

## STUDENTS' LEARNING STYLES AND ACADEMIC PERFORMANCE

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Institutions of higher learning are engaged in a sustained and continuous process of maximizing the quality of their graduates so as to enhance their readiness for the job market and further education. Thus, it is important for educational institutions to focus on improving the critical aspects of teaching and learning. One area which has received increasing attention is the learning styles of students. Several studies have shown that academic performance of university students is related to their learning styles. The objectives of this study are to ascertain the dominant learning styles of the students and to discover the relationship between learning style and academic performance. The Grasha-Riechmann Student Learning Style Scales (GRSLSS) instrument was administered to determine student learning preferences in six learning style categories. The subjects of this study were first year students at the International Education Center (INTEC), Universiti Teknologi MARA, Shah Alam. These sponsored students were undergoing their preparatory programmes at INTEC before pursuing their degree at reputable universities in, Australia, New Zealand, the United Kingdom and the United States, among others. Cluster analysis was used to identify their dominant learning styles, while discriminant analysis was used to analyze the relationship between learning styles and the various demographic and educational variables. Academic performance based on learning style was found to be significant. Analysis was carried out using SAS/STAT<sup>®</sup>, SAS/GRAPH<sup>®</sup> and SAS/IML<sup>®</sup>.

**Keywords:** Learning styles, cluster analysis, discriminant analysis, SAS/STAT<sup>®</sup>, SAS/GRAPH<sup>®</sup>, SAS/IML<sup>®</sup>

### 1. Introduction

One area of higher education which has received increasing attention is the learning styles of students. Several studies have shown that academic performance of university students is related to their learning styles. The objectives of this study are to ascertain the dominant learning styles and to discover the relationship between learning style and academic performance of first year students enrolled in pre-university courses.

The Malaysian government sponsors more than two thousand students each year to pursue tertiary education overseas. These scholars are selected based on their Sijil Pelajaran Malaysia (SPM) results and undergo a preparatory education in Malaysia before pursuing education abroad. The International Education Centre (INTEC), University Teknologi MARA is one of the institutions that conduct such courses. They are scholars of various sponsorship bodies such as Public Service Department of Malaysia (JPA), MARA, PETRONAS and others. These students undergo between one-year to two and a half years of various preparatory university programs such as the Australian Matriculation, A-Level and American Degree Program. Upon completion and successfully meeting their sponsors' academic requirement at INTEC these scholars then pursue their tertiary education at prestigious

universities in The United States of America, The United Kingdom, Australia, New Zealand, among others.

A majority of the students excel in their pre-university courses while at INTEC. However there are some who found difficulties in adapting their learning styles adopted while in school to a more independent one expected at INTEC. Thus it is the objective of this study to identify the learning styles of these post-secondary students during their first semester in higher education and explore the relationship with their academic performance. It is important for lecturers to be able to identify early the learning styles of their students and could then alert the students on their potential academic weaknesses and suggest mechanisms for them to cope and adapt their learning at institutions of higher learning after leaving INTEC.

## 2. Literature Review

There are many instruments available to study students' learning styles. Some are designed for general purpose and others are for specific area of studies. Among them are Index of Learning Styles (Felder and Spurlin, 2005), Kolb's Learning Styles Inventory (LIS, 1984), Pharmacist's Inventory of Learning Styles (PILS, 2003) and The Grasha-Riechmann Student Learning Style Scales (GRSLSS). Irrespective of the instrument used, many studies have shown that learning style plays an important role in the academic performance of college students. The accommodation of students learning styles in the learning environment have resulted in improved test scores while a mismatch in learning characteristics and learning environment resulted in poor students' achievement (Andrews, 1990; Dunn *et al.*, 1995; Klavas, 1994).

Learning styles do differ with cultural differences of various ethnic groups. In a study among Chinese, Filipino, Korean, Vietnamese, and White students in California secondary schools, Park (1997a) came to a conclusion that Vietnamese showed major preference for group learning, whereas Filipino showed minor preference and Whites showed negative preference. Park also observed that middle and low achievers had minor preference for group learning and that high achievers had negative preference for group learning. However Slavin (1983) found that academic gains could be achieved by cooperative group learning as was proven among African and Latino students. Students who participated in the study demonstrated improved social skills and have a better understanding of cultural differences than those who did not.

Park (2000) discovered that among Southeast Asian students there is no statistically significant difference among high-, middle-, and low achieving group in their favorable preferences for learning styles such as auditory, visual, kinesthetic or tactile learning styles. These Southeast Asian students show either major or minor preference for group learning compared with East Asian students (Koreans and Chinese) who showed negative preference for group learning (Park 1997a, 1997b). However, the subjects of Park (2000) study were Southeast Asians immigrants: Cambodians, Hmong, Lao and Vietnamese whose profile is different from the subjects of the current study.

Learning style also plays a role in classroom performance for gifted middle school students as were reported by Rayneri and Gerber (2004). These gifted students respond accordingly to different classroom environments. They have a high preference for tactile and kinesthetic learning style and like to be active participants in the discovery process in order to be motivated and engaged in class. Mismatch in the students' learning style preference with learning environment would result in academic underachievement (Redding, 1990; Whitmore, 1986).

Goldfinch and Hughes (2007) worked on learning styles that reflects on preferences on four stages of adult learning cycles: having an experience (the activist stage), reviewing the experience (the reflector stage), concluding the experience (the theorist stage), and planning the next steps (the pragmatist stage). However, this study only focuses on first year students and their performance during this year. Highly activist learning styled students performed not

as well in all subject during first year. Meanwhile the highly reflective did best in non-quantitative subjects and that of highly theoretical style did better in accounting.

Several other studies found that the more independent thinking students were more successful in higher education (Porter & Cano, 1996; Diaz & Carnal, 1999). Similar results by Cano (1999) found that dependent students are more likely to receive disciplinary action due to lower CGPA compared to the more independent students. Thus, the study concluded that as scores in learning styles moves up the scale from dependent to independent so does the ACT scores and CGPA, which are indicators to academic success.

### 3. Methodology

#### Subjects

The subjects of this study were first semester students undergoing various preparatory programs at INTEC. Table 1 shows there are almost equal proportions of males (50.9%) and females (49.1%) in the sample, but a slightly higher proportion of those who studied at government day schools (51.6%) compared with those from residential schools (46.1%). The majority of the current student population is JPA scholars and this is reflected by the corresponding sample proportion (78.5%).

Table 1: Profile of the Sample

Variable	Category	Percent (n)
Gender	Female	50.9% (342)
	Male	49.1% (330)
Sponsor	JPA	78.3% (526)
	MARA	12.9% (87)
	PETRONAS	1.6% (11)
	State Government	4.5% (30)
	Others	2.7 % (18)
Type of School	Government day school	51.6% (347)
	Government residential	46.1% (310)
	Private day school	1.0% (7)
	Private residential	1.2% (8)

#### Instrument

For this study, the GRSLSS is chosen as it focuses on the student's interaction with the facilitator, other students, and the learning process itself. Gauging these characteristics will give a reflection about how they will adapt to a new learning environment overseas. The results will also help to determine whether there is a need for INTEC to intervene in this transition from a preparatory institution to institutions of higher learning abroad. The GRSLSS measures learning styles vis-à-vis social interaction and permits the introduction of social and affective dimensions. It also allows us to evaluate a student's learning style. The use of the GRSLSS, therefore, allows for measurement of learning style, identification of potential preferences for teaching style, and measurement of social interaction.

This instrument is self-administered, and comprises of a 60-item questionnaire that is designed to identify six major learning styles. Ten questions are assigned to each learning style construct and answers are recorded using a 5-point Likert scale. The individual learning styles are described in Table 1 (Ritchie, 2006). The pilot study results showed that the items in the Avoidant dimension were scored very low and thus excluded from the final instrument. This exclusion is not expected to affect the results of the study.

Table 1: Grasha-Riechmann Student Learning Styles Dimensions

Dimension	Characteristic of Learners
1) Independent	Like to think for themselves and confident in their learning abilities. Prefer to work alone.
2) Dependent	Show little intellectual curiosity and learn only what is required. Look for authority figures for specific guidelines on what to do.
3) Collaborative	Work well with others and enjoy cooperative learning and working in groups.
4) Competitive	See the classroom as a win-lose situation in which they must win and enjoy competitive activities.
5) Participant	Eager to learn course content, enjoy learning, and take responsibility for his/her own learning.
6) Avoidant	Do not want to learn the content, do not enjoy learning and avoid taking part in course activities

### Data Analyses

Cluster analysis was used to segment the subjects into clusters of similar characteristics in terms of learning styles, while discriminant analysis was used to understand the characteristics of the resulting clusters better. Academic performance is measured by the final grades obtained by the students for their semester-end final examination. Relationship between learning styles and academic performance was analysed using association analyses as the grade that represents performance is a categorical variable. The above analyses were carried out using SAS<sup>®</sup> PROC FASTCLUS, PROC CANDISC and PROC FREQ, respectively. Graphical presentations were produced using PROC GPLOT and SAS/IML macros developed by Friendly (2000).

## 4. Discussion of Results

### Reliability of GRSLS and Correlation between Dimensions

The Cronbach Alpha values (Table 2) show that the items used to measure the five respective dimensions of learning styles are reliable, especially for Dependent, Competitive and Collaborative learning styles. The correlations between most of the learning styles (Table 3) are significant but low. The highest correlation is between Collaborative and Participant learning styles (0.356) which means that those who are more collaborative tend to be more participatory in their learning approach. Another meaningful relationship is between Competitive and Participant (0.350) learning styles. The results also indicate a low positive relationship between the Independent learning style and the Competitive (0.237) and Participant (0.164) learning styles. These indicate that people who are more independent in their learning styles also tend to be more competitive and to a lesser degree, participative. There is also a positive relationship between dependent and competitive learning style (0.336), which implies that dependent learners tend to be more competitive than independent learners. There is also no evidence of differences in learning styles between male and female students and between those who studied at day school and residential school.

Table 2: Cronbach Alpha and sample items

Dimension	Cronbach Alpha	Sample Items
1. Independent	0.67	i) I learn a lot of the content in my class on my own ii) When I don't understand something, I try to figure out myself.
2. Dependent	0.75	i) I want clear and detailed instructions on how to complete the assignment ii) I rely on my teachers to tell me what is important for me to learn
3. Collaborative	0.72	i) Working with other students on class activities is something I enjoy doing ii) I enjoy discussing my ideas about course content in my class
4. Competitive	0.75	i) It is necessary to compete with other students to get a good grade ii) I like to solve problems or answer questions before anybody else can
5. Participant	0.62	i) It is my responsibility to get as much as I can out of a course ii) I do all assignments well whether or not I think they are interesting

Table 3: Correlation between learning style

Learning Style	Dependent	Collaborative	Competitive	Participant
Independent	0.065	0.017	0.237*	0.164*
Dependent	-	0.178*	0.336*	0.198*
Collaborative	-	-	0.162*	0.356*
Competitive	-	-	-	0.350*

### Segmentation by Learning Styles

Initial segmentation of the subjects (PROC FASTCLUS) based on the learning style scores resulted in three clusters. A discriminant analysis was conducted in order to understand better the differences in learning styles between the clusters (PROC CANDISC). The results (Figure 1) show that the clusters are not very distinct. The first canonical function separates Cluster 1 from Cluster 3 while the second function separates Cluster 1 from Cluster 2.

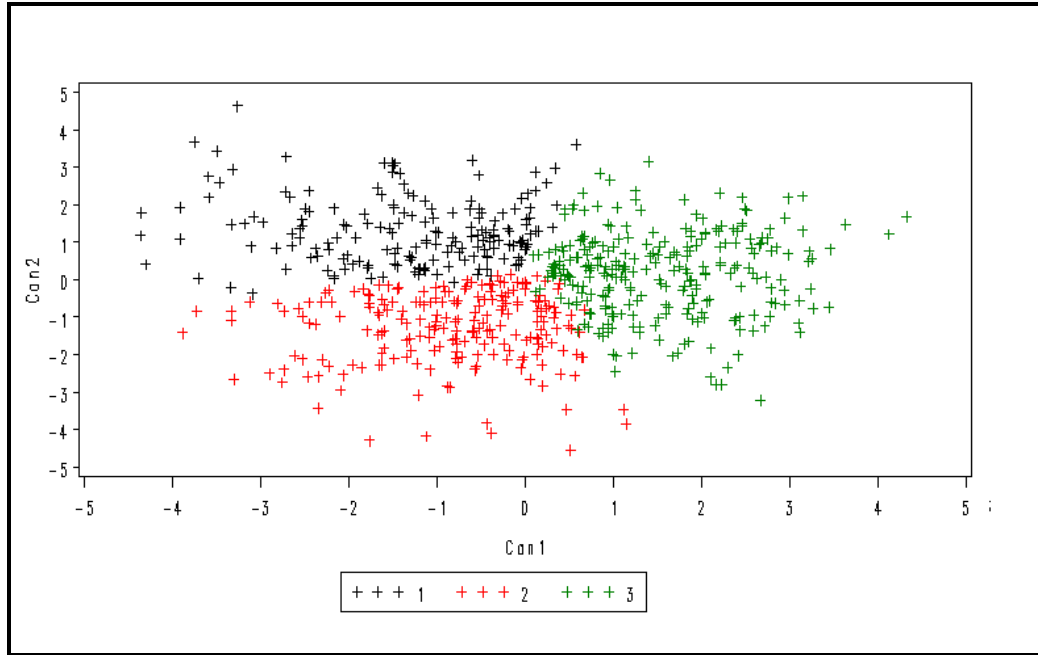


Figure 1: Canonical Discriminant Functions and Cluster Membership

Further cluster analysis was carried out to identify two clusters only. Figure 2 shows the plot of the median scores of each learning style by cluster. In order to help in identifying differences between the clusters, the following categories are used to indicate the level of each learning style based on the mean scores: (1) Low (<2.8); (2) Moderate (2.8 –< 3.8); and (3) High (3.8 or higher). A cut-off point of 3.8 (high) is used to differentiate the two clusters. Based on the median scores, the levels of all learning styles are higher for Cluster 2 than Cluster 1. The nature of differences is similar for four of the five learning styles, except for Participant dimension. On the average, all of the subjects are highly collaborative and dependent but not very competitive and independent. However, Cluster 2 members are highly participative while Cluster 1 members are moderately participative.

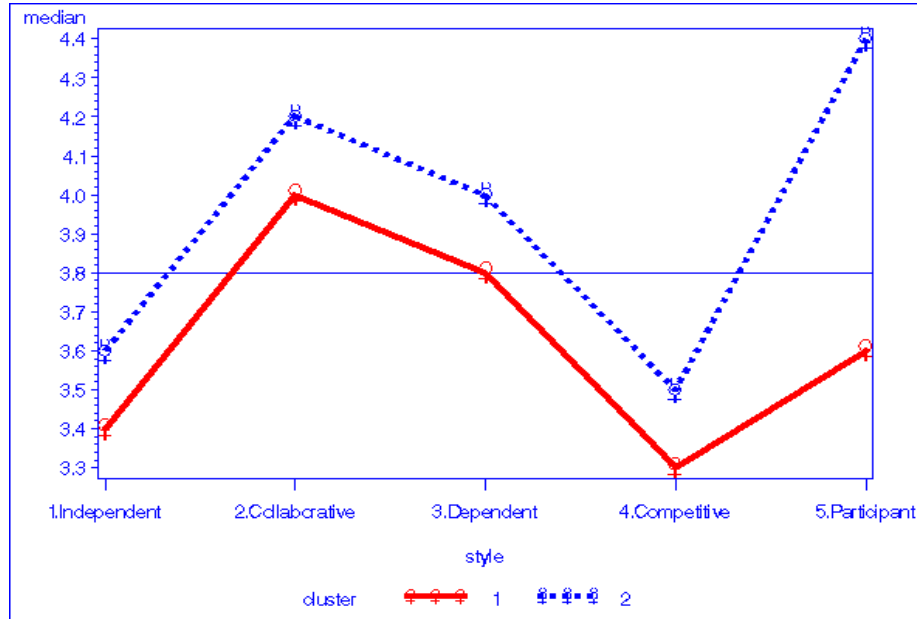


Figure 2: Comparison of median scores for each learning style by cluster

**Learning Style and Academic Performance**

Figure 3 shows that there is an association between cluster and grade. In particular, those who are participative (Cluster 2) achieved better grades (blue region) than those who are not (Cluster 1). Analysis on the association of academic performance (grade) with the level of individual learning style (Low, Moderate or High) does not reveal any significant relationship except for Independent learning style (Table 4). Specifically, highly independent learners tend to score better grades than those who are less independent.

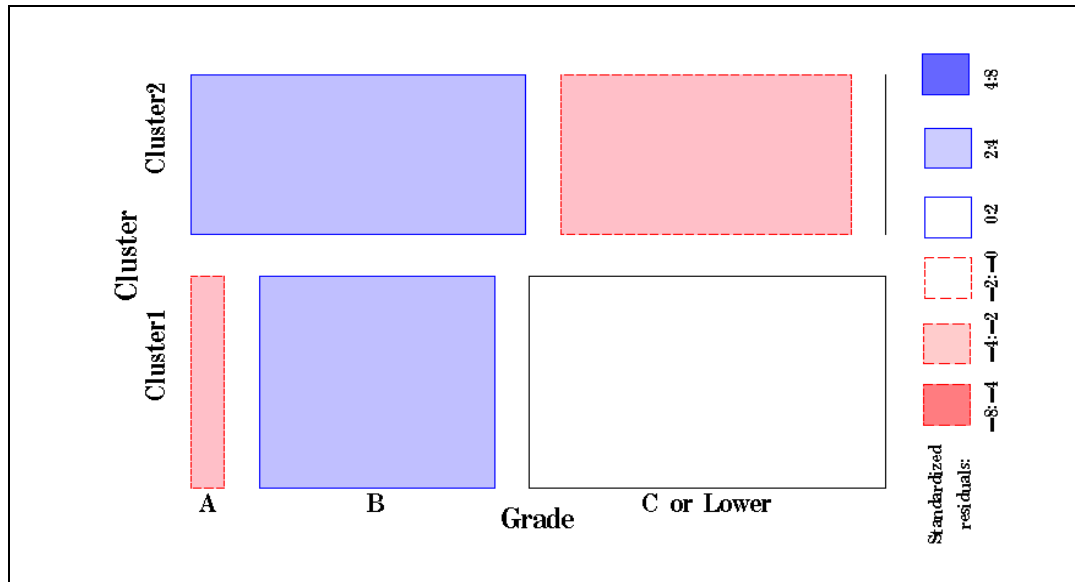


Figure 3: Association between learning style and academic performance

Table 4: Relationship between individual learning style and academic performance

Learning Style	$\chi^2$ Test Statistic	p-value
1. Independent	14.158	0.007
2. Dependent	5.260	0.262
3. Collaborative	3.873	0.423
4. Competitive	0.128	0.998
5. Participant	11.224	0.024

## 5. Conclusion

The results indicate that in general the first semester pre-university students are highly collaborative and dependent learners, but moderately independent and competitive. However, some are distinctly more participative than others. Even though there is no strong correlation can be concluded between learning style and academic performance, there is an indication that those who are more participative tend to perform better academically at the end of their first semester at INTEC. There is also an indication that highly independent learners (ignoring the level of the other learning styles) are more likely to achieve better grades than those who are not.

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