LEARNING STYLES AND THE SELECTION OF MAJORS AMONG LEBANESE YOUTH

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Abstract – *Learning style preferences and selection of university major data were obtained from a sample of 199 Lebanese high school graduates. These measures and gender were used to assess the relation between the selection of major and learning style preferences. The main assumption was that students who believe they have competencies or ability in a certain area would make choices to pursue activities in these areas in order to develop further these competencies (Holland, 1973). The perceptual and biological development of students' auditory, visual, tactual and kinesthetic senses appeared to be a key factor in their way of acquiring information. Thus, fitting learning preferences to the specific content knowledge required is with little doubt a very important issue that needs to be addressed by research. This study found that learning style preferences were not homogeneous and were not homogenously distributed across majors. Overall, students indicated a preference for the visual and active learning styles. Females, however, were higher than males on both reflective and verbal styles. Chi-square analyses indicated that each of the six general major areas had distinct learning style attribute profiles that distinguished them from the others. Learning style profiles, therefore, may contribute positively to student selection processes for different majors.*

Introduction

M ost educators are receptive to the idea that students are not alike and consequently do not learn in the same way. When students approach a learning task or situation, they do not all use the same approach, and not all of them perform in the same way in the same setting. A differentiated conception of learning-centred learning styles has been formulated by educational researchers (e.g., Renzulli & Dai, 2001) and many dimensions have been identified (see William, 2000). Among the learning style dimensions that have gained prominence in the field of education and cognitive psychology, there are abstract versus concrete (Kolb, 1976), sensing modality (Renzulli & Smith, 1978), visual versus auditory learning preferences (Barbe & Swassing, 1979), the physical and social characteristics of the learning environment (Dunn, Dunn & Price, 1975) and the kind and amount of formal content structure there is in the degree discipline and learning process (Hunt, 1975).

Although a number of learning style models have been developed, it is Kolb's (1984) model which is the most popular and widely used among adolescents in schools (Sternberg & Grigorenko, 2001). Basing himself on Carl Jung's (1971) theories discussed in *Psychological Types*, Kolb conceptualised learning style as the personality style. Kolb's work was later modified by Myers (1978) into what is now known as the Myers-Briggs Type Indicator (MBTI). The MBTI instrument assesses personality types with application to learning, but is viewed by many as somewhat limited and flawed in several ways (see Pittenger, 1993). More recently, however, Richard Felder and Linda Silverman have proposed a learning style model which comprehensively captures and integrates many of the different views and learning style dimensions currently found in the literature. These two theorists classify students as having preferences for one category or the other along the following four dimensions: (i) Active/Reflective; (ii) Sensing/Intuitive; (iii) Visual/Verbal; and (iv) Sequential/Global (see Felder & Silverman, 1988; Felder, Felder & Dietz, 2002; Felder & Spurlin, 2005). A detailed description of these dimensions is given in the Methods section of this paper and can be found in even greater detail in Felder & Silverman (1988) and Felder (1993). Learning style preferences (through re-scoring the same items) can also be organised into another frame of reference (or lens) which has three dimensions: cognitive, affective and psychological behaviours that serve as relatively stable indicators of how students interact with, perceive and respond to a given learning environment (DeBello, 1989). The identification of any learning style and personality trait associated with student choice of major (and later completion of a major) could serve as a valuable guide and additional formal screening tool for admissions to a university.

Learning styles and choice of major

In recent years, considerable attention has been paid to new pedagogies and the non-traditional learning paradigm. This new focus has prompted a fundamental shift in classroom pedagogy from one that is centred on providing instruction to one that focuses on active, collaborative and cooperative tasks which seek to engage students in their own education (Barr & Tagg, 1995). Given the now prevailing view that certain fields of study accommodate certain learning styles and the 'new pedagogies' better than other learning styles and pedagogies, it is somewhat surprising that little research has been done on this potential interaction. Thus, an attempt at identifying and clarifying the relationships between individual learning style preferences and choice of major is certainly a step in the right direction. Unfortunately (to those of us in the rest of the world), the available

studies have primarily had a North American focus (Worthington & Higgs, 2004) and their ecological validity is doubtful if not unknown. As far as the present authors are aware, with the exception of the studies by Nasser & Abouchedid (2006) and Abouchedid & Nasser (2000), little research has been done on how students select their majors in the Middle East and in Lebanon in particular. Even with the glut of studies on learning style preferences in relation to scholastic majors, studies have been limited to 'within' studies that investigate learning styles of students within a specific major. These include education (Mathews, 1994; Braio, 2000), nursing (Laschinger & Boss, 1984; Underwood, 1987; Duff, Johnston & Laschinger, 1992), food sciences (Palou, 2006), engineering (Felder & Silverman, 1988; Ingham, 2000), geography (Healey, Kneale & Bradbeer, 2005), business (Loo, 2002), marketing (Brown & Burke, 1987; Stewart & Felicetti, 1992; Davis, Misra & Van Auken, 2000), accounting (Baker, Simon & Bazeli, 1986; Brown & Burke, 1987; Hoiley & Jenkins, 1993), finance (Brown & Burke, 1987) and various other disciplines (Mathews, 1994). This study, on the other hand, investigates the relations between learning styles and choice of major (i.e., comparatively) among students who are about to enter a private Catholic university in Lebanon.

The theoretical view used in this study to model the selection of majors is derived from Holland's (1973) work *Making Vocational Choices*. According to this view,

> 'people who believe they lack competencies or ability in some areas will make choices that avoid activities in those areas and thus do not develop further competencies in those areas. In contrast, people who believe they have competencies or ability in certain areas will make choices to pursue activities in those areas and thus further develop their competencies.' (Gottfredson, 2002, p. 202)

Although Holland emphasised that learning is an important component of the process of making vocational choices, he did not integrate learning style preferences into his model. His helical view of vocational selection, where activities lead to interests and thus to competencies, suggests that learning is at the front-end and parallel to performance. A career seeker may gain these interests (as well as satisfactions) from others who provide encouragement to pursue these interests later (Holland, 1985). In this way, then, students may choose certain majors because they use pedagogies that match their individual learning preferences. For instance, students may choose a business major because it lends to social/conceptual-based pedagogies (Mathews, 1994), or they may choose architecture because it lends to visual competencies not found in the business field. The current study, therefore, extends and clarifies this view

and the understanding of students' selection of their major by explicitly rather than implicitly measuring and including learning style in this model and theoretical view.

Educational and scientific importance of the study

This investigation is unique because it is an *a priori* study were measures of learning styles were taken prior to the enrolment in an academic program. Previous studies on the selection of majors (see Underwood, 1987; Melear, 1989; Stewart & Felicetti, 1992; Mathews, 1994; Braio, 2000; Ingham, 2000; Loo, 2002; Davis, Misra & Van Auken, 2000) measured learning styles after enrolment into a scholastic major, which confounds a clear examination of this relationship in several different ways. The current study also extends the work on learning style as a possible guide for career counsellors. By utilising documented learning style profiles for each scholastic major, academic counsellors can use students' learning style profiles to provide guidance to students applying to join university along with other pre-admission screening criteria. With the rising popularity of certain academic majors at university, such as the business administration (Davis, Misra & Van Auken, 2000), there is also a need to understand how students prefer to learn in these courses. This would help to design these courses along the lines indicated by their learning-teaching style profiles. The pedagogical approaches that facilitate learning can do much to foster students' positive attitude toward learning and the quality of outcomes. Research reveals in fact a positive relationship between attitude and learning (see Johnson, 1996; Kuhlemeier, van den Bergh & Melse, 1996). Thus, the need to assimilate learning styles within student-centred pedagogical approaches as a basis for good teaching is, with little doubt, an important goal toward the development of highly successful pedagogies in higher education.

Higher education faculty often wonder if college students are really interested in their major. One could argue that students probably choose college majors for reasons other than interest in the subject area (e.g., financial returns). A great deal of the literature, however, indicates that although interest is one of, if not, the dominant factor in career choice (see Carifio, 1992), students have difficulties making decisions about careers and majors at the beginning of their higher education careers. Thus, the present study examined learning style preferences of entry level students to a Lebanese university in relation to their selection of majors to see if student choice might be better understood and predicted by this important variable, which is related to personality as are career interests and choices in adulthood.

The current policy in international higher education is that students have to choose their majors prior to admission to a university (Chitnis, 1999; Darvas, 1999; Sporn, 1999). Therefore, the possibility of using learning style preferences as one criterion for admission to a scholastic major is a viable and psychometrically sound (personality self-assessment) approach and construct to career aspirations and choices. Further, it has been suggested by Renzulli & Dai (2001) that once an area of study (scholastic major) is identified, learning style could be used along with other combinations of aptitude measures as criteria for admission, hence providing a fuller picture of prospective university student admission profile and perhaps better prediction of outcomes.

Methods

Procedure

Students were asked to fill the Learning Style Index questionnaire during the pre-admission examinations. The questionnaire was included in fact with their examination package for a private university in Lebanon. All students were told that filling out the questionnaire was a voluntary initiative and that complete response confidentiality would be maintained. Prospective students were also told that if they wished, they could just finish their admission examinations and leave. The learning styles inventory (Felder & Spurin, 2005) had a 98% completion rate for these students.

The sample of respondents in this study consisted of high school graduates who were seeking admission to a Lebanese private university. Most students came from schools in which English was the medium of instruction. A probabilistic sampling technique was employed by one of the researchers in this study. Students who were applying for admission and taking the entrance examination were asked to fill the Learning Style Index. Their age range spread from 17 to 43, averaging 19.69 years. There were 90 females and 109 males. Out of the prospective applicants, 82 were for the business school, 61 for engineering, 4 for the sciences, 13 for communication studies, 13 for architecture and graphic design, and 8 for the humanities and social sciences. The rest did not respond.

The constructs of the Learning Style Index

The Learning Style Index questionnaire has four dimensions, which are supported by well-established theories in education and cognitive psychology (Felder & Silverman, 1988). The four dimensions included in the instrument are:

(i) Active/Reflective; (ii) Sensing/Intuitive; (iii) Visual/Verbal; and (iv) Sequential/ Global.

- The first dimension is part of the activity or learning-centred approach (Rayner & Riding, 1997) and is based on Kolb's (1984) learning styles model. **Active** learners are those who prefer group work and physical activity, whereas **Reflective** learners prefer to work alone and are introspective learners.

- The second dimension is a personality trait measure which is measured by the Myers-Briggs Type Indicator (Myers, 1978). While **Sensing** learners prefer to use external cues such as sounds and physical sensations, **Intuitive** learners try to discover possibilities, hunches and relationships.

- The third dimension is based on Paivio's (1971) dual coding theory which suggests that visual and verbal information are processed by different cognitive sub-systems. While **Visual** learners prefer pictures, diagrams, graphs and flowcharts, **Verbal** learners are more attuned for auditory sounds and words.

- The fourth and final dimension is based on work on individual differences (Witkin et al., 1962; Dyk & Witkin, 1965) which is specifically driven by cognitively based styles. This dimension defines whether one is a sequential or a global learner. Whereas a **Sequential** learner accommodates and understands material in small, connected chunks, a **Global** learner tends to absorb information in seemingly unconnected chunks.

Needs to be said however that other sub-dimensions of these four major dimensions also play important roles in determining how a student receives and processes information.

The overall research question for this study explores whether a specific type of learning style (i.e., Active/Reflective; Sensing/Intuitive; Visual/Verbal; and Sequential/Global) can be identified by the type of scholastic major that students choose, in the knowledge that students' learning styles worldwide are active, sensing, visual and global (Felder & Spurlin, 2005).

Instruments

The Index of Learning Styles is a 44-item questionnaire designed to assess learning style preferences along four dimensions (Felder & Spurlin, 2005). Each learning dimension has 11 items. Each item has a forced response choice format (either 'a' or 'b') which characterises if one has a specific attribute for that

dimension. For instance, on the Active/Reflective dimension, the active and reflective characteristics can have an overall score from 0 to 11. While the 'a' responses for the 11 items of this dimension represent the active learner preferences, the 'b' responses for the same 11 items represent the reflective learner preferences. Preferences can be thought of in degrees. Thus, if a respondent makes 6 to 8 'a' responses on the Active/Reflective dimension, he or she is then an above average active learner. Should, however, the respondent make 8 to 10 'a' responses on the same dimension, the respondent would be then a highly active learner. For each dimension, the two attributes are inversely related to each other. In practice, taking once again the Active/Reflective dimension as a case in point, the higher the active learning style score for the respondent, the lower is his or her reflective learning style score. A number of parametric tests (including correlations, *t*-tests and ANOVAs) were performed to examine if there is a relation between the learning preferences expressed within each dimension and the selection of majors.

On the 'selection of major' questionnaire, students are asked to indicate their selected (i.e., desired) major. The students in this study were however also asked to indicate their selected major on the 'learning style preferences' questionnaire. In addition, these students were further asked to place their candidate number on the 'learning style preferences' questionnaire to crosscheck their selection of major on the questionnaire to their application form. The principal investigator administered the instruments and offered feedback to interested subjects at the end of the sessions. Subjects were assured that the data would only be used for research and that the exercise was voluntary.

Results

The first analysis focused on the score on each of the four dimensions of the learning style preferences questions for this sample of students. Recalculating a count score for the 11 items of each dimension by multiplying the first of the couplet (i.e., active, sensing, visual and sequential) by '-1' creates positive and negative deviation scores for each dimension that should average to zero if there were no imbalances in the sample relative to the attributes of the couplet for that dimension. Thus, a mean of 0 for a given dimension would indicate a 'no preference condition' for either of the learning styles in the couplet and an equal distribution for each attribute pair that made up the dimension. A *z*-test of the difference between the dimensional mean and the theoretical mean of 0 was calculated for each of the couplets. The results were: (i) Active(-ve)/Reflective dimension ($M = -4.06$, $SD = 3.62$, $p > .05$); (ii) Sensing(-ve)/Intuitive dimension ($M = -1.63$, $SD = 4.48$, $p > .05$); (iii) Visual(-ve)/Verbal dimension ($M = -4.31$,

$SD = 4.32$, $p > .05$); and (iv) Sequential(-ve)/Global dimension ($M = -0.25$, $SD = 4.08$, $p > .05$). These results indicate no significant differences between the ideal mean of 0 and the mean of each dimension. The learning preferences for students in this sample were found to be 'balanced' and representative in theory of the population of students who take this questionnaire.

The second analysis involved obtaining a count for each of the responses and then a mean and standard deviation of these counts for the whole sample. Table 1 reports these means and standard deviations. As can be seen from Table 1, the highest mean in the sample was for visual learning styles, followed by those who prefer active learning styles.

Comparisons of mean learning styles by gender were also carried out (see Table 2). As can be seen from Table 2, the only two differences found were that while males were significantly higher than females on active learning style preferences ($p < .05$), females were significantly higher than males on reflective learning style preferences ($p < .05$). Given that these were only 2 of the 8 attributes measured by the scale, one may conclude that the females and males in this sample were more alike than they were different in terms of their learning style preferences. This is particularly so since the differences found could be due, in part, to cultural conditioning.

TABLE 1: Overall means (M) and standard deviations (SD) for each couplet attribute of the four learning styles measured

Learning Styles	*N*	*M*	*SD*
Active	199	7.43	1.88
Reflective	199	3.37	1.83
Sensing	199	6.21	2.30
Intuitive	199	4.57	2.26
Visual	199	7.56	2.21
Verbal	199	3.25	2.19
Sequential	199	5.48	2.09
Global	199	5.23	2.11

TABLE 2: Comparisons of mean learning style preferences by gender

Learning Styles	Gender	*N*	*M*	*SD*	*t*-value
Active	Female Male	90 109	7.1333 7.6789	1.8914 1.8453	-2.05*
Reflective	Female Male	90 109	3.7111 3.0917	1.8618 1.7667	2.40*
Sensing	Female Male	90 109	6.1667 6.2385	2.3619 2.2645	-0.22
Intuitive	Female Male	90 109	4.6444 4.5138	2.3431 2.2011	0.41
Visual	Female Male	90 109	7.5111 7.5963	2.0731 2.3259	-0.27
Verbal	Female Male	90 109	3.3000 3.2110	2.0904 2.2774	0.29
Sequential	Female Male	90 109	5.5556 5.4220	2.1832 2.0244	0.45
Global	Female Male	90 109	5.1778 5.2844	2.1650 2.0687	-0.35

* *p* < .05

A two-way ANOVA was done to determine whether there were any differences between the selection of major and gender. A main effect (see Table 3) was found for major (using the couplet score) on the Sensing/Intuitive dimension ($F(5,169) = 2.67$, $p < .05$). In identifying the differences within the selection of major variable, Scheffe's post-hoc analyses revealed differences between those who selected sciences and architecture, and between those who selected sciences and social sciences/humanities, with science majors being consistently more sensing than intuitive. Thus, when comparing the differences in the selected majors on each learning style uniquely, it was found that only the sensing and

intuitive dimensions of learning style were different between the six majors. The science students were more sensing in their learning styles than the students in other majors. In addition, those who were in the humanities and social sciences were more intuitive than those in other types of major.

A significant main effect was also found for gender ($F(1,169) = 4.71, p < .05$), with females being more reflective than active (which is practically the same difference found and reported in Table 1).

TABLE 3: Mean and F-ratio differences between majors for each learning style dimension

Selection of Major							
Active	7.74	7.03	6.50	7.62	7.62	7.75	1.37
Reflective	3.16	3.59	4.50	3.38	3.31	3.25	0.73
Sensing	6.55	6.13	8.75	6.54	5.00	4.50	3.22*
Intuitive	4.29	4.51	2.25	4.46	5.85	6.50	3.37*
Visual	7.74	7.52	7.75	6.54	7.92	7.25	0.79
Verbal	3.13	3.13	3.25	4.46	3.00	3.75	1.03
Sequential	5.60	5.28	7.75	6.00	4.92	4.63	1.74
Global	5.20	5.26	3.25	4.85	5.85	6.38	1.47

* $p < .05$

The final analysis attempted to understand the relationship between each of the leaning styles and the different majors. This was done by comparing the frequency of each learning style attribute by a selected major. As can be seen from Table 4, significant differences were found between each of the styles. Students choosing business and economics majors tended to be active rather than reflective learners, and also visual rather than verbal learners. Engineering majors tended to be more active than reflective and more visual than verbal. Science majors tended to be sensing rather than intuitive, sequential rather than global, and visual rather than

verbal. Those who selected communication studies had a higher mean on active learning style, followed by sensing and then intuitive. Students who selected architecture tended to be more visual than active. Finally, in comparison to the other selected majors, those who selected the humanities and social sciences were more active than reflective and more visual than verbal.

TABLE 4: Frequencies and percentages for each major selection by each learning style

Selection of Major						
	Number of Responses by Learning Style (Column Percentages)					
Active	635 (17.84)	429 (16.56)	26 (14.77)	99 (17.37)	99 (17.52)	62 (17.61)
Reflective	259 (7.28)	219 (8.46)	18 (10.23)	44 (7.72)	43 (7.61)	26 (7.39)
Sensing	537 (15.08)	374 (14.44)	35 (19.89)	85 (14.91)	65 (11.50)	36 (10.23)
Intuitive	352 (9.89)	275 (10.62)	9 (5.11)	58 (10.18)	76 (13.45)	52 (14.77)
Visual	635 (17.84)	459 (17.72)	31 (17.61)	85 (14.91)	103 (18.23)	58 (16.48)
Verbal	257 (7.22)	191 (7.37)	13 (7.39)	58 (10.18)	39 (6.90)	30 (8.52)
Sequential	459 (12.89)	322 (12.43)	31 (17.61)	78 (13.68)	64 (11.33)	37 (10.51)
Global	426 (11.97)	321 (12.39)	13 (7.39)	63 (11.05)	76 (13.45)	51 (14.49)
χ^2	566.01**	361.50**	38.33**	72.29**	86.91**	50.91**

** $p < .001$

The study found that learning style preferences were not homogeneous and were not homogenously distributed across majors. Overall, students indicated a preference for the visual ($M = 7.56$, $SD = 2.21$) and active ($M = 7.43$, $SD = 1.88$) learning styles (see Table 1). Using each major as a cohort group, chi-square analyses indicated that each of the six general major areas had distinct learning style attribute profiles that distinguished them from the others (see Table 4). In general, pre-admission students showed a significantly high percentage of active styles compared to other styles.

Discussion and conclusion

Students in different areas of studies in college and universities have different learning styles. Similar to the students in the studies by Palou (2006), Zualkernan, Allert & Qadah (2006) and Felder & Silverman (1988), the students in this study favoured active, sensing, visual and sequential learning styles. It was also found in this study that active and visual styles dominate students' learning approaches. But, on the other hand, university teaching at undergraduate level is predominately verbal, thus requiring a reflective and in some cases abstract involvement in the learning process. We found Lebanese students to be more active than reflective. These students, therefore, may get discouraged and may do poorly, or drop out altogether, because of the various mismatches between the learning and teaching styles. Differences between majors and learning styles were significant on the Sensing/Intuitive dimension. It was shown that engineering and science students were more sensing than the liberal arts students. This finding concurs with that of Litzinger et al. (2005) who found that engineering students were less intuitive than those in the liberal arts. The other results of Litzinger et al. (2005), on the other hand, were not confirmed in this study. In fact, the highest sequential individuals were those who applied for communication studies majors such as journalism, radio and TV programmes. It is possible that these majors require individuals to be process oriented and self-organised in order to get various tasks done over time.

In the present study, the pre-admission students were, in general, more active than reflective in their learning styles. In a university setting, students with this style could bring a certain level of preconceptions about learning that could be a detrimental to their performance. In one of the more comprehensive studies relating selection of majors and learning styles, Healey, Kneale & Bradbeer (2005), using Kolb's (1984) measures, found a predominance of the active learning style in the students they surveyed. In particular, they found that business and engineering students were more active-abstract and that these students fell in the convergence type quadrant. On the other hand, liberal arts and social sciences

students were higher on the reflective-concrete[1] dimension and fell in the divergent quadrant. Education students were higher on the active-concrete dimension and were more accommodators. Science majors were higher on the reflective-abstract dimension and were more assimilators. Healy, Kneale & Bradbeer (2005), therefore, found that learning styles were not homogeneous, but differentiated by majors, as also found in this study.

In their review of the research on the learning styles of engineering students, Felder & Spurlin (2005) found that engineering students tend to be more active than reflective, more sensing than intuitive, more visual than verbal and more sequential than global. But in this study, engineering students were found to be as global as they were sequential. Students in the present study were therefore not similar to typical engineering students found in academic settings. This difference may be due to the fact that the students in this study were university applicants not yet admitted or enrolled in engineering programmes. It may be that the students in other studies, who were or had been in engineering programmes, had already underwent their change in learning styles from the Sequential/Global 'balance' noted in the present study to the predominantly sequential style that is typical of students who are or have studied engineering. The difference, therefore, may reflect style accommodations to the effects of the engineering education experience.

In this study, gender differences were only found in pre-engineering students, precisely on the Visual/Verbal dimension with males emerging as being more visual than females. This finding cross-validated the finding of Litzinger et al. (2005) who reported that males who had selected engineering as major were more visual than females. Male preference for the visual and higher self-rating in spatial activities has also been reported by Furnham (2001). This result for engineering students is not surprising as it is similar to other types of self-rated abilities that tend to be attributable to the masculine gender type.

Final caveat

When pedagogical trends moved toward more student-centred approaches, the function of matching student learning style preferences to the instructional approaches used in courses began being viewed as a strategy that can be used to enhance student performance (Nelson et al., 1993). Matching students' learning styles with the teaching styles used in courses is indeed one factor that enhances the success of students in courses, and consequently, over time, of the course programme and the major itself. As such, students should be able to select a major where they can expect the teaching styles to approximate or accommodate their learning style. This signals the importance of using the learning style

questionnaire as part of the admission and selection process. The verbal dimension in learning is understandably quite dominant, as class lectures and reading are a must in higher education. Therefore, the finding that students prefer more visual approaches would certainly seem to put them at odds with current higher education modes of instruction. The sequential presentation of material in textbooks and lectures could also be seen as a point of concern and in need of closer scrutiny because students were equally sequential and global across all majors in this study.

Needs to be said that when teaching and learning styles do not match, students may feel anxious, frustrated, angry and consequently alienated, resulting in turn in lower achievement and leaving school altogether, which would then lead to loss of investment and skilled worker short falls (Gregore & Butler, 1984). On the other hand, student attitudes and dispositions play an important role in learning, as doing what one likes and finds enjoyable, and working in an area in which one is making reasonable progress all tend to enhance learning (Glazer, Steckel & Winer, 1987). The point is that all things that help to produce positive rather than negative affective states in learners while learning lead to improved outcomes, including retention, graduation, and continued work in the careers for which they were educated. Knowing precisely the relationships between learning preferences, major selection, and eventually achievement, graduation and career retention are very important issues on which further research needs to be done, even if only in terms of cost-benefits considerations.

Recommendations

Further studies are needed to assess whether learning styles predict graduation from a given major, as well as to assess whether learning styles change over the course of pursuing a given major, and also to examine if one of the problems with dropouts from a major is that their 'major incompatible' learning style does not change. Laschinger & Boss (1984) found a difference in the learning styles of pre-admission nursing majors and nursing majors close to graduation. Using Kolb's (1976) learning style instrument, they found that nursing students were more concrete learners in the later phases of their academic careers. This study and future studies would be greatly enhanced if we could understand better any changes in learning styles that occur during the course of pursuing a major, and the subsequent influence that these changes (or lack of) have on student performance. Again, a better understanding of the relationships between student learning preferences and the selection of and success in a given major may help to improve course instruction. It may be that a more diversified approach to instruction in majors, which both reflects the different learning styles of students

and the particular instructional requirements of the non-traditional majors, may lead to higher graduation rates and a better retention of students in these majors. This particular outcome from this line of research would be particularly helpful in meeting increased graduate needs in various majors that are critical to the needs of a given economy or society. The whole issue is to better manage the supply-demand dynamics associated with in-and-out migration problems that are very costly and very disruptive to the development of a given culture and society.

Note

1. Sensing/Intuitive being analogous to Kolb's Concrete/Abstract dimensions.

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References

Abouchedid, K., & Nasser, R. (2000) External and internal social barriers in stereotyping university majors, *Current Research in Social Psychology*, Vol. 5(9), pp. 151-169. Available online at: http://www.uiowa.edu/~grpproc/crisp/crisp.5.9.htm

Baker, R. E., Simon, J. R., & Bazeli, F. P. (1986) An assessment of the learning style preferences of accounting majors, *Issues in Accounting Education*, Vol. 1(1), pp. 1-12.

Barbe, W. B., & Swassing, R. H. (1979) *Teaching through Modality Strengths: Concept and Practices*. Ohio: Zenr-Bloser.

Barr, R. B., & Tagg, J. (1995) From teaching to learning: a new paradigm for undergraduate education, *Change*, Vol. 27(6), pp. 12-25.

Braio, A. (2000) Learning styles and college teaching: my experiences with education majors. In R. Dunn & S. A. Griggs (eds.) *Practical Approaches to Using Learning Styles in Higher Education* (ERIC Document Reproduction Service No. ED444419).

Brown, E. D., & Burke, R. C. (1987) Accounting education: a learning styles study of professional-technical and future adaptation issues, *Journal of Accounting Education*, Vol. 5(2), pp. 187-206.

Carifio, J. (1992) Interest as a predictor of initial early career choice and success, *Career Education Quarterly*, Vol. 2(3), pp. 47-72.

Chitnis, S. (1999) The transformation of an imperial colony into an advanced nation: India in comparative perspective in higher education. In P. Altbach & P. Peterson (eds.) *The 21st Century: Global Challenge and National Response*. New York: Institute of International Education.

Darvas, P. (1999) A regional perspective: Central and Eastern Europe. In P. Altbach & P. Peterson (eds.) *The 21st Century: Global Challenge and National Response*. New York: Institute of International Education.

Davis, R., Misra, S., & Van Auken, S. (2000) Relating pedagogical preference of marketing: seniors and alumni to attitude toward the major, *Journal of Marketing Education*, Vol. 22(2), pp. 147-154.

DeBello, T. C. (1989) *Comparison of Eleven Major Learning Styles Models, Variables, Appropriate Populations, Validity of Instruction and Research behind Them*. Paper presented at the National Conference of the Association of Supervision and Curriculum Development (ERIC Document Reproduction Service No. ED312093).

Duff, V., Johnston, N., & Laschinger, H. (1992) Learning styles of Chinese nursing faculty and career choice preferences, *Journal of Advanced Nursing*, Vol. 17(2), pp. 229-233.

Dunn, R., Dunn, K., & Price, G. E. (1975) *Learning Style Inventory*. Lawrence, KS: Price Systems.

Dyk, R., & Witkin, H. (1965) Family experiences related to the development of differentiation in children, *Child Development*, Vol. 30(1), pp. 21-55.

Felder, R. M. (1993) Reaching the second tier: learning and teaching styles in college science education, *Journal of College Science Teaching*, Vol. 23(5), pp. 286-290.

Felder R. M., Felder, G. N., & Dietz E. J. (2002) The effects of personality type on engineering student performance and attitudes, *Journal of Engineering Education*, Vol. 91(1), pp. 3-17.

Felder, R. M., & Silverman, L. K. (1988) Learning and teaching styles in engineering education, *Engineering Education*, Vol. 78(7), pp. 674-681.

Felder, R. M., & Spurlin, J. (2005) Reliability and validity of the Index of Learning Styles: a meta-analysis, *International Journal of Engineering Education*, Vol. 21(1), pp. 103-112.

Furnham, A. (2001) Self-estimates of intelligence, *Personality and Individual Differences*, Vol. 31(8), pp. 1381-1405.

Glazer, R., Steckel, J., & Winer, R. S. (1987) Group process and decision performance in a simulated marketing environment, *Journal of Business Research*, Vol. 15(6), pp. 545-557.

Gottfredson, G. (2002) Interests, aspirations, self-estimates, and the self-directed search, *Journal of Career Assessment*, Vol. 10(2), pp. 200-208.

Gregore, A. F., & Butler, K. A. (1984) Learning is a matter of style, *Vocational Education*, Vol. 53(3), pp. 27-29.

Healey, M., Kneale, P., & Bradbeer, J. (2005) Learning styles among geography undergraduates: an international comparison, *Area*, Vol. 37(1), pp. 30-42.

Hoiley, J. H., & Jenkins, E. K. (1993) The relationship between student learning style and performance on various test question formats, *Journal of Education for Business*, Vol. 68(5), pp. 301-308.

Holland, J. L. (1973) *Making Vocational Choices: A Theory of Vocational Personalities and Work Environments*. Englewood Cliffs, NJ: Prentice-Hall.

Holland, J. L. (1985) *Making Vocational Choices: A Theory of Vocational Personalities and Work Environments* (2nd edition). Englewood Cliffs, NJ: Prentice-Hall.

Hunt, D. E. (1975) Person-environment interaction: a challenge found wanting before it was tried, *Review of Educational Psychology*, Vol. 45(2), pp. 209-230.

Ingham, J. (2000) Meeting the academic challenges of an undergraduate engineering curriculum. In R. Dunn & S. A. Griggs (eds.) *Practical Approaches to Using Learning Styles in Higher Education* (ERIC Document Reproduction Service No. ED444419).

Johnson, R. (1996) *An Analysis of Learner Variables related to Achievement in an Introductory Graduate Statistics Course*. PhD thesis, Wayne State University, USA.

Jung, C. G. (1971) *Psychological Types* (Collected Works of C. G. Jung, Volume 6). Princeton, NJ: Princeton University Press.

Kolb, D. A. (1976) *Learning Style Inventory: Technical Manual*. Boston: MceBer.

Kolb, D. A. (1984) *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice-Hall.

Kuhlemeier, H., van den Bergh, H., & Melse, L. (1996) Attitudes and achievements in the first year of German language instruction in Dutch secondary education, *Modern Language Journal*, Vol. 80(4), pp. 494-508.

Laschinger, H. K., & Boss M. W. (1984) Learning styles of nursing students and career choices, *Journal of Advanced Nursing*, Vol. 9(4), pp. 375-380.

Litzinger, T. A., Lee, S. H., Wise, J. C., & Felder R. M. (2005) *A Study of the Reliability and Validity of the Felder-Soloman Index of Learning Styles*. Paper presented at the 2005 Annual Conference, American Society for Engineering Education. Available online at: http://www.asee.org/about/events/conferences/search.cfm

Loo, R. (2002) A meta-analytic examination of Kolb's learning style preferences among business majors, *Journal of Education for Business*, Vol. 77(5), pp. 252-256.

Mathews, D. (1994) An investigation of students' learning styles in various disciplines in colleges and universities, *Journal of Humanistic Education and Development*, Vol. 33(2), pp. 65-74.

Melear, C. T. (1989) *Cognitive Processes in the Curry Learning Style Framework as Measured by the Learning Style Profile and the Myers-Briggs Type Indicator among Non-Majors in College Biology*. PhD thesis, Ohio State University, USA.

Myers, I. (1978) *Myers-Briggs Type Indicator*. Palo Alto, CA: Consulting Psychologist's Press.

Nasser, R., & Abouchedid, K. (2006) Effects of gender and choice of major on estimates of multiple intelligences for self, mother, and father among Lebanese youth, *Current Research in Social Psychology*, Vol. 11(9), pp. 127-142. Available online at: http://www.uiowa.edu/~grpproc/crisp/crisp11_9.pdf

Nelson, B., Dunn, R., Griggs, S., Primavera, L., Fitzpatrick, M., Bacilious, Z., & Miller, R. (1993) Effects of learning style intervention on college students' retention and achievement, *Journal of College Student Development*, Vol. 34(5), pp. 364-369.

Paivio, A. (1971) *Imagery and Verbal Processes*. New York: Rinehart & Winston.

Palou, E. (2006) Learning styles of Mexican food science and engineering students, *Journal of Food Science Education*, Vol. 5(3), pp. 51-57.

Pittenger, D. J. (1993) The utility of the Myers-Briggs Type Indicator, *Review of Educational Research*, Vol. 63(4), pp. 467-488.

Rayner, S., & Riding, R. (1997) Towards a categorization of cognitive styles and learning styles, *Educational Psychology*, Vol. 17(4), pp. 5-27.

Renzulli, J. S., & Dai, D. Y. (2001) Abilities, interests, and styles as aptitudes for learning: a person-situation interaction perspective. In R. J. Sternberg & L. Zhang (eds.) *Perspectives on Thinking, Learning, and Cognitive Styles*. New Jersey: Lawrence Erlbaum Associates.

Renzulli, J. S., & Smith, L. H. (1978) *The Learning Style Inventory: A Measure of Student Preference for Instructional Techniques*. Mansfield Center, CT: Creative Learning Press.

Sporn, B. (1999) Current issues and future priorities for European higher education systems. In P. Altbach & P. Peterson (eds.) *The 21st Century Global Challenge and National Response*. New York: Institute of International Education.

Sternberg, R. J., & Grigorenko, E. L. (2001) A capsule history of theory and research on styles. In R. J. Sternberg & L. Zhang (eds.) *Perspectives on Thinking, Learning, and Cognitive Styles*. New Jersey: Lawrence Erlbaum Associates.

Stewart, K., & Felicetti, L. (1992) Learning styles of marketing majors, *Educational Research Quarterly*, Vol. 15(2), pp. 15-23.

Underwood, S. (1987) *Application of Learning Style Theory to Nursing Education and Nursing Practice* (ERIC Document Reproduction Service No. ED287415).

William, D. A. (2000) *An Investigation of Methods of Instruction and Student Learning Styles in Internet-Based Community College Courses*. PhD thesis, University of Nevada, USA.

Witkin, H., Dyk, R., Faterson, H., Goodenough, D., & Karp, S. (1962) *Psychological Differentiation*. New York: John Wiley & Sons.

Worthington, A., & Higgs, H. (2004) Factors explaining the choice of an economics major: the role of student characteristics, personality and perceptions of the profession, *International Journal of Social Economics*, Vol. 31(5/6), pp. 593-613.

Zualkernan, I. A., Allert, J., & Qadah, G. Z. (2006) Learning styles of computer programming students: a Middle Eastern and American comparison, *IEEE Transactions on Education*, Vol. 49(4), pp. 443-450.