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Suggested Topic: Teaching/Pedagogy/Administrative Issues

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I. Abstract

The *Index of Learning Styles* (ILS) instrument based on the Felder-Silverman Learning Style Model was used to compare distribution of learning styles of business students in the United States and the Dominican Republic. Results show that majority of business students have a balanced learning style in each of the four learning styles dimensions examined. Difference in learning style preference between United States and Dominican Republic was statistically significant only for the sensing-intuitive and active-reflective dimensions of the Felder-Silverman model. The knowledge of statistically significant difference in learning styles of the U.S. and non-U.S. students may help American faculty pay attention to special needs of international students attending universities in the U.S.

II. Introduction

Research in the field of educational psychology indicates that individual learning style affects educational achievements of a student in addition to factors such as intellectual ability and aptitudes (Loo, 2002a). Different researchers have defined learning style in slightly different ways. According to Loo (2002a), "learning style refers to the consistent way in which a learner responds to or interacts with stimuli in the learning context." Felder (1996) claims that students have different learning styles which he defines as "characteristic strengths and preferences in the ways they take in and process information." Campbell (1991) cites Gregorc (1979) who defines learning style as "the distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment."

A number of articles have reported studies related to distribution of learning styles of students in accounting and business education. Loo (2002a) discusses the results of studies by Kolb (1984), Baldwin and Reckers (1984), Baker *et al.* (1986), Brown and Burke (1987), Reading-Brown and Hayden (1989), and Holley and Jenkins (1993). These results indicate varying proportion of students falling under different learning styles. Loo (2002b) performs a meta-analytic examination of eight studies involving business majors and concludes that Kolb's (1984) learning styles are not equally distributed. A study of the learning styles of business students by Biberman and Buchanan (1982) indicated that predominant learning styles were different for different business disciplines. Loo (2002a) studied the difference in learning style distribution between hard and soft business majors and between male and female business students. He found an equal distribution of learning styles for the soft majors but not for the hard majors. He did not find any significant difference in distribution with respect to gender. However, a study by Keri (2002) of college students found that predominant learning styles of male and female students were different. A study of business majors by Wynd and Bozman (1996) indicated that the learning styles of students with higher GPA differed from those of

students with lower GPA. The implication of differing learning styles is that different students may prefer and use different learning methods that match their learning styles.

Just as students may prefer learning methods that match their learning styles, teachers seem to prefer teaching styles that match their own learning styles. This possibility implies that teachers tend to teach the way they themselves learn the material (Campbell, 1991). If predominant learning styles of students in a class differ markedly from the learning style of the teacher, a serious mismatch may occur between the teaching method used by the teacher and the preferred learning methods of the majority of the students. Charkins *et al.* (1985) suggest that the greater the mismatch between teaching style and learning style, the lower is the achievement of students in a course. Felder (1993) argues that if the teaching style in a course matches learning styles of students, it helps them to retain information longer, to apply material learned more effectively, and to foster a positive post-course attitude. Teachers who are aware of the distribution of the learning styles of their students can orient their primary teaching methods to the students with the modal learning styles (Bell, 1998) and diversify their teaching methods to meet the needs of other students.

Although knowledge about the distribution of learning styles of students may help teachers fine-tune their teaching methods, sufficient information about the learning styles of business students seems to be lacking. Perceiving a need for such information, Naik (2009) studied the learning styles of undergraduate business students at the Beacom School of Business, University of South Dakota using the *Index of Learning Styles* (ILS) instrument (Felder, 1996) based on the Felder-Silverman Learning Style Model (Felder and Silverman, 1988) and presented the results at the 16th Annual South Dakota International Business Conference in October 2009. The results showed that majority of the business students who took part in the study preferred sensing, visual, active, and sequential learning styles. An examination of the gender difference in learning styles indicated that gender difference was statistically significant only in the visual-verbal dimension. Attendees at the presentation asked whether there was any difference in the learning styles of the U.S. students and international students. This paper presents the preliminary results of a research to answer the question. The objective of the current research presented in this paper is to investigate whether the learning style distributions of business students in the U.S. are significantly different from that of business students in a developing country such as Dominican Republic. If significant differences in the learning styles of U.S. and non-U.S. students are observed, American faculty may consider enhancing their teaching styles to meet the needs of international students studying in the U.S.

A brief description of the model used for determining the learning styles of business students is described next followed by the methodology used in this research. The results of the analysis of data are then presented and discussed. Finally, a conclusions section wraps up the paper.

III. Felder-Silverman Learning Style Model

A number of learning style models has been devised by researchers to identify individual learning styles of people. Felder (1996) briefly describes the essential elements of four of these learning style models, viz., the Myers-Briggs Type Indicator, Kolb's Learning Style Model, Herrmann Brain Dominance Instrument, and Felder-Silverman Learning Style Model. Felder

and Silverman (1988) synthesized the results of a number of studies to develop their model which they claim to be particularly relevant to science education. Felder-Silverman Learning Style Model classifies students into five dichotomous categories: sensing learners or intuitive learners, visual learners or verbal learners, inductive learners or deductive learners, active learners or reflective learners, sequential learners or global learners.

Felder (1996) with Barbara Solomon has developed an *Index of Learning Styles* (ILS) instrument that classifies students on four of the five dimensions of Felder-Silverman Model (it excludes the inductive-deductive dimension). The ILS can be administered either by a printed copy of the survey questionnaire or on-line on the Web (Felder and Soloman, 1998). The characteristics of the four dimensions of the ILS are briefly explained next.

Sensing learners prefer learning facts and solving problems by well-established methods. They dislike complexities and surprises such as being tested on material not explicitly covered in the class. They understand material better with real-world examples and applications. They also like brain storming with group-mates. Intuitive learners, on the other hand, are comfortable with abstract ideas, mathematical formulations, and innovative methods of problem solving. They dislike memorization and routine calculations. In the extreme cases, sensing learners may rely too much on memorization without understanding, and intuitive learners may not pay attention to details and be careless in calculations.

Visual learners like pictures, diagrams, flow charts, photographs, videos, and demonstrations. They like color-coding, highlighting, and drawing boxes, circles, and lines to show connections. Verbal learners, on the other hand, are comfortable with written or spoken explanations and like to outline material in their own words. They like to discuss material in groups, and explaining and listening to each other.

Active learners prefer hands-on activities, group discussions and group problem-solving. They dislike simply sitting in the class and taking notes. Reflective learners tend to think about a concept or problem quietly first. They like to study and solve problems alone, take notes and summarize material. In the extreme cases, active learners can jump into activities prematurely without thinking while reflective learners may never get anything done.

Sequential learners first understand the connection between parts in sequential steps to understand the whole. On the other hand, global learners gain an overall understanding first by absorbing material at random and then see the significance of the parts to the whole. Sequential learners dislike teachers who jump around topics and skip steps. They learn new topics better when related to that already learned. Global learners can solve complex problems faster but may not be able to explain how they did it. In the extreme cases, sequential learners may know a lot about specific aspects of a topic but have difficulty in relating them to different aspects or different topics. Extreme cases of global learners may not have any clue of what is going on until the light bulb of the big picture turns on.

Although the dimensions of the Felder-Silverman model used in the ILS have been presented as dichotomous categories, Felder (1993) emphasizes that these dimensions should be treated as continua and not as either/or categories. He argues that a student's preference could be

represented on a scale of weak, moderate or strong in one side of a dimension. He also points out that learning style preferences for a particular student may vary with subject and learning environment, and can change over time. The objective of this research is to investigate whether the differences in the learning environment in different countries lead to significant differences in learning styles of business students. A brief description of the methodology used in this research is presented in the following section.

IV. Research Methodology

For this research, a sample of 297 undergraduate business students of the Beacom School of Business, The University of South Dakota, Vermillion, South Dakota previously reported by Naik (2009) was used. In addition, a limited sample of 39 business students of Universidad Iberoamericana, Santo Domingo, Dominican Republic was used. The *Index of Learning Style* (ILS) instrument (Felder and Soloman, 1998) based on Felder-Silverman Learning Style Model was selected since it was previously used by Naik (2009). The survey instrument administered was made anonymous and voluntary.

The ILS was administered to the students in the form of a printed questionnaire. The ILS has 44 questions and takes about 10 minutes to complete. The responses to the learning style questions were then entered on-line using the Web for each respondent. The responses for a particular student were processed on-line and the result of the analysis was displayed as a report for each respondent. Thus 297 printed reports corresponding to 297 students from the U. S. and 39 printed reports corresponding to 39 students from Dominican Republic formed the basis of the data analysis and results presented next.

V. Data Analysis and Results

The analysis report for a student obtained from on-line processing of survey responses consists of scores on a scale of 1 to 11 (odd numbers only) for one of the dichotomy of each of the four ILS dimensions. A score of 1 to 3 in either dichotomy of a dimension indicates a learning style preference that is fairly balanced in that dimension. A score of 5 to 7 indicates a moderate preference in the associated dichotomy of the concerned dimension. A score of 9 to 11 indicates a strong preference. Thus, there are five possible categories in each of the four dimensions to which a student can belong. For example, in the visual-verbal dimension, these five categories are strong visual, moderate visual, balanced visual-verbal, moderate verbal, and strong verbal. As an example, assume that the analysis report for a hypothetical student contains the following scores: 3 reflective, 5 sensing, 7 visual, and 9 global. Thus, the hypothetical student belongs to the following categories: balanced active-reflective category in the active-reflective dimension, moderate sensing category in the sensing-intuitive dimension, moderate visual category in the visual-verbal dimension, and strong global category in the sequential-global dimension.

The analysis reports for the 297 students from the U.S. and 39 students from the Dominican Republic were analyzed and the percentage of students belonging to each of the five categories in each of the four dimensions for each country were calculated. Table 1 shows the percentages of students belonging to the five categories of sensing-intuitive dimension for each

country. The corresponding results for the visual-verbal, active-reflective, and sequential-global dimensions are shown in Tables 2, 3, and 4 respectively.

Table 1: Row Percentages for the Sensing-Intuitive Dimension

	Strong Sensing	Moderate Sensing	Balanced SEN-INT	Moderate Intuitive	Strong Intuitive
U.S.	19.19	41.08	32.66	5.72	1.35
Dominican Republic	12.82	17.95	58.97	7.69	2.56

Table 2: Row Percentages for the Visual-Verbal Dimension

	Strong Visual	Moderate Visual	Balanced VIS-VRB	Moderate Verbal	Strong Verbal
U.S.	30.98	29.63	34.01	5.05	0.34
Dominican Republic	25.64	23.08	46.15	2.56	2.56

Table 3: Row Percentages for the Active-Reflective Dimension

	Strong Active	Moderate Active	Balanced ACT-REF	Moderate Reflective	Strong Reflective
U.S.	4.71	20.54	63.30	9.76	1.68
Dominican Republic	15.38	30.77	48.72	2.56	2.56

Table 4: Row Percentages for the Sequential-Global Dimension

	Strong Sequential	Moderate Sequential	Balanced SEQ-GLB	Moderate Global	Strong Global
U.S.	5.39	30.30	54.55	8.75	1.01
Dominican Republic	2.56	28.21	56.41	10.26	2.56

The results presented in Tables 1 through 4 are also presented as bar charts in Figures 1 through 4 to allow visual comprehension of the differences in the distribution of learning styles of business students between the U. S. and the Dominican Republic. Figure 1 shows significant country related difference in learning style distribution along the sensing-intuitive dimension. Country related difference seems to be the least along the sequential-global dimension as shown in Figure 4. Some country related differences are noticeable in the other two dimensions as shown in Figures 2 and 3.

Although the bar charts show some country related differences in the learning style distributions, it is not clear whether these differences are statistically significant. A chi-square

test of independence was performed for each of the four learning style dimensions to see if county played a role in determining learning style preferences. The null and alternative hypotheses are stated as follows:

H_0: The learning style preferences are independent of country
H_a: The learning style preferences are not independent of country

Figure 1: Comparison along Sensing-Intuitive Dimension
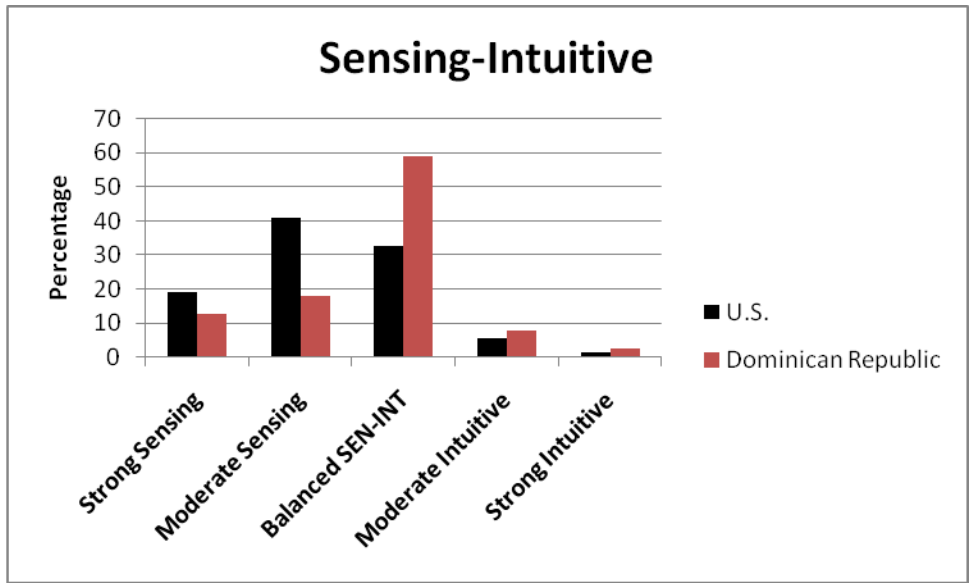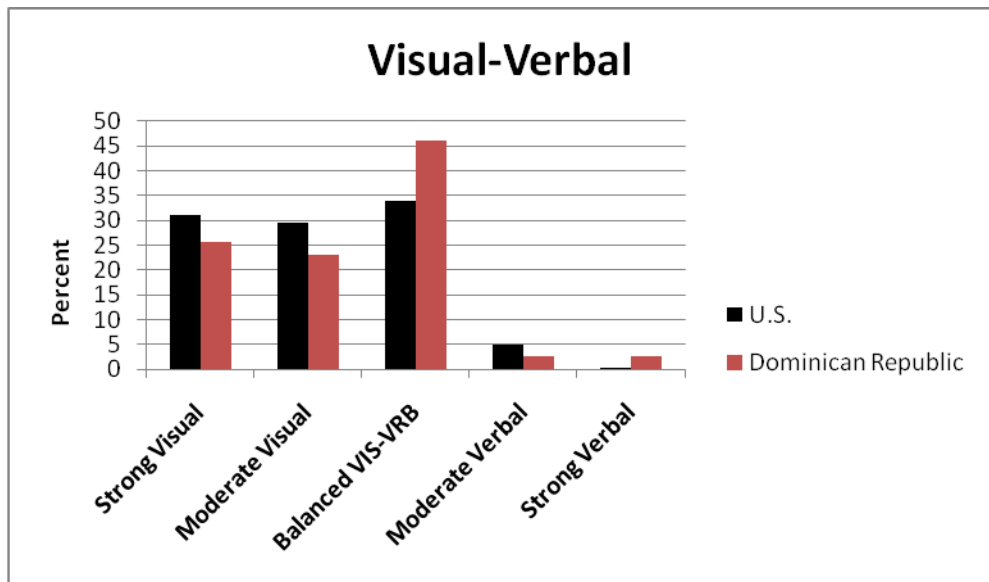

Figure 2: Comparison along Visual-Verbal Dimension

With five categories of preferences in each learning style variable and two categories in the country variable, the degree of freedom is 4. Assuming a significance level 0.05, the critical

value of the chi-square test statistic to reject the null hypothesis is 9.48773 (taken from the chi-square table).

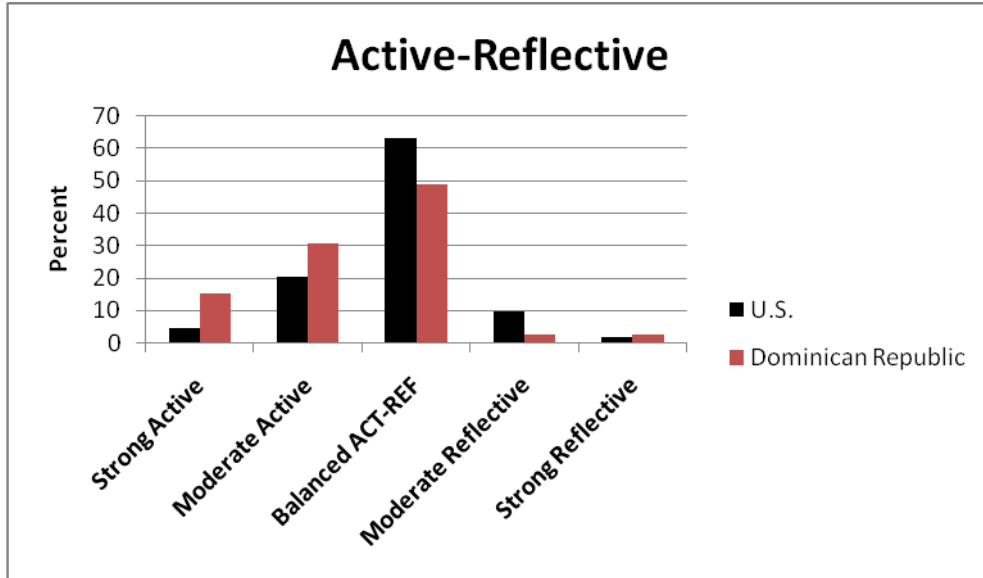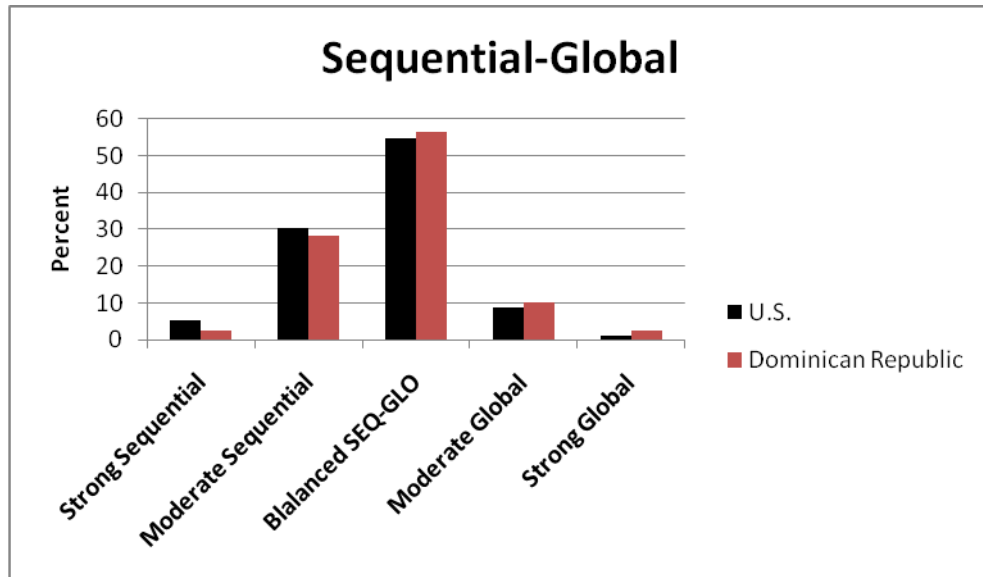*Figure 3: Comparison along Active-Reflective Dimension*

Figure 4: Comparison along Sequential-Global Dimension

The chi-square test statistic values and p-values calculated for the four learning style dimensions are shown in Table 5. It can be seen from Table 5 that the null hypothesis is rejected for the sensing-intuitive and the active-reflective dimensions of the learning style distribution since the corresponding values of the chi-square statistics are greater than the critical value. The null hypothesis is not rejected and the alternative hypothesis is accepted for the visual-verbal and the sequential-global dimensions since the chi-square statistics are less than the critical value. Thus,

the data analysis seems to suggest that country of the students has an influence on the distribution of learning styles only along the sensing-intuitive and active-reflective dimensions. However, the statistical inference drawn here should be considered with caution because of the small size of the sample from the Dominican Republic.

Table 5: Chi-Square Test Statistic Values and p-values

Dimension	Chi-Square Test Statistic	p-Value
Sensing - Intuitive	12.81319	0.01223
Visual - Verbal	5.59311	0.23167
Active - Reflective	11.59641	0.02062
Sequential - Global	1.40183	0.84388

VI. Discussion

Since the data analysis suggests statistically significant differences in learning style distributions between the U.S. and the Dominican Republic along the sensing-intuitive and active-reflective dimensions, it is worthwhile to examine figures 1 and 3 to understand the nature of the differences. Figure 1 shows relatively greater proportion of strongly and moderately sensing students in the U.S. Figure 3 shows greater proportion of strongly and moderately active students in the Dominican Republic. It is beyond the scope of this research to investigate the cultural and educational environmental factors that may be contributing to the observed differences in learning styles between the U.S. and the Dominican Republic. The preliminary research presented here simply suggests that statistically significant differences may be observed in the learning styles of business students between a developed and a developing country. Further empirical research needs to be carried out with more data from different countries to obtain better insight into this issue. The findings of such research can benefit faculty in the U.S. higher education in meeting the needs of international students.

VII. Conclusions and Recommendations

Prior research indicates that individual learning styles of students significantly influence the effectiveness of classroom teaching. Mismatch between the teaching style of the instructor and the learning styles of the majority of students can lead to poor performance in and negative attitude toward a course. Knowledge of the distribution of the learning styles of students in the class can help the instructor customize his or her teaching methods to match the modal learning styles of the students in the class. If significant differences in learning styles of international students studying in the U.S. are observed, instructors in the U.S. can benefit from an understanding of the nature of these differences and can meet the needs of the international students better.

In this research the authors used the *Index of Learning Styles* (ILS) instrument to survey 297 undergraduate business students in the U.S. and 29 undergraduate business students in the Dominican Republic. The analysis of the data shows that statistically significant differences in

the learning styles of students of the two countries exist along two of the four dimensions of the Felder-Siverman Learning Style Model. However, investigation of the reasons why such differences should exist is beyond the scope of this research and can be carried out separately.

Since the sample size from the Dominican Republic used in this preliminary research is small, it is suggested that this research be repeated with more data from the Dominican Republic. In addition, it is recommended that this research be conducted with data from other developing countries to draw any definite conclusion as regards to the nature of the differences in learning styles of students from developing and developed countries.

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