similarities

between the two (2) learning styles questionnaires; 1) the Learning Style Inventory (LSI) developed by Kolb (2000), and the Productivity Environmental Preferences developed by Dunn, Dunn, and Price (2003) was to provide a clear picture of the learning preferences of the participants of the study and help them to succeed in college.

Literature Review

Description of the Learning Style Inventory (LSI)

The Learning Style Inventory (LSI) was validated using Kolb's (1984) experiential learning theory. In this theory, Kolb integrated a combination of "experience, perception, cognition, and behavior, as part of the learning process" (p. 21). The questionnaire provides four categories from which to choose in order to identify the strength of each of the student's learning styles. Categories for learning styles were described as "convergent, divergent, assimilation, and accommodative" (p. 77).

The LSI was developed as a self-description, self-scoring test, with the purpose of identifying the four learning modalities within a learning cycle (CE, RO, AC, and AE), as well as the preferred learning styles, including Divergers, Accommodators, Assimilators, and Convergers (Kolb, 1984). In developing the LSI, Kolb (2000) took into consideration the design, the type of test, and the flexibility of its use. For the design of the test, Kolb was interested in creating an inventory "that people would respond to just as they would a learning situation in real life" (p. 5). Kolb believed that self-descriptive tests are more accurate in identifying peoples' choices in learning. Kolb indicated that results on the LSI must be flexible; therefore, he developed a test that could have several applications, ranging from career choices to leadership styles. Kolb was interested in developing a learning style inventory that was "valid, brief, straightforward, and flexible enough to be applicable to across a number of industries, from education to business" (p. 5).

The LSI has experienced numerous changes in its composition, and it has been revised numerous times (Veres, Sims, & Locklear, 1991). The original version of the LSI, developed in 1971, "consisted of nine rows of four words" (Kolb, 2000, p. 7). In this version, individuals were asked to identify their preferred way of learning. The four rows of the LSI consisted of the four learning styles developed in his theory (i.e., CE, RO, AC, and AE). Research conducted on this LSI version underscored the poor test-retest results and lack of internal reliability (Kolb, 2000). As a result of these difficulties with the test's reliability, Kolb revised the test and developed a new version in 1984 (Kolb). This version consisted of 12 sentences that needed to be completed in order to describe peoples' learning style. The inventory organized the learning style preferences by rank. According to Kolb (2000), the main change in this version consisted of substituting the words with sentences. This change was intended to "better rank the endings when provided with a context in which to apply the descriptions" (p. 7). Kolb (2000) stated that the reliability of this new version was improved; however, he made a third revision in 1993.

In 1993, the four learning modes were arranged similar to the 1981 version (Kolb, 2000). "The sentence endings that correspond to each of the four learning modes were arranged in the same order for all 12 items of the inventory" (p. 7). This version was also criticized, since the test presented a problem of response bias that seemed to alter its internal consistency. In order to fix this new problem, Kolb developed a last version in which scores were randomized using a different pattern. This version is known as Version 3.1 and was developed in 1999. This version not only includes the randomized scoring of the LSI, it also incorporates the use of color-coded sheets. In this version, Kolb categorized the learning styles differently. Learning styles were classified as "Diverging, Assimilating, Converging, and Accommodating" (p. 7). Version 3.1 is the most recent version of the LSI and consists of 12 items in which individuals are asked to describe their learning style (Kolb, 2000). The most recent version of the LSI in Spanish is Version 3.

In order to complete the LSI, individuals must follow the steps explained in the LSI manual (Kolb, 2000). The first step in the manual requires individuals to complete the LSI while thinking about recent learning situations and reflecting upon them. The LSI consists of 12 sentences that describe the individual's way of learning in different situations. Sentences are ranked using numbers from 1 to 4. For example, if an individual believes that the ending of the sentence best describes her or his way of learning, the end of the sentence will be ranked with a number 4 (high). If the ending of the sentence does not describe the way in which the individual learns, the sentence will be ranked with a number 1 (low). Individuals must rank all of the endings without repeating the numbers. Each ending must have a different number from 1 to 4.

After completing the survey, individuals must calculate their scores using a learning cycle (Kolb, 2000). After scores are calculated and plotted on the learning cycle graph, individuals must connect the dots to identify their preferred learning style. In order to determine their learning styles, individuals will take the scores for the four learning phases listed on the second sheet of the survey and subtract the AC from the CE (this score tells how individuals take in experience), and the AE from the RO (this score indicates how individuals deal with experience). After calculating the scores, individuals will mark where the style falls on a grid (i.e., AC, CE, AE, or RO). According to Kolb (2000), "understanding your preferred learning style, and the strengths and weaknesses inherent in that style, is a major step toward increasing your learning power and getting the most from your learning experience" (p. 7).

Criticisms of the LSI

One of the criticisms of the LSI developed by Kolb has been in the method used to measure its psychometric properties. The following section includes an explanation of the difficulties in measuring the validity and reliability of the LSI, as well as some of the uses of the inventory.

Difficulties in measuring validity and reliability.

Kolb's work has been viewed by educators, trainers, and administrators as key in identifying individual preferences in learning (Chiou & Yang, 2006; Mestre, 2006). According to Pickworth and Schoeman (2000), the experiential learning theory developed by Kolb is a practical and useful one. Kolb's work explains individual differences in learning. Pickworth and Schoeman (2000) suggested that the learning styles modalities could be useful, depending on the situation to which the results of the LSI would be applied. Kolb (2000) also suggested that the LSI is a flexible inventory that could be applied in many different situations. Nevertheless, the major criticism of Kolb's Learning Style Inventory (1984) has been focused on the method used to measure learning styles, specifically on the psychometric properties of his LSI (Pickworth & Schoeman, 2000). In order to analyze the psychometric properties of the LSI, Pickworth and Schoeman (2000) collected data from first-year college students. To determine the reliability of the four learning styles, they applied an alpha coefficient and a chi-square analysis. A 5-point Likert scale was used to determine item analysis and internal reliability. This scale helps to determine bias in the participants' responses.

After these analyses were applied, Pickworth and Schoeman (2000) indicated that the reliability and the validity of the LSI could be questioned, since the LSI is considered an ipsative instrument. Ipsative scores, according to Anastasi (1968), are the type of scores in which "the strength of each need is expressed, not in absolute terms, but in relation to the strength of the individual's other needs" (p. 453). When an individual responds by expressing a preference for one item against another, the resulting scores are considered ipsative (Anastasi, 1968). In addition, Anastasi and Urbina (1997) declared that the frame of reference of ipsative scores is the individual, rather than the normative sample. In other words, two individuals with identical scores on the LSI may differ in what they have expressed as their learning needs. Ipsative scores are more suitable for determining "intraindividual" preferences than "interindividual" (Anastasi & Urbina, 1997, p. 370) preferences.

The combination of the intra and interindividual preferences makes the LSI appear as though its validity and reliability are not strong enough. Anastasi and Urbina (1997) indicated that common statistical analyses are not accurate enough to determine the validity and reliability of self-report inventories, and analyses such as test-retest and coefficient alpha should be applied. "With ipsative scores, the mean intercorrelation of individual scales tend to be negative and the mean correlation of all the scales with any outside variable will approach zero" (Anastasi & Urbina, 1997, p. 371). Kolb (1984) justified the use of ipsative scores, indicating that "a self-description format was chosen for the inventory, since the notion of possibility-processing structure relies heavily on conscious choice and decision" (p. 68). Kolb stated that the LSI is a reliable inventory and declared that the LSI version 3 has a very high internal consistency. According to Kolb (2000),

> The reliability of the LSI Version 3 is substantially improved as a result of the new randomized self-scoring format. The four learning modes all show very good internal consistency, as measured by coefficient alpha, and test-retest reliability, as measured by zero-order correlations. (p. 69)

According to Pickworth and Schoeman (2000), one of the most difficult aspects of the LSI has been to determine its validity and reliability. They indicated that the LSI does not measure variables such as second-language needs, gender, and cultural differences. They encouraged other researchers to investigate the possible relationship between learning styles, gender, language, and cultural differences. In 1984, Kolb indicated that the LSI could be applied cross-culturally and has been tested in many countries, including New Zealand, China, Australia, Japan, Thailand, Singapore, United Kingdom, Finland, Spain, Canada, China, and Brazil. In addition, the LSI has been translated into six different languages, including Spanish, Arabic, French, Swedish, Chinese, and Italian.

Some studies have indicated that the LSI possesses high internal reliability and validity. For example, Wen-Bin and Chao-Chin (2006) explored teachers' modeling advantage and their modeling effects on college students' learning styles and career decision making. The study was conducted with 174 freshman students in a 4-year bachelor program of Culinary Arts in Taiwan. Wen-Bin and Chao-Chin (2006) indicated that modeling advantage

> is a process through which individuals learn behaviors, attitudes, values, and beliefs by observing others and the consequences of others' actions. In an educational context, teachers are one of the important role models in students' learning processes. If students recognize teachers as role models, teachers will have an impact on what students learn through social learning. (p. 1)

Modeling effect is the impact that the modeling advantage has on the students' learning and in their career decision making (Wen-Bin & Chao-Chin, 2006).

In order to conduct the experiment, Wen-Bin and Chao-Chin (2006) selected teachers who taught a technical course in Culinary Arts and used a collaborative approach to teaching. According to Wen-Bin and Chao-Chin, the collaborative approach of teaching involved a variety of teaching techniques ranging from arts and creativity, to a more kinesthetic approach. Half of the participants in the study were placed in classrooms with teachers who used the collaborative approach, and half were placed in classrooms with teachers who preferred the lecturing approach to teach their lessons.

Wen-Bin and Chao-Chin's (2006) study revealed that the teachers who used the collaborative approach were perceived by the majority of students as role models, as opposed to those teachers who preferred the lecturing approach to conduct their classes. In addition, the teachers who used the collaborative approach seemed to have a greater modeling effect on students' learning styles. Students who chose the teaching style of the teachers who used the collaborative approach as their preferred teaching style were those students who had a preference for an experience-driven mode, in other words, the Accommodators.

In addition, Wen-Bin and Chao-Chin (2006) found that students who preferred the lecture approach of teaching were those students whose preferred learning style was identified as Assimilator. Wen-Bin and Chao-Chin(2006) suggested that college students could benefit from their teachers if teachers developed their lessons in accordance with students' learning styles. Wen-Bin and Chao-Chin (2006) analyzed the internal consistency of the test using Cronbach's Alpha, which was .87. A confirmatory factor analysis (CFA) was applied in order to examine the construct validity.

> The overall model fit index indicated that the factor structure was marginally acceptable (GFI # = .91, AGFI # = .89, NFI # = .88, RMSEA = .05). The path coefficients of the measurement model in CFA ranged from 0.34 to 1.11, and all of them were significant at *p*. = .05 (t-values ranged from 1.89 to 9.59). (Wen-Bin & Chao-Chin, p. 5)

Reliability of the LSI

In response to the criticism of the LSI's poor measurement properties, Veres, Sims, and Locklear (1991) revised the inventory. A total of 763 men and women participated in the initial study (LSI I), and 1,115 individuals participated in the replication study (LSI II).

> In both studies, the LSI was altered to form the LSI IIa by randomly determining the order of the four sentence endings that correspond to each question. The LSI IIa was administered three times at eight-week intervals to all subjects. (p. 147)

The mean coefficient alphas for the initial analysis of the LSI ranged from .53 to .71, and for the replication sample, the mean coefficient alphas ranged from .56 to .78. In addition, test-retest reliabilities were estimated for the three administrations of the test by computing zero-order correlation coefficients between scale scores produced by each subject at administration 1, 2, and 3. The test-retest reliabilities for the four scales of the LSI across administrations were very high. The test-retest indices in the initial sample

ranged from .92 to .97, while those for the LSI replication sample ranged from .92 to .97. According to Veres et al. (1991), the LSI has considerable utility for determining individuals' learning styles. They concluded that

> The results of these two studies indicate that when the format of the LSI II is revised to eliminate a probable response set caused by the order of the items, its performance is surprising. While internal-consistency estimates for the LSI IIa dropped as expected, test-retest reliabilities and kappa coefficients increased dramatically. (p. 149)

Veres et al. (1991) indicated that these results contradict the criticisms of Anastasi and Urbina (1997) and Pickworth and Schoeman (2000) on the use of the LSI. The changes in reordering the organization of the sentences on the LSI have positively influenced the stability and internal consistency of the LSI (Veres et al., 1991).

Sadler-Smith (2001) conducted a study with 233 undergraduate management students at the United Kingdom University and concluded that the LSI statistical analysis is accurate in determining the four stages of learning. For Sadler-Smith (2001), the implication of the analysis is that "an individual may theoretically, at least, excel at all four stages of this cycle or process, although it is acknowledged that individuals are likely to have strengths and weaknesses or preferences for particular part of the cycle" (p. 6). Sadler-Smith (2001) confirmed the validity of Kolb's LSI and recognized the importance of the LSI in determining people's learning preferences.

Dunn and Dunn Learning Styles Model

Dunn and Griggs (2000) declared that the theory developed by Kolb (1984) was focused on only one or two learning variables. They suggested that the learning style theory is more complex in nature and should encompass a multidimensional perspective. Dunn and Griggs indicated that a multidimensional perspective is required to reflect individual differences resulting from each individual's "biological, developmental, and psychological experiences" (p. 8). The learning process is impacted by many variables. In other words, "when using only a single- or dual- dimensional model, the very variable that might produce the most achievement gains for one individual could be the variable *not* included in that model" (p. 8). Dunn and Griggs (2000) indicated that Kolb's theory was focused on just two dimensions of the learning spectrum. According to Dunn and Griggs (2000), the Dunn and Dunn (1983) model is more multidimensional since the model is "comprised of both biological and developmental characteristics that make the identical instructional environments, methods, and resources effective for some learners and ineffective for others" (p. 8). The Dunn and Dunn model was designed for determining not only the learning preferences of elementary students, but the secondary and adult population, as well (Dunn & Griggs, 2000).

Dunn and Griggs (2000) indicated that individuals' learning styles differ from one individual to the other in regard to gender, age, and culture. In addition, "males and females frequently learn differently from each other" (p. 8). Dunn, Dunn, and Price (1987) have investigated the topic of learning styles with Mexican Americans from grades 3 to 12. They developed an LSI that they described as the "the first comprehensive approach to the assessment of an individual's learning style in grades 3 to 12" (p. 5). The LSI classifies the conditions in which individuals tend to learn. Results on the LSI help to identify the type of environment, the educational activities, and the social and motivational factors that promote an individual's learning (Dunn et al., 1987). "Learning styles is the way that students of every age are affected by their (a) immediate environment, (b) own emotionality, (c) sociological needs, (d) physical characteristics, and (e) psychological inclinations" (Carbo, Dunn, & Dunn, 1986, p. 2). The questions on the LSI are subjective and relative. Dunn et al. (1987) believed that individuals' learning styles are based on a complex set of reactions, stimuli, feelings, and learning patterns.

The Productivity Environmental Preference Survey (PEPS) was developed by Dunn, Dunn and Price (1996) to identify adults' learning preferences for each of 20 different elements (Dunn et al., 1996). They indicated that the PEPS includes individuals' "reactions to the immediate instructional environment (sound, temperature, light and design)" (p. 5). Individuals' emotions are also included in the PEPS as elements of "motivation, persistence, responsibility, and the preference for a structure or a flexible learning environment" (p. 5). Individuals' sociological preferences for learning are also included in the PEPS. Among the sociological preferences are "learning alone, with peers, with an authoritative figure, and in a variety of ways as opposed to patterns and routines" (Dunn & Griggs, 2000, p. 9). Physiological characteristics or strengths are also measured in the PEPS based on the perceptual strengths of an individual (Dunn & Dunn, 1983). These physiological characteristics are identified in the PEPS as auditory, visual, tactile, and kinesthetic.

The PEPS physiological elements are also measured by considering the individuals' preferred time of the day for studying, intake (food consumption), energy levels, and needs for mobility while learning. The 20 areas included in the PEPS are: (1) sound, (2) light, (3) warmth, (4) formal design, (5) motivated/unmotivated, (6) persistent, (7) responsible, (8) structure, (9) learning alone/peer-oriented, (10) authority-oriented learner (i.e., the preference of having an authority figure present while learning), (11) several ways (referring to presenting the information in different ways), (12) auditory preferences, (13) visual preferences, (14) tactile preferences, (15) kinesthetic preferences, (16) requires intake, (17) evening/morning, (i.e., preference in time of the day for studying), (18) late morning, (19) afternoon, (20) needs mobility.

Validity and Reliability of the PEPS

The PEPS was designed to identify the variables that describe the way in which individuals prefer to learn (Dunn et al., 1996). In order to analyze the items in the PEPS, a factor analysis procedure was applied. The instrument was revised after administering it to a non-random sample group of 589 adults from different states and from a variety of academic and work settings (Dunn et al., 1996). Results of the factor analysis indicated that 31 of the factors had values greater than 1.00, explaining 65 % of the cumulative proportion of the total variance of the PEPS. Dunn et al. indicated that in terms of inter-item correlations, answers were submitted to a computerized program and analyzed using varimax and orthogonal rotation.

> The number of iterations for the rotation was 50, and the gamma (precision) level was 1.00. The factors were rotated to identify the factors that were orthogonal (independent) and to minimize cross loadings (items loading on more than one scale). (p. 14)

The 31 factors accounted for 65 % of the total variance, ranging from 7.89 to 1.02. No factors were selected with less than a total score of 1.00. Dunn et al. (1996) suggested that these analyses were the basis for determining the reliability and validity of the test. In terms of reliability, 90 % of the PEPS elements had a Cronbach's alpha that was equal to or greater than .60 (Dunn et al., 1996).

Dunn et al. (1996) indicated that the reliability of the 20 elements measured in the PEPS was very high, except for the areas of authority-oriented learner and tactile preference. Reliability scores for each area were as follows: sound, .86; light, .91; warmth, .86; formal design, .76; motivated/unmotivated, .65; persistent, .63; responsible, .76; structure, .71; learning alone/peer-oriented, .86; authority-oriented learner, .48; several ways, .67; auditory preferences, .81; visual preferences, .71; tactile preferences, .33; kinesthetic preferences, .67; requires intake, .88; evening/morning, .87; late morning, .84; afternoon, .88; and needs mobility, .83.

Uses of the PEPS

The Productivity Environmental Preference (PEPS) has been used for different purposes such as developing corporate training (Franchi, 2002), developing teaching strategies (Carlson, 2002), improving Grade Point Average (GPA) (Rochford, 2004), determining motivation (Caldwell & Ginther, 1996), and for identifying learning styles preferences (Collinson, 2000). The uses of the PEPS are discussed below.

Results

Learning Style of the Participants of the Study

In order to identify participants' learning styles, descriptive statistics were run (see Table 1). Information about the different learning preferences exhibited by the students on the two inventories, the Learning Style Inventory (LSI) developed by Kolb

(2000) and the Productivity Environmental Preferences Survey (PEPS; Dunn, Dunn, & Price, 2003), are presented. Half of the participants fell under the category of Assimilators (55.5%), with 23.1% falling under the category of Diverger. Assimilators prefer to learn by understanding abstract ideas and difficult theoretical concepts. Divergers, on the other hand are those individuals who learn by combining the Concrete Experience (CE) modality of learning with Reflective Observation (RO) (Kolb, 1984). Divergers prefer to learn by experimenting with concrete and tangible learning situations instead of abstract learning situations.

Table 1
Participants' Learning Styles on the Learning Styles Inventory (LSI)

Variable	%	N= 229
Kolb's Learning Style		
Assimilators	55.5	127
Divergers	23.1	53
Convergers	9.2	21
Accomodators	7.9	18
Balanced	3.9	9
Not Completed	.4	1

Table 2 shows that more than half of the participants (59.5%) preferred the element of Structure while learning. Students who chose this element need detailed instructions in order to complete assignments, exercises, or any given task (Dunn et al., 1996). The element of Afternoon was chosen by 40.9% of the participants, which means that students are more productive and learn best during the afternoon (Dunn et al., 1996). Participants also indicated having a preference for the element of Auditory (38.0%), indicating that this type of student learns best by listening. The element of Authority Figures was chosen by 32% of the participants, implying that students like to have authority figures present while learning. The least preferred elements among participants were the element of Several Ways of Learning (6.3%), Time of Day (6.3%) which implies that students like to learn during the day, Temperature (3.8%), and Design (2.7%). When students indicated a preference for the element of Several Ways, it means that students learn better by having different teaching approaches in their lessons. A preference for the element of Time of Day implies that students like to learn during the day. A preference for the element of Temperature means that students preferred cool environments while learning. The element of Design means that when students learn, they like to sit in a straight chair at a desk, or at a table.

Table 2
Participants' Learning Styles on the Productivity Environmental Preference Survey (PEPS)

Characteristic	%	*N*= 229
PEPS Learning Preferences		
Structure	59.9	137
Afternoon	40.9	94
Auditory	38.0	87
Authority Figures	32.0	73
Tactile	29.3	67
Alone/Peers	23.1	53
Late Morning	22.7	52
Needs Mobility	18.8	43
Food Intake	18.4	42
Light	16.6	38
Kinesthetic	16.2	37
Motivation	15.3	35
Noise	14.7	34
Persistent	13.1	30
Visual	11.0	25
Responsible (Conforming)	10.8	35
Several Ways of Learning	6.3	15
Time of Day	6.3	15
Temperature	3.8	9
Design	2.7	6

Do any patterns of similarity exist between the results of the Learning Style Inventory (LSI) and the Productivity Environmental Preferences Survey (PEPS)?

Pearson's correlations were calculated in order to determine the relationship between Kolb's modalities of learning and the PEPS elements (Table 3). Correlations were found between seven of the elements of the PEPS and the Kolb modalities of learning. The PEPS element of Tactile negatively correlated with the Kolb Reflective Observation (RO) modality of learning (r = -.181; p = .006).

Four of the elements on the PEPS--Persistence (r = .161, p = .015), Structure (r = .144, p = .030), Alone (r = .158, p = .017), and Kinesthetic (r = .134, p = .043) positively correlated with the Active Experimentation (AE) learning modality. The element of Late Morning (r = .155, p =.020) positively correlated with the element of Abstract Conceptualization (AC). On the other hand, the PEPS (Dunn et al., 2003) elements of

Motivation (r = -.183, p = .006) and Kinesthetic (r = -.227, p = .001) negatively correlated with Kolb's Concrete Experience (CE) modality of learning.

Table 3
Correlation among Kolb's Modalities of Learning and the Elements of the PEPS

	CE	RO	AC	AE
	r	*r*	*r*	*r*
Tactile		-.181**		
Late Morning			.155*	
Persistence				.161*
Structure				.144*
Alone/Peers				.158*
Motivation	-.183**			
Kinesthetic	-.227**			.134*

Note. * Only correlations < .05 are presented.

Discussion

Students' learning styles were explored by administering two learning styles instruments, the Learning Style Inventory (LSI) developed by Kolb (2000) and the Productivity Environmental Preferences Survey (PEPS) developed by Dunn et al. (2003). Results from the LSI developed by Kolb (2000) showed that 55.5% of the students at Hostos Community College preferred the Assimilator learning style. According to Kolb (1984), Assimilator learners like to deal with abstract concepts while learning. They prefer to learn by analyzing ideas, understanding difficult concepts, creating conceptual models, and engaging in structured activities. Kolb indicated that this type of learner enjoys a systematic approach, as well as clear and detailed instructions. This learning style is the combination of two modalities of learning, Reflective Observation (RO) and Abstract Conceptualization (AC). Findings from this study matched the findings of a study conducted by Warren (1997), who found that Latino students had a high preference for the Assimilator learning style. Warren indicated that 42% of the Latino students who participated in his study chose the Assimilator learning style.

The Diverger learning style was the second most preferred learning style in the study (23.1%). Divergers are those individuals who learn by combining the Concrete Experience (CE) modality of learning with Reflective Observation (RO) (Kolb, 1984). Divergers prefer to learn by experimenting with concrete and tangible learning situations instead of abstract learning situations. Warren (1997) indicated that 26.3 % of the Latino students in his study preferred the Diverger style of learning.

Students at Hostos Community College indicated that they preferred the elements of Structure (59.9%), Afternoon (40.9%), Auditory (38.0%), and Authority Figures (32.0%) to learn. Students who preferred the element of Structure while learning need to get detailed instructions from their teachers (Dunn et al., 1996). Those students who indicated having a preference for the element of Afternoon are more productive and learn best during the afternoon. Students who chose the element of Auditory like to learn by listening, and students who have selected the element of Authority Figures want to have figures of authority present while they are learning.

Do any patterns of similarity exist between the results of the Learning Style Inventory (LSI) (2000) and the Productivity Environmental Preferences Survey (PEPS) (2003)?

Pearson's moment correlations were computed to determine the relationship between the results of the LSI modalities of learning (Kolb, 1984) and the elements of the PEPS (Dunn et al., 1996). I explored possible relationships between the two instruments. Dunn et al. (1996) indicated that the two instruments were different. The LSI developed by Kolb (2000) was mainly focused on the way in which individuals perceive and input the information, while the PEPS, developed by Dunn et al. (2003) included the environmental conditions in which an individual tends to learn best. By performing this analysis, I was trying to get a clearer picture of the student learning process, including ways of perceiving and the optimum environmental conditions. A correlation was found between seven of the elements of the PEPS and the Kolb modalities of learning. Nevertheless, it is important to point out that the correlations that were found among the elements of the PEPS were very weak. The PEPS element of Tactile correlated negatively with the Kolb Reflective Observation (RO) modality of learning (r = -.181, p = .006). Thus, students who preferred the Tactile element of learning were less likely to prefer the Reflective Observation (RO) modality of learning.

Students who indicated a high preference for the element of Tactile like to draw, take notes, and touch things while learning (Dunn et al., 1996), while students who prefer the Reflective Observation (RO) modality of learning are able to reflect upon the information that was presented, analyzing it from different perspectives. Late Morning (r = .115, p =.20) positively correlated with the Abstract Conceptualization (AC) modality of learning. Students who prefer to learn during the late morning also like to analyze and evaluate ideas while learning.

Four of the elements on the PEPS—Persistence (r = .161, p = .015), Structure (r = .144, p = .030), Alone (r = .158, p = .017), and Kinesthetic (r = .134, p = .043) positively correlated with the Active Experimentation (AE) learning modality. These correlations imply that students who actively engaged in their learning by doing were also very persistent, liked structure, wanted to learn alone, and preferred "hands on" activities.

On the other hand, the PEPS (2003) elements of Motivation (r = -.183, p = .006) and Kinesthetic (r = -.227, p = .001) correlated negatively with Kolb's Concrete Experience (CE) modality of learning. These correlations, although low, suggested that students who like to become involved in actual tangible situations need to move around and are less motivated to learn. It is important to understand that the elements on the PEPS included environmental preferences. These preferences are different from Kolb's modalities of learning. In his theory, Kolb (1984) explained the way in which individuals learn using information- processing concepts. This study identified not only the way in which students at Hostos Community College process the information, but also how the environmental conditions relate to their preferred way of learning.

Recommendations for Teachers

In order for teachers to implement a variety of instructional strategies, they need ongoing opportunities to build their understanding on how students prefer to learn (Maldonado Torres, 2014). These opportunities should also help teachers to recognize the impact that the accommodation of learning styles into their own repertoire of teaching strategies has in students' academic performance. This study revealed that students preferred ways of learning regarding the elements of the environment are intrinsically related to some of the modalities of learning presented in Kolb's theory (2000). By understanding these relations, teachers might be able to provide meaningful learning opportunities for students based on environmental preferences in learning as well as in the way in which they process the information provided (Maldonado Torres, 2016).

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Author's Note

Dr. Sonia Maldonado is an Assistant Professor at Hostos Community College (CUNY) in Bronx, New York.