The Study of Learning Styles among Mechanical Engineering Students from Different Institutions in Malaysia

Yit Yan Koh, Yaw Long Chua *

Inti International University, Persiaran Perdana BBN, Putra Nilai, Nilai, 71800, Malaysia

Abstract

Learning style is viewed as a method of education that is particular to personal study experiences to achieve the best learning results, which is some cases, the deep learning experiences. To date, researchers have recognized at least 21 components, where normal individuals would have 6 to 14 strongly preferred learning styles. The understanding of these learning styles will help the lecturers in their design of the delivery of lecture to suit students’ learning styles to achieve deep learning among students. This research aims to look into the differences in learning styles among Mechanical Engineering students from different institutions and levels. In accordance to this, this paper will report the analyses of the types of learning styles among engineering students.

© 2012 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of Centre of Engineering Education, Universiti Teknologi Malaysia

Keywords: Learning styles, learning styles inventories; Barsch Learning Style Inventory

1. Introduction

To an instructor or educator, the understanding of students’ learning style helps him/her to design the course structure and delivery more effectively according to the different styles possessed by students. The students involved will be able to learn faster and easier and gain benefits.

To date, three basic learning style inventory types have been identified:

• Cognitive Inventories. This looks into how the student processes gained knowledge. In particular, the student is can be viewed as primarily a visual, auditory or kinesthetic learner.

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: yawlong.chua@newinti.edu.my
Affective Inventories. This inventory studies the inner behavior of the learner, such as the motivation, attitudes, preferred physical conditions and the handling of success and failure.

Psychomotor Inventories. This relates to the type of content a student likes best, the mode of presentation that the student prefers, and how much action is required in the learning environment.

The learning styles of a student can be determined by using the learning styles inventories. There are many learning style inventories available to study how students learn. Each of them consists of various questions to test on different types of learning styles. All the students have to do is just answer the questions on those inventories. Few of these learning styles inventories are briefly introduced here.

**ATLAS (Assessing The Learning Strategies of AdultS) Learning Strategies** developed by Conti and Fellenz (1991) consists of questions related to learning in real-life situations which one is able to control the learning situation. The instrument categories the learning styles into types of engagers, navigators and problem solvers. Each of this type is further divided into two subtypes. Despite the confusing questions posted, the concept is interesting and easy to implement.

**Index of Learning Styles** formulated by Felder and Soloman of North Carolina State University is an online instrument used to evaluate preferences on four dimensions namely active/reflective, sensing/intuitive, visual/verbal, and sequential/global. The instrument consists of 44-item questions to evaluate the learning style of a person.

**DVC Learning Style Survey for College** (Jester, 2000) helps the learner to determine the learning style in the categories visual-nonverbal, visual-verbal, auditory-verbal, tactile-kinesthetic from 32-item questions online. Statements such as, “I tend to ‘doodle’ during lecture by drawing on my notebook pages” are posted and the learner needs to respond by clicking one of a set of three radio buttons labeled “Often, Sometimes, Seldom”.

**Barsch Learning Style Inventory** (Barsch, 1991) contains 24 questions written in the first person, such as, “I can tell if sounds match when presented with pairs of sounds.” The learner is given three choices – “Often, Sometimes, and Seldom”. Three learning styles are tested, namely Visual, Auditory, and Tactile (Kinesthetic).

In this paper the learning styles of the Mechanical Engineering students from diploma and degree levels, INTI International University, Tunku Abdul Rahman College and Nilai University College, Malaysia, will be studied and presented. The analysis aimed on finding the differences in the learning style throughout a semester of study (15 weeks) from different institutions. From the analysis the general learning style of Mechanical Engineering students are known and compared.

2. Research Methodology

The Barsch Learning Style Inventory is chosen to be the Inventory used for this study. This cognitive inventory is selected to study the ability and method to process, analyse and store the information received that the student has. Furthermore, Barsch Learning Style Inventory only consists of 24 questions. The students are able to complete in relatively shorter time. This will not take up a lot of time during the lectures hence will not be a burden for the lecturers as well as the students.

The targeted institutions of higher learning are:

a) Inti International University (INTI), both degree and diploma students
b) Nilai University College (NUC), both degree and diploma students
c) Tunku Abdul Rahman College (TARC), diploma students only

With the information gathered from 244 participants, where 166 are from diploma level and 78 are from degree level, basic information on the learning style among the students in the Mechanical Engineering is known. Table 1 shows the distribution of number of students of the three institutions according to the type of programme.

Table 1. Number of students who took part in the study from each programme in the various institution

<table>
<thead>
<tr>
<th>Institution</th>
<th>Type of programme</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTI Internaitonal University</td>
<td>BEng</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Diploma</td>
<td>26</td>
</tr>
<tr>
<td>Nilai University College</td>
<td>BEng</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Diploma</td>
<td>25</td>
</tr>
<tr>
<td>Tunku Abdul Rahman College</td>
<td>Diploma</td>
<td>115</td>
</tr>
</tbody>
</table>

The learning styles among the students are categorised into 7 categories, namely

- Visual (V), where students’ learning is mainly based on the “looking”. This may be including the use of mind map, notes taking, visualisation of the concept in mind and information gathering through reading.
- Auditory (A), where student’s learning is mainly based on the “hearing”. This may be including the Podcast and information gathering through listening.
- Kinesthetic (K), where students’ learning is mainly based on the “touching”. This may be including the laboratory works, prototype building, model construction, and information gathering through physical involvement.
- Visual and Auditory (V+A), where students’ learning is achieved through Visual and Auditory equally.
- Visual and Kinesthetic (V+K), where students’ learning is achieved through Visual and Kinesthetic equally.
- Auditory and Kinesthetic (A+K), where students’ learning is achieved through Auditory and Kinesthetic equally.
- Visual, Auditory and Kinesthetic (V+A+K), where students’ learning is achieved through All three types of basic learning styles.

3. Results and Propositional Discussions

Figure 1 shows the learning style distribution for the diploma students in INTI. The results is plotted based on 26 students, where their learning styles are categorised into Visual (V), Auditory (A), Kinesthetic (K), or combination of any two or above of these three basic learning styles. About one-third of students here possess the learning styles of Visual, and from the results, it can be seen that the majority of students in the Diploma in Mechanical Engineering are learning through Visual and Auditory. Only a minority of students possess the Kinesthetic learning style, where the percentage is recorded as low as 19% for those who has the Kinesthetic alone, or combination of Kinesthetic with other learning styles.
This results also shows a similar behavior compared to Koh (2008), where the learning styles of students in Engineering, which includes Civil Engineering, Electrical and Electronic Engineering, Mechanical Engineering. The two studies shows a consistent pattern of the distribution of the learning styles, where the majority of the students possess the single learning style (with Visual being the highest). Interestingly, in both studies, there is no record of students having a combination of three learning styles in this institution.

Table 2. The comparison of the learning style distribution among students in Diploma in Mechanical Engineering in INTI between the current study and Koh (2008). The learning styles are categorised into Visual (V), Auditory (A), Kinesthetic (K), or combination of any two or above of these three basic learning styles.

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Current Study</th>
<th>Koh (2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>34.62%</td>
<td>48.48%</td>
</tr>
<tr>
<td>A</td>
<td>23.08%</td>
<td>22.73%</td>
</tr>
<tr>
<td>K</td>
<td>3.85%</td>
<td>9.09%</td>
</tr>
<tr>
<td>V+A</td>
<td>23.08%</td>
<td>13.64%</td>
</tr>
<tr>
<td>V+K</td>
<td>3.85%</td>
<td>4.54%</td>
</tr>
<tr>
<td>A+K</td>
<td>11.54%</td>
<td>1.52%</td>
</tr>
<tr>
<td>V+A+K</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Students in the NUC presented a rather different yet interesting learning style, as depicted in Figure 2. From the figure it can be seen that, out of 25 students who took part in the survey, as high as 15 students or 60% shows a learning style of Visual. This left with the remaining 40% students who appear to have other learning styles, that appeared to be rather of the similar distribution. Worth mentioning, 8% of the students here possess a learning style of V+A+K, which suggests that they would be able to adapt to any of the learning style of ensure they obtain the information they need.
As predicted, majority of students in the TARC possess the Visual learning style. In addition, students who possess the Kinesthetic-related learning style only contributed 12.17% to the total population, which is also similar in comparison to the other two institution, where INTI and NUC reported to have 19.23% and 24%, respectively, of the number of students who possess the Kinesthetic-related learning styles. As there are considerable laboratory works and final semester design project in the Diploma in Mechanical Engineering programme which is rather Kinesthetic, it turns out that, interestingly, students learn best through Visual and Auditory approach. This is, of course, to be further researched into with the comparison of Business or Computing students, so see if the range of the percentage between 10% and 25% of Kinesthetic-related learning styles is the general observation, or otherwise.

![Learning style distribution among students in Diploma in Mechanical Engineering in TARC.](image)

For the BEng (Hons) in Mechanical Engineering courses, a total of 78 students took part in the research, where 72 students were from INTI, while 6 students were from NUC. In NUC, the programme is newly introduced in mid 2011, and hence the number of students is relatively low, as they do not cover various levels of study. Figure 4 shows the percentage distribution of students who are attending the BEng (Hons) in Mechanical Engineering in both institutions.

![Distribution Percentage of learning style distribution among students in BEng (Hons) in Mechanical Engineering INTI and NUC.](image)

Results reveals that only 16.67% of students in both institutions possess Kinesthetic-related learning style, which is consistent to that proposed in the analyses of the Diploma courses, where the range of students who possess the Kinesthetic-related learning style is within 10% - 25%.
Zooming the analyses into INTI, where if the results from Diploma and BEng programmes are compared, a difference in the different learning styles between the two types of programmes in the same institution is observed, as shown in Figure 5.

Compared to the Diploma, the BEng programme is not as hands-on, where much of the concepts were delivered through the understanding of the derivation, rather than through the experiment reports. Hence, students might have the tendency in shifting their learning styles to the Visual, where drawing mind-maps and notes would be much easier for them to understand the concepts. Again, this would need to be confirmed through different studies.

Comparing the three institutions on the total numbers, it turns out that the students in these three institutions possess the similar distribution of learning styles. The percentage of distribution is presented in Figure 6. It can be seen that the small difference among the institutions are observed for learning styles of V, A, K A+K and V+K, which reflect that Mechanical Engineering students in these three institutions are of the similar learning styles.

Fig. 5. Comparison of the learning styles between the Diploma and BEng students in INTI.

Fig. 6. Comparison of the learning styles among the students in three institutions.
From the analyses of the data, propositional statements can be made as follow on students who involved in the study:

- Majority of the engineering students (68.44%) in the study possess a learning style that is Visual and Visual-related, with 51.23% of students possess Visual learning Style.
- Kinesthetic or Kinesthetic-related learning style, in contrast, is owned by minority of them (15.98%), which is consistent to the figure reported by Koh (2008), leading to the proposal that the engineering students who possess the Kinesthetic or Kinesthetic-related learning style if of the range of 10% - 25% of the population.
- Students of higher level (BEng) have shown a single learning style (80.55% for INTI), as compared to students in Diploma (61.55%).
- The distributions of the learning styles among the three institutions are rather similar, which suggests the distribution of the learning style for Mechanical Engineering students.

With the above learning style analyses, it opens an opportunity to look into the learning style distribution for students in various disciplines in the engineering, or even the learning styles of students from various study fields, which will provide the educators a good knowledge on the teaching styles to be used when conducting the lectures to students of various backgrounds.

Acknowledgements

The author would like to take this opportunity to thank Mr Choy Hau Yan from Tunku Abdul Rahman College and Ms Constance Linda from Nilai University College, their helps in obtaining the data for the research.

References