



## Effects of Students' Approaches to Learning on Performance in Two Pedagogical Environments

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### Abstract

This paper investigates various approaches to learning and their effect on performance of a cohort of international students in two different pedagogical environments. The effect of approaches to learning on performance was determined by using Cohen's  $d$  with Hedges  $g$  correction. Coe's spread sheet was used for the purpose. The study showed that the magnitude of difference in the effect of approaches of learning on performance varied from *very small* to *medium*. Teaching international students from diverse educational, linguistic and cultural backgrounds is a complex task. Students from different cultural backgrounds tend to exhibit greater diversity in their approaches to learning. Appropriate teaching strategies are suggested to use to enhance the learning process of international students. An understanding about the magnitude of difference in performance of students with various approaches of learning helps to optimize the learning environment.

**Keywords:** International Students, Approaches of Learning, Teaching Methods, Effect Size

### Introduction

Understanding student approaches to learning and learning preferences, the interaction between learning and teaching practices and the effect such interactions have on student performances were the area of interest of this research. Students from different cultural backgrounds tend to exhibit greater diversity in their approaches to learning than students from relatively same or similar cultural background (Bennett, 1999). This study investigated the effect of students' approaches to learning on their performance under two different methods of teaching and learning for a cohort of international students in Foundation Studies (FS) Biology classes at the Royal Melbourne Institute of Technology (RMIT) University, Australia. The two methods used in this study were the Traditional Teaching and Learning (TTL) and Problem-Based learning (PBL). Learning style is a personal quality that influences students' ability to acquire information and participate in learning experiences (Grasha, 1996). The learning style of each person is based on the mode of how information is gathered, processed and applied when it is needed. It is well established that students' individual differences influence both their learning and their academic achievement (Riding, 2005). It is a challenging task to accommodate all individual differences and optimize the learning environment. Several research studies have demonstrated that students score higher on tests when exposed to a teaching style that matches their learning style (Felder, Felder, & Dietz, 2002). However, no study has measured the magnitude of the difference in performance due to approaches to learning or teaching style differences. Secondly, there is a dearth of such research on international students at the post-secondary level. Thirdly, there has been no research into how well international students who are not very proficient in English can cope with PBL and its associated activities. It is on these three counts that this study is unique and differs from other educational research in this field.

Foundation Studies (FS) is a two semester course for preparing International students for their tertiary education in Australian universities (RMIT, 2006). Most of the Biology FS students proceed with their higher education in Health Science areas. Health education in Australian universities is increasingly using the Problem-Based method of teaching and learning. It is in this context that this study seeks to examine whether International students from vastly different educational, cultural and linguistic backgrounds are able to carry out their studies in the PBL method. PBL is an approach to education and is both a curriculum and a process (Barrows & Tamblyn, 1980). It is an instructional method that challenges students to learn how to learn, work cooperatively in groups to seek solutions to real world problems (Duch & Norton, 1992). TTL views teaching as a transmission of knowledge and learning as acquisition of knowledge. Programs are designed and organised around disciplines and students are taught through lectures and discussions. However, in TTL students are passive recipients of information and teachers often make assumptions about what their students should know. Sometimes such assumptions do not address students' abilities or needs (Knowles, 1975).

### Research Participants

The participants of this research were the whole population of Foundation International Biology students at RMIT during the 2003, 2004, 2005 and 2006 academic years. There were two intakes in each year with an average of 14 Biology students in each intake. The first intake runs from January to November consisting of two 18-week semesters with five contact hours per week for Biology. The first semester for this intake runs from February to June and the second semester from July to November each year. The second intake runs from June to January and consists of two 14-week semesters with six contact hours each. The first semester for the second intake runs from June to September and the second semester from October to January of the following year. The total participants were 116 students over four academic years.

### Data collection

The data collection commenced in the second semester of 2003. In each intake thereafter, the data collection was conducted during the second semester. The Paragon Learning Style Inventory (PLSI) (Shindler, 2003) was administered to measure students' learning style preferences. The PLSI is a self-administered inventory based on the personality test called the MBTI, which in turn is based on Jung's theory of personality (Yeung, Read, & Schmid, 2005). Shindler and Yang developed this instrument and it has shown excellent reliability and stability (Shindler, 2002). It was developed specifically for use in educational settings and has been previously used in determining the learning styles of tertiary students (Yeung & Read, 2006). Foundation students at RMIT are all international students and the majority has difficulties learning in English during their first year in Australia. Hence the PLSI was used to determine their learning styles because of its simple language and structure of questions. Furthermore the easy self-assessed scoring system facilitated a reliable classification for educational purposes. The PLSI uses Jungian/Myers-Briggs dimensions, *Extroversion/Introversion*, *Sensing/Intuiting*, *Thinking/Feeling* and *Judging/Perceiving* (Shindler, 2002). Sixteen Learning Style Types (LST) are formed from these four dimensions. Each dimension has two traits and each student has one or the other as a preferred trait. Owing to the small number of participants in some of the LST, learning style traits have been considered for the analysis purpose. This provided a much better representation of each trait category of each dimension.

Of the ten topics in semester 2, one topic (Topic 1) was taught under the TTL method and the second topic (Topic 2) was taught under PBL method for the intake one (*Group 1*) of each year. For the intake two (*Group 2*) of each year, Topic 1 was taught under PBL method and Topic 2 was taught under TTL method. At the end of each topic a test was conducted to assess students' understanding in these particular areas. The test that was given after TTL method of teaching was named TTL test and the test after the PBL method of teaching was called the PBL test for the analysis purpose. Thus each participant took both TTL and PBL tests.

Each test consisted of two sections, Section A and Section B. Section A of each test consisted of 20 multiple-choice questions worth 20 marks. Section B of both tests consisted of four short questions worth 10 marks each. Hence the total mark for each test was 60. The learning issues in Topic 1 were DNA, RNA, genes, chromosomes, genotype, phenotype, the significance of meiosis in variation, monohybrid cross, dihybrid cross, polygenic inheritance and pedigree analysis. The learning issues of Topic 2 were mutation, types of mutations, diseases such as Sickle cell anemia, Cystic fibrosis, Down syndrome as examples of diseases caused by various types of mutations and protein synthesis (Varughese, 2002).

### Procedure for the Study

The *Group 1* of 2003 was taught Topic 1 in TTL. A test was conducted after the TTL to assess students' understanding of this topic. The same students were facilitated by the researcher to learn Topic 2 by PBL method. For this purpose, the students of Group 1 were divided into small groups, and each group was seated separately in the same classroom. A Case Study in the form of an analysis worksheet was given to each student of all the groups by the researcher. The case was prepared in such a way that students could derive the required learning issues from Topic 2 after group discussions

and deliberation about the case. The case was designed in three sections. After each section, there was a discussion time of about 10 minutes in which students within a group could identify and come to a common consensus about the key information, the problem mentioned, the hypotheses and rationale of the hypotheses. Each student wrote this information in the given space of the worksheet. In this group discussion the researcher was the facilitator and encouraged each student to participate actively. Then students in each group read and discussed the second section of the case. More information was added and hypotheses and rationale were added or modified according to the student reflection and deliberation about the case. The same process was continued with the third section. At the end of the three sections, students were able to derive the learning issues and each group identified a few learning issues. The researcher checked the learning issues derived by each group and made sure that all the required learning issues were covered. For this exercise two periods of approximately 50 minutes were used. The next two biology periods were used for collecting information about the learning issues and organising them by referring to library books, journals, videocassettes and Internet facilities. This section was conducted at RMIT library. Each group undertook the task separately. This information gathering session was used to build on existing knowledge of each group to enable them to solve the problems in the case study and learning issues. In this process students worked as a team helping each other to find the solutions for most of the learning issues. The researcher was helping and guiding the students to gather information at the appropriate level. The next two Biology classes were used for the presentation, discussion and deliberation by each group. At the end of the session all learning issues were summarized by the students and the researcher made sure that all the required information at the appropriate level was discussed and explained. A test was conducted after the PBL to assess students' understanding of this topic.

The same process was undertaken with Group 2 of 2003. However, the PBL method was used for Topic 1 and Topic 2 was taught by TTL method. The researcher prepared another PBL case study for Topic 1, so that students could derive all of the required learning issues for this topic. The same process was repeated in 2004, 2005 and 2006 using the same case studies and the same tests. The researcher marked both TTL and PBL tests of each group.

### Data Analysis

The analyses were mainly carried out using the statistical package SPSS 13.0 and an Excel spreadsheet. This included preliminary analyses of frequencies of data grouped according to the learning traits of the participants. This was followed by an investigation of the variations observed by determining the magnitude of the differences or effect sizes in performance by learning traits. Effect sizes were calculated by using Cohen's *d* (Cohen, 1988) with Hedges *g* correction (Hedges & Olkin, 1985). Coe's spreadsheet (Coe, 2006) was used for the purpose. Effect size measures the treatment effect (Glass, McGaw, & Smith, 1981). Descriptors for magnitudes of effect sizes include *small*, *medium*, *large* (Cohen, 1969) and *very small* (Izard, 2004). An effect size of  $\geq 0.8$  has been classified as *large*, any value  $\geq 0.5$  and  $< 0.8$  as *medium*, a value  $\geq 0.2$  and  $< 0.5$  as *small* and anything  $< 0.2$  as *very small* or negligible. In effect this provides an assigned range on either side of the endpoints for decimal rounding. For example any effect size from 0.45 to 0.74 is the assigned range for *medium* effect size.

### Results and Discussion

The effect of learning traits on performance in TTL and PBL was measured by the effect size (magnitude of difference) of the difference in means between pairs of learning traits in each dimension of PLSI. The results are given in Table 1.

The magnitude of difference in performance of *introvert/extrovert* traits was *small* in TTL and *medium* in PBL and both are in favour of students with *introvert* trait. It indicates that both *introvert* and *extrovert* students are comfortable in TTL. However, *extrovert* students need additional support in PBL. This could be because *extroverts* were probably less focused in self-directed learning expected in PBL. *Extrovert* students are impatient with long slow jobs, prefer to communicate by talking rather than writing, and like to learn a new task by talking it through with someone. *Introvert* students like to watch before doing, prefer working alone or with one other, set own standards possible, while *extrovert* students learn best from doing, are more at ease and confident socially, like to know how others are doing it and their ideas start from outside in (Shindler, 2003). In PBL students work in groups and they are expected to engage with complex situations presented to them. As a curriculum it consists of carefully selected and designed problems. As a process it needs systematic approaches in resolving problems or meeting challenges that are encountered in life and career. Since PBL is a time consuming process, a well organized approach to the whole learning process is expected from students. So *extrovert* students are recommended to organize themselves in a better way to improve their performance in PBL. Teachers should be aware of this and give additional support for the *extrovert* students in PBL.

The magnitude of difference in performance of *intuitive/sensing* students was *small* in both TTL and PBL, though it was in favour of students with *sensing* trait. This showed that students with these learning traits can perform equally well in both TTL and PBL. However, the effect was lesser in PBL. This could be because *intuitive* students were able to cope better with the demands of self-directed learning expected in PBL. *Intuitive* students are aware of new challenges and possibilities, focus on how things could be improved, dislike doing the same thing repeatedly, work in bursts of energy powered by enthusiasm with slack periods in between, whereas *sensing* students are more realistic, practical,

more patient and steady (Shindler, 2003). So students with these two traits are reasonably comfortable in both TTL and PBL. These students could be supported in their learning process by giving an overall picture of the task without overemphasizing details, providing individual attention when necessary and ensuring a mix of both traditional and Problem-Based methods of teaching.

The magnitude of difference in performance between *Thinking/Feeling* students was *small* in TTL and *very small* in PBL, both in favour of *thinking* trait. The effect was lesser in PBL. This could be because *feeling* students were able to cope better with PBL. Students with *thinking* trait are more interested in fascinating ideas and make decisions based on rational thought but students with *feeling* trait are interested in people than ideas and make decisions based on their heart (Shindler, 2003). However, *thinking* students might need more facilitation in group-oriented activities. This can be done by giving them concrete and regular feedback, convincing them of the necessity for accommodating the feelings of other students and valuing their logical input. In general students with these two traits can perform in a similar manner in both TTL and PBL.

The magnitude of difference in performance between *Judging/Perceiving* learning traits was found to be *medium* in TTL and *small* in PBL, both in favour of *judging* trait. Students with *perceiving* trait were able to cope better with PBL. Students with *judging* trait are more decisive, like planned activities and make decisions quickly where as students with *perceiving* learning trait often do things at the last minute and perform well under pressure of a deadline, adapt well to changing situations and use lists as reminders of all the things they have to do (Shindler, 2003). The performance of these students could be enhanced by providing clear written assignment guidelines and time frames for completion. They might need some help to make decisions and avoid postponing unpleasant jobs.

### Summary

This research study investigated approaches of learning of international students undertaking Foundation Studies at RMIT University under two different methods of teaching and learning. Although the results are modest the study does begin to address the question “are there different teaching and learning practices more appropriate to international students studying in an English dominated study environment?” The globalization of university curricula around the world demands such a consideration. In addition, catering for an ever increasing mobile student body needs to address such a question. Seeking to understand the learning needs of all students is a principal concern for all teaching staff at all level of education. In the light of some trends observed in this study, which involved a relatively small sample of international students, there is need for research on a much larger scale in order to ensure that conclusions may be generalised to other contexts. The study replicated in other universities or other countries may lead to greater insights into the influence of student approaches to learning and other student characteristics on academic performance under the traditional and Problem-Based method of teaching and learning.

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Table 1. Magnitude of difference in performance between learning traits

|     |                   | n  | Mean  | sd    | pooled<br>sd | Diff<br>in | Effect<br>size<br>Means |
|-----|-------------------|----|-------|-------|--------------|------------|-------------------------|
| TTL | <i>Introvert</i>  | 71 | 37.07 | 11.21 | 11.46        | 4.79       | 0.42                    |
|     | <i>Extrovert</i>  | 45 | 32.28 | 11.84 |              |            |                         |
| PBL | <i>Introvert</i>  | 71 | 37.08 | 12.22 | 12.57        | 6.15       | 0.49                    |
|     | <i>Extrovert</i>  | 45 | 30.93 | 13.10 |              |            |                         |
| TTL | <i>Intuitive</i>  | 50 | 33.00 | 11.02 | 11.54        | -3.89      | -0.33                   |
|     | <i>Sensing</i>    | 66 | 36.89 | 11.91 |              |            |                         |
| PBL | <i>Intuitive</i>  | 50 | 33.43 | 12.17 | 12.88        | -2.22      | -0.17                   |
|     | <i>Sensing</i>    | 66 | 35.65 | 13.39 |              |            |                         |
| TTL | <i>Thinking</i>   | 58 | 36.12 | 11.92 | 11.66        | 1.82       | 0.16                    |
|     | <i>Feeling</i>    | 58 | 34.30 | 11.39 |              |            |                         |
| PBL | <i>Thinking</i>   | 58 | 35.57 | 12.25 | 12.90        | 1.75       | 0.13                    |
|     | <i>Feeling</i>    | 58 | 33.82 | 13.51 |              |            |                         |
| TTL | <i>Perceiving</i> | 30 | 31.17 | 10.08 | 11.45        | -5.45      | -0.47                   |
|     | <i>Judging</i>    | 86 | 36.62 | 11.88 |              |            |                         |
| PBL | <i>Perceiving</i> | 30 | 31.40 | 10.72 | 12.77        | -4.44      | -0.35                   |
|     | <i>Judging</i>    | 86 | 35.84 | 13.40 |              |            |                         |