Engineering students learning styles preferences using Honey and Mumford Learning Styles Questionnaire: A Case study in Malaysia

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Abstract:
This paper presents a preliminary study on the learning styles preference of the mechanical engineering students in Universiti Tenaga Nasional (UNITEN). The Honey and Mumford Learning Styles Questionnaire (LSQ) was distributed to the engineering students with the sample of (n=104) as the instrument to assess the students preferred learning styles. The findings of this study showed that the most dominant learning style(s) for engineering students is activist (very strong preference), followed by Theorist and Reflector (strong preference), Pragmatist (average preference). Therefore, it is important for engineering educators to be aware of the students preferred learning styles in the efforts of facilitating students learning potential through various teaching and learning approaches and suggest the use of smart information and communication technology (ICT) tools to be used in their learning.

Keywords-learning styles; engineering education; ICT; educational technology

I. INTRODUCTION
In today’s knowledge driven society, the paradigm shift in tertiary education in response to the rapid changes in the global environment raised the serious attention of the education practitioners, including the field of engineering education. Numerous studies and reports discussed actively on the issues related to the new paradigms of engineering education [1], [2], [3], [4]. In order to better improve the quality of teaching and learning in engineering education, the student’s preference in learning is an important factor that should not be neglected by the education practitioners. This referred to the learning styles of the students. Learning styles are defined as the characteristic cognitive, affective, and psychological behaviours that serve as relatively stable indicators of how learner perceives, interacts with, and responds to the learning environment [5]. According to [6], learning style referred to the characteristics strengths and preferences in the way people take in and process information. As the engineering instructor, we should aware that different students are comfortable with different learning styles [7]. A better understanding of the students learning styles may help the educator to design for better teaching and learning strategies that may suit for different students’ preferences in learning.

II. OVERVIEW OF LEARNING STYLES
The area of learning styles research is active for more than four decades [8]. Many researchers have contributed valuable efforts in categorizing the learning styles theories according to different [9], [10]. In the
literature, there are four widely accepted learning style models in engineering education context [11], [12], which are the Myers-

![Learning Styles and Learning Cycle Based on Kolb's Model][1]

The four types of learners in this classification (Figure. 1) scheme are:

- **Type 1** (concrete, reflective) – the **divergent**. Type 1 learners respond well to explanations of how course material relates to their experience, interests, and future careers. Their characteristic question is “Why?” To be effective with Type 1 students, the instructor should function as a motivator.

- **Type 2** (abstract, reflective) – the **assimilator**. Type 2 learners respond to information presented in an organized, logical fashion and benefit if they are given time for reflection. Their characteristic question is “What?” To be effective, the instructor should function as an expert.

- **Type 3** (abstract, active) – the **converger**. Type 3 learners respond to having opportunities to work actively on well-defined tasks and to learn by trial-and-error in an environment that allows them to fail safely. Their characteristic question is “How?” To be effective, the instructor should function as a coach, providing guided practice and feedback in the methods being taught.

- **Type 4** (concrete, active) – the **accommodator**. Type 4 learners like applying course materials in new situation to solve real problems. Their characteristic question is “What if?” To be effective, the instructor should pose open-ended questions and then get out of the way, maximizing opportunities for the student to discover things for themselves. Problem-based learning is an ideal pedagogical strategy for these students.

**C. The Felder-Silverman Model**

The Felder-Silverman Learning Style Model [18], [19] classifies students along four dimensions: sensing/intuitive, visual/verbal, active/reflective and sequential/global as shown in Table 1.
D. Honey and Mumford’s Learning Styles Questionnaire (LSQ)

Honey and Mumford [20] defined learning styles as “a description of the attitudes and behaviours that determines an individual’s preferred way of learning, p.6.” Honey and Mumford proposed a model similar to Kolb’s in which individuals has a mixture of four learning styles, normally with a preference for one or two of the styles. Honey and Mumford’s learning styles questionnaire (LSQ) and Kolb’s learning styles inventory (LSI) are both diagnostic tests to help individuals identify their strengths, weaknesses, and development needs. The four learning styles, based on Kolb’s theory of stages in the learning cycle, are: activist, reflector, theorist, and pragmatist as shown in Table 2. Through the use of the LSQ instrument, instructors can gain a better understanding of individual learners’ attitudes and behaviours and learning processes [21], [22].

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Strengths</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activist (learn best when they are actively involve in new tasks)</td>
<td>Sociable, open-minded, welcome, challenge, highly involved, prefers here-and-now</td>
<td>Bored by implementation details and the longer term, always seeks the headline</td>
</tr>
<tr>
<td>Reflector (learn best through review and reflect)</td>
<td>Good listener, tolerant, sees different perspectives, postpones judgment, cautious</td>
<td>Takes a back seat in meetings, low profile, distant</td>
</tr>
<tr>
<td>Theorist (learn best when they can relate new information to concepts &amp; theory)</td>
<td>Integrates observations with theory, rational, objective, analytical</td>
<td>Perfectionist, detached, impatient with subjective and intuitive thinking</td>
</tr>
<tr>
<td>Pragmatist (learn best when they see relevance of real life issues)</td>
<td>Experimenter, quick to adopt and try out new ideas, practical, down-to-earth</td>
<td>Impatient with theory, impatient with open-ended discussion</td>
</tr>
</tbody>
</table>

III. METHODOLOGY

In this study the Honey and Munford LSQ was employed. The questionnaire was prepared and administrated to the students in the hardcopy form during the mid of the first study semester in July 2012. Five sections of the year 3 mechanical engineering students were involved and a total of 107 samples were collected.
Two mechanical engineering academic staffs were involved in the survey by distributing the questionnaires to the students for approximately 20 minutes before the class ended. Short briefing was provided for the students before the questionnaire was distributed. Each student took approximately 12 to 15 minutes to complete the questionnaire. Two weeks before the survey was conducted, the pilot questionnaire was distributed to two of the academic staffs and two of the final year engineering students. The distribution of the pilot questionnaires served two purposes [24]: firstly to determine the duration for completion and secondly to identify potential problem(s) with the questionnaire design (layout and readability). Feedbacks were collected through the pilot study and a few recommendations were provided by the participants. Regarding the readability issue, some of the terms or phrases used in the questions are found to be slightly difficult for the non-native English speaking students to understand. This may lead to the misunderstanding of the listed questions, thus created the potential to affect the results findings. Therefore, some additional description for certain terms and phrases were added to aid in the students understanding. Furthermore, the duration for the questionnaire completion was suggested to be at least 15 minutes.

IV. FINDINGS AND ANALYSIS

A total of 107 students returned the completed LSQ questionnaires. Since 3 of the questionnaires were incomplete, the total numbers of questionnaires that can successfully be used for data analysis were 104. For the purpose of data interpretation and analysis, Honey and Mumford’s scoring norm in the UK (1992) was used as the main reference (see Table 3). Through the scoring norm’s Table, it can be identified that the scores are divided into five groups from very strong preference to very low preference. If the respondents score in the LSQ survey was found to be above the average, it is likely to indicate that the respondents are having the greater preference in a particular learning style. Otherwise, it is likely to indicate that the respondents are having lower preference in a particular learning style.

Table 3: Scoring norm in the UK (n = 3500) as defined by Honey and Mumford [25]

<table>
<thead>
<tr>
<th></th>
<th>Activist</th>
<th>Reflector</th>
<th>Theorist</th>
<th>Pragmatist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strong preference (highest score 10 per cent)</td>
<td>15.20</td>
<td>18.20</td>
<td>10.20</td>
<td>1.20</td>
</tr>
<tr>
<td>Strong preference (next 20 per cent)</td>
<td>11.12</td>
<td>15.17</td>
<td>14.15</td>
<td>15.16</td>
</tr>
<tr>
<td>Moderate preference (middle scoring 40 per cent)</td>
<td>7.10</td>
<td>12.14</td>
<td>11.13</td>
<td>12.14</td>
</tr>
<tr>
<td>Low preference (next 20 per cent)</td>
<td>4.60</td>
<td>9.11</td>
<td>8.10</td>
<td>9.11</td>
</tr>
<tr>
<td>Very low preference (lowest 10 per cent)</td>
<td>0.30</td>
<td>0.80</td>
<td>0.70</td>
<td>0.80</td>
</tr>
<tr>
<td>Mean score</td>
<td>9.30</td>
<td>13.60</td>
<td>12.50</td>
<td>13.70</td>
</tr>
</tbody>
</table>

A detailed distribution of engineering student’s preferences is compiled and listed as shown in Table 4. Based on the 104 respondents, it can be clearly identified that more than 78% of the engineering students scored within the range of strong to very strong preference towards the activist learning style. More than 63% of the engineering students scored within the strong to very strong preference range for the reflector style. For theorist
learning style, more than 68% of the engineering students scored within the range of strong to very strong preference. While approximately 43% of the engineering students scored within the range of strong to very strong preference.

Table 4: Detailed distribution of UNITEN engineering student’s preferences according to LSQ

<table>
<thead>
<tr>
<th>Preference</th>
<th>Activist</th>
<th>Reflector</th>
<th>Theorist</th>
<th>Pragmatist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Strong</td>
<td>61 (61.5%)</td>
<td>29 (27.88%)</td>
<td>38 (36.51%)</td>
<td>18 (17.31%)</td>
</tr>
<tr>
<td>Strong</td>
<td>18 (17.31%)</td>
<td>5 (5.56%)</td>
<td>55 (51.5%)</td>
<td>28 (26.2%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>20 (19.23%)</td>
<td>30 (28.5%)</td>
<td>28 (26.92%)</td>
<td>45 (43.27%)</td>
</tr>
<tr>
<td>Low</td>
<td>1 (0.9%)</td>
<td>7 (6.75%)</td>
<td>4 (3.85%)</td>
<td>13 (12.3%)</td>
</tr>
<tr>
<td>Very Low</td>
<td>1 (0.9%)</td>
<td>1 (0.96%)</td>
<td>1 (0.96%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Mean score</td>
<td>13</td>
<td>13.33</td>
<td>14.52</td>
<td>14.19</td>
</tr>
</tbody>
</table>

In order to know the respondents’ preference in learning style, the mean scores of the engineering students’ LSQ were generated and listed in Table 4. Through the comparison of the means scores between the engineering students with the general norms in the UK, it can be identified that students shown relatively higher preferences in the activist, reflector and theorist categories. As referred to Table 3, students have very strong preference in activist while strong preference in reflector and theorist. However, students only achieved moderate preference in the pragmatist learning style. This is the learning style that students may need enhancement. Referring to Table 5, the results of the mean score of engineering students indicated that all the learning styles preferences are above average. This shows balanced learning styles preference for the engineering students and is a good indicator for learning through various methods. It is interesting to know from this research result that engineering students in UNITEN have quite a balance in their learning styles while likely weak in the pragmatist preference which could be due to lack of opportunities to express their ideas relating to real life applications. This may due to the teacher-centred teaching approach used (passive and less interactive) rather than the student-centred approach used throughout the learning process in UNITEN.

Table 5: Comparison of the mean scores between engineering students in UNITEN with the general norms in UK

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
<th>Honey and Mumford 1992 norm [25]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activist</td>
<td>2-20</td>
<td>13</td>
<td>9.3</td>
</tr>
<tr>
<td>Reflector</td>
<td>8-20</td>
<td>15.53</td>
<td>12.6</td>
</tr>
<tr>
<td>Theorist</td>
<td>7-30</td>
<td>14.52</td>
<td>12.5</td>
</tr>
<tr>
<td>Pragmatist</td>
<td>8-19</td>
<td>14.19</td>
<td>13.7</td>
</tr>
</tbody>
</table>

V. DISCUSSIONS

The results of this research study showed that UNITEN students have a very strong preference towards the activist learning style. As known, activist learners are those learners that like to learn through the trial and error process. They have the strong willingness in trying new things. This indicated that the engineering students
are open minded in the process of learning and willingly to act towards new form of learning experience. The traditional one way (passive) teaching and learning strategies in the engineering education may limit their learning potentials. This is a good indication by which the smart information and communication technology (ICT) can be propose and utilize in order to aid the engineering students in their formal learning process. For example, the utilization of smart ICT tools in creating interactive learning environments for the engineering students to interact and experiment with 2-D or 3-D mechanics models may lead to better visualization. In fact, the smart ICT tools such as the use of interactive multimedia educational applications that utilize the text, graphics, audio, video and animation elements in delivering the engineering concepts may further enhance the learning experience of the students to acquire the techniques for engineering problem solving.

Through the research findings, the students also showed strong preferences towards theorist and reflector styles of learning. For theorist, as known in the literature, they are the one that emphasize more on logical thinking and likely to involve in the process of analyzing and synthesizing based on principles and theories. This indicated that the students may like to learn and solve the engineering problems by following the step-by-step logical approach. Thus, the teaching and learning strategies should emphasis more on the sequential and systematic way of problem solving to enhance the students learning abilities in knowledge absorption. It is suggested that the used of coach based interactive multimedia applications [11] that provide the step-by-step guidance features may aid the students learning process according to their own time and pace. For reflector, they are the types that prefer to collect as much data thoroughly before coming to any conclusion. They are thoughtful people that preferred listening and observing before reaching any conclusion. Thus, in the design of the teaching and learning strategies, the engineering educators should be aware of the reflector style of learning in providing comprehensive background knowledge to aid the students learning. They are the types that like to grasp the 'whole picture' of the scenario for the engineering problems before proposing for any solutions. Digital storytelling that utilizes the interactive multimedia technologies to deliver the presented knowledge contents in both the visual and verbal way may aid in the background understanding of the engineering scenario for the students. One of the strengths of digital storytelling is to increase the learners’ comprehension of contents [26]. However, the research studies on the educational used of digital storytelling in engineering education is still in its infancy state that could be explored further.

The least preference style of learning for engineering students in UNITEN is the pragmatist style as compared to the others. Pragmatist learners are keen on trying out new ideas, apply the new ideas and strongly preferred the demonstrations using real examples or real life situation. These findings raised an important issue for the engineering educators that the students are not aware of the important or not likely to cultivate the behaviour of generating new ideas or keen to try out new ideas into practice. As known, in the knowledge driven era, the creative ideas are the main source for the innovation efforts. Currently, the innovation efforts are the main competitive advantage for survival in the knowledge driven global era. As emphasized in [27], one of the
new paradigms in engineering education is to cultivate the ability not only to adapt to change but to actually drive change in the global market environment. The ability to drive change in the engineering industries may refer to those organizations that continuously introduced new products, technologies, services and processes as the sustainable market leaders. This tied strongly with the ability to innovate (creative ideas and implementation).

VI. CONCLUSION

This paper presents the preliminary research study to assess the engineering students preferred learning styles in UNITEN by using the Honey and Mumford LSQ as the instrument. The research results indicated that the engineering students have a quite balance learning styles in Activist (very strong preference), Reflector (strong preference) and Theorist (strong preference) while less on Pragmatist (average preference). Various teaching and learning approaches including the utilization of smart ICT tools to support the broad range of learning styles should be considered by the education practitioners in enhancing the learning potential of engineering students. In addition, the awareness to widen the learning preference of students should be improved for better learning performance.

VII. REFERENCES


