Dimension of Learning Styles and Students’ Academic Achievement

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Abstract

Individual learning styles are varying according to the tendency of each individual. An appropriate learning style could help students to achieve good academic record in any subject they learned. Therefore, this study aimed to determine the relationship between student achievement and learning style for technical and non-technical subject. A total of 288 Diploma student enrolled in Electrical Engineering program participated in this study. Solomon Felder Learning Style Index was distributed to the participants and the Felder and Silverman model was used to interpret the data. Result showed that the electrical engineering students have an active type of learning style for the first dimension, the sensing for the second dimension, visual for the third dimension, and sequence for the fourth dimension. The result showed that there is no significant relationship between the dimensions of learning styles and academic achievement for Electrical Technology subject and only the second dimension has a significant relationship with academic achievement of the Polibriged subject. In conclusion, learning style is not the main factors to enhance students’ achievement, but it can be used to identify the tendency of learning styles possessed by students.

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Keyword : learning styles ; academic achievement ; technical; non-technical.

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1. Introduction

Student performance in learning can be influenced by several factors. The basic issues of student learning as explored by group of researchers were such as home background, learning environment, and government policies (Fabumi, Brai-Abu & Adenji, 2007; Yinusa & Basil, 2008). In other research, the finding syndicated that family background factors (Yinusa & Basil, 2008) and learning styles determined academic performance (Yahaya, Boon, Hashim & Wan Hamid, 2003). Francis and Segun (2008) concluded that the school environment and teacher-related factors were the dominant factors influencing achievements, especially if the student was highly self-motivated. Learners must observe and experience the required cognitive processes to learn them and know how, where, and when to use them. Proponents of learning styles maintain that adapting classroom teaching methods to suit students’ preferred styles of learning improves the educative process (Felder, 1993). However, opponents of learning style theories maintain that little empirical evidence could support this proposition. Instead, the opponents believe that learning styles involve strategies that students are likely to apply to a given teaching situation. Each individual can fit different styles which results in students adopting attitudes and behaviors that are repeated in different situations (Ajzen, 2005).

There are various educational programs offered at university and college level in Malaysia including Technical and vocational education (TVE). Polytechnic is one of the technical institutions which supply human capitals to meet the needs of the local industries. The majority of the program offered at the polytechnics are engineering program. Students are expected to develop competencies in two different areas including technical (core and elective subjects related to engineering) and non-technical subjects (co-curriculum, languages, and Islamic or moral subjects). Technical based subjects that is Electrical Technology (ET101) are evaluated through several phases of evaluation including formative assessment in the form of assignments, quizzes, tests and group discussion activities as well as summative assessment through examinations (Ismail & Haron, 2012). Non-technical subjects based on the technical curriculum namely Polibridged (AR101) also assessed through examinations overall assessment involves several phases including continuous assessment which includes practical, quizzes, written tests, presentations, tutorials and problem-based learning (Mohd Ghazali & Azmi, 2011).

This study was conducted to identify any differences in the learning styles of engineering students for both, technical and non-technical subjects, based on Felder and Silverman Learning Style Model (FLSM) (Felder & Silverman, 1988). This study applied the FLSM model in order to see the pattern of learning styles for the electrical engineering students at the polytechnic. This study also investigated the relationships between the student’s learning styles and academic achievement in a technical and non-technical subject. According to the lecturers, low performance in any of the technical and non-technical subjects can be one of the reasoning for the students to dropout from the engineering program in their first year of study. The conceptual framework as illustrated in Figure 1.

![Fig.1.Conceptual framework](image-url)
The objectives of this study are:

i. To identify patterns of student learning styles among engineering diploma students at polytechnic.

ii. To examine the relationship between Felder-Silverman learning style and the student academic achievement in a technical subject.

iii. To identify the relationship between Felder-Silverman learning style and the student academic achievement in a non-technical subject.

2. Research Method

This study applied quantitative study approach where the researcher decided what to study; ask specific, narrow questions, collect quantifiable data from participants, analyzes these numbers using statistic and conduct the inquiry in unbiased and objective manner (Creswell, 2005). The Index of Learning Style (Felder & Solomon, 1997) and a set of questionnaire developed by this researcher were used in this study. The ILS consist 44 questions which represent four dimension of learning styles. Reliability of the instruments was tested through pilot studies with scores of Cronbach Alpha is 0.6. Although alpha 0.8 has high implications in questionnaires, Tuckman (1999) propose to test attitudes, values of 0.5 or greater than 0.5 are acceptable and formulate α = 0.5 can be accepted for learning styles instruments.

There were 288 students participated in this study. The samples of this study were consisted of Diploma students who enrolled in second semester of Electrical Engineering program at a Polytechnic in Malaysia. The samples size used in this study met the recommendation made by (Chua, 2006). It was a requirement that participants for this study must have completed their examination in the Electrical Technology (technical) and Polibriged (non-technical) for the particular semester. The examination results were used to represent their academic achievement. The results were obtained from the examination unit at the polytechnic. Table 1 shows the division of each question.

Table 1 represents clusters of the ILS’s dimensions and the respective learning style items. Each dimension is represented by 11 items, all of which were grouped based on what learner preferences when processing information given during learning.

Table 1: Index of learning styles (ILS)

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>Dimension</th>
<th>Item Group</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>Processing</td>
<td>Trying something out</td>
<td>1,17,25,29,5,9,13,21,33,37,41</td>
</tr>
<tr>
<td>Reflective</td>
<td>Processing</td>
<td>Think about material Impersonal oriented</td>
<td>1,4,17,25,29,9,13,21,33,37,41</td>
</tr>
<tr>
<td>Sensing</td>
<td>Perception</td>
<td>Existing ways Concrete material Careful with details</td>
<td>2,30,34,6,10,14,18,26,38,22,42</td>
</tr>
<tr>
<td>Intuitive</td>
<td>Perception</td>
<td>New ways Abstract material Not careful with detail</td>
<td>2,14,22,26,30,34,6,10,18,38,42</td>
</tr>
<tr>
<td>Visual</td>
<td>Input</td>
<td>Pictures</td>
<td>3,7,11,15,19,23,27,31,35,39,43</td>
</tr>
<tr>
<td>Verbal</td>
<td>Input</td>
<td>Spoken words</td>
<td></td>
</tr>
</tbody>
</table>
As it is seen at table 1, Index Learning Styles for Felder Silverman divided into four dimensions namely processing, perception, input, and understanding dimension. Active and Reflective styles refer to Processing Dimension, Sensing and Intuitive styles refer to Perception Dimension, Visual and Verbal refer to Input Dimension and Sequential and Global refer to Understanding Dimension. Each dimension is divided into 11 questions. Active style refers to a person who learn by trying out and enjoy working in group. Reflective refers to a person who learn by thinking things through, prefer working alone or with a single familiar partner. Sensing style refers to a person who have concrete thinker, practical, oriented toward facts and procedures. While Intuitive style refers to a person who have abstract thinker, innovative, oriented toward theories and underlying meanings. Someone who has a Visual style prefer visual representations of presented material, such as pictures, diagrams and flow charts. While someone who has a Verbal style prefer written and spoken explanations. Sequential style refers to a person who have a linear thinking process, and learn in small incremental steps. While Global refers to a person who have holistic thinking process and learn in large leaps (Felder & Spurlin, 2005).

3. Result

   i) Patterns of student learning styles of the participants.

   As shown in Figure 2, Item 1 showed that 79.9 percent of the respondents could understand a thing after trying. Item 5 shows that the respondents are more inclined to think of something deeply whereas 77.1 percent compared to 22.9 percent who think more about the new learning. A total of 78.5 percent more interested and involved to contribute ideas. While 21.5 percent said they would sit and listen to any difficult tasks related to the study group. Question 13 indicates that respondents are more likely to know many students in the class compared to 20.1 percent who rarely recognize classmates. Item 17 informed us that 50.7 percent of respondents will find a solution as soon as possible when completing assignments at home compared to 49.3 percent prefer to first understand what the problem is given before the solution is made.

   The majority of respondents prefer to learn in groups of 66.3 percent of all respondents. About 33.7 percent of respondents prefer to learn individually. Analysis of these questions refer to item 21. Respondents tended to try something before thinking is higher than the tendency to think of ways when doing something. This finding refer item 25. The results for the items 29 show that respondents easier to remember things that are done from a deeply thoughtful. Item 33 show that respondents prefer to hold brainstorming sessions related to an idea compared to 39.6 percent tend to think of ideas individually and then share in the group. Item 37 answered a social level respondent. A total of 69.4 percent is a simple class affectionate and likes to hang out versus 30.6 percent comprised of groups who are less sociable and hard to get along with others. From the last item in processing dimension show that 74 percent of respondents willing to receive the same assessment for group assignments. Only 26 percent less interested.
As shown in figure 3, item 2 shows that 59 percent of respondents is an innovative individual versus realistic that is 41 percent. Adaptive analysis of item 6 shows 67.7 percent respondents tend to teach courses related to the facts and circumstances the real life. When 32.3 percent tend to teach a course in the form of ideas and theories. Item 10 shows the 70.5 percent find it easier to learn something in the form of concept versus 29.5 percent who find it easier to learn something in the form of facts. Item 14 also shows respondents tend to input readings that give an idea and develop cognitive stage. When 43.8 percent showed a tendency towards reading input that teaching respondent new facts. Item 18 showed 79.5 percent of respondents prefer a definite idea than 20.5 percent of respondents like the theoretical idea. The findings of the analysis showed that 52.4 percent of respondents are creative when doing a job. While 47.6 percent of respondents is a person who commits a detailed work. This analysis refer to item 22.

While item 26 shows that when reading, 66 percent of respondents prefer to creative writing and interesting compared to 34 percent who loves writing has a clear statement. Refer item 30, analysis showed 58.3 percent of respondents prefer to equip themselves with only one way to perform a task. While rate of 41.7 percent of respondents indicated prefer to submit a new way to perform a task. Item 34 showed 61.1 percent of respondents think it is high praise for ensuring one's make judgments accordingly, while 38.9 percent think it is better to make a person have imaginative power. Respondents who prefer courses that emphasize the fact compared to data is 55.6 percent. While 44.4 percent prefer courses that emphasize the concepts and theories. This analysis refers to item 38.

Item 42 showed that respondents who tend to repeat all the calculations and carefully reviewing the work is 62.5 percent compared to 37.2 percent thought to review the calculation is a tedious. Respondent argues that long computation is a compulsion.
As shown in figure 4, shows the percentage distribution of respondents by pattern visual and verbal in learning styles. Analysis of item 3 showed 86.8 percent of respondents easier to remember images that have been seen the day before while 13.2 percent easier to remember what he has done for the day before. Analysis of item 3 showed 86.8 percent of respondents easier to remember images that have been seen the day before, while 13.2 percent easier to remember what he has done for the day before. Percentage of respondents who prefer getting new information in the picture, diagrams, graphs or maps was 77.1 percent compared to 22.9 percent who prefer to get new information from written instructions, or information orally for testing on items 7. Item 11 showed 79.5 percent of respondents saw the pictures and charts carefully when seeing or reading a book containing pictures and charts compared to 20.5 percent of respondents who tend to focus on writing text. Item 15 showed 59.4 percent of respondents prefer teachers who showed a lot of pictures on the board, while 40.6 percent of respondents liked the teachers who are willing to take the time to explain something. Item 19 answered the question on how one man to remember something. Analysis of the findings showed that 79.5 percent of respondents would remember things that they see more than 20.5 percent of respondents considering what they hear. Item 23 showed 61.8 percent of respondents chose the map as the best navigation tool to move to a new place. While 38.2 percent chose navigation tool written instructions.

Item 27 showed that 64.6 percent of respondents would remember pictures than 35.4 percent thought might be considering matters specified by the instructor when see a diagram or sketching in the class. Analysis showed 69.1 percent of respondents prefer the form of charts or graphs when someone shows data while 30.9 percent prefer form of text when someone shows data. Testing for items 35 for the situation when meeting someone at formal event, the analysis showed that 67.4 percent of respondents tend to remember the person appearance compared only 32.6 percent tend remember a person through speech. The findings of the analysis of the items 39 showed 83 percent of respondents prefer watching television compared to 17 percent who choose to read the book as a way to have fun. The last analysis of the items 43 showed 76 percent of respondents tended to describe places I've ever visited with ease and accuracy. While 24 percent of the respondents tended to describe the difficult and can’t give a detailed description.

Fig.3. Perception Dimension
As shown in Figure 5, the first item that refer item 4, responses showed 59.4 percent tend to understand the overall structure but maybe fuzzy about the details compared 40.6 percent who tend to understand the details of a subject but maybe fuzzy about its overall structure. Item 8 showed 61.5 percent of respondents could see matching parts of a problem in the context of an understanding of a problem compared to 38.5 percent only understand the whole thing. For item 12, 52.4 percent of respondents would normally see the solution first and try to get a solution when do the calculation compared 47.6 percent of respondents who would attempt to get the solution step by step when solving computational problems. Item 16 shows how respondents analysing a story or novel. About 75.7 percent think environmental events in literature and try to relate it to understand the theme. While 24.3 percent of respondents only know theme after reading and then read it again to find events related to the theme.

Refer item 20, about 66.3 percent of respondents thought the instructor should demonstrate a substance by clear step when learning process. Some minority of 33.7 percent respondents thought the instructor must give an overview of the materials and relate with other subjects. The majority of respondents that is 67.7 percent of students studying in an accordance, organized method and serious and also specify the method that is able to make respondents more understanding. Minority respondents, 32.3 percent study in a discontinuous and said that there is confusion realized after learning process. This analysis refer to item 24. Item 28 showed 60.8 percent of respondents tend to understand the overall content of the information before focusing on the details versus 39.2 percent of respondents who tend to focus on a detailed and ignore the overall content. For item 32, analysis found that when making a writing, 55.2 percent of respondents would probably start writing sequentially with thoughts by beginning to final and 44.8 percent prefer to think and write in different parts and combine again in sequence. The findings of the analysis for the items 36 showed a high percentage for learning new subjects, namely 67.7 percent of respondents tend to focus on the subject and more explore something relevant to the subject. While 32.3 percent respondents tend to relate one subject to another subject. Lecturers, teachers or trainers who started teaching with a course outline or guidelines subjects can help 72.9 percent of respondents, while 27.1 percent thought of giving a course outline before teaching helps students in the learning process. This analysis represents for item 40. Item 44 showed 61.5 percent of respondents tend to think of the steps in the solution process, while 38.5 percent tend to think of the possible effects in the wider field.
ii) Relationship between Felder Silverman learning style and academic achievement of students in technical subject at polytechnics.

Table 2: Correlation between student learning styles and academic in the technical subject

<table>
<thead>
<tr>
<th>Learning Styles</th>
<th>Active Reflective</th>
<th>Sensing Intuitive</th>
<th>Visual Verbal</th>
<th>Sequential Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>r 0.040</td>
<td>-0.047</td>
<td>0.003</td>
<td>-0.068</td>
</tr>
<tr>
<td>p</td>
<td>0.495</td>
<td>0.428</td>
<td>0.961</td>
<td>0.252</td>
</tr>
<tr>
<td>N</td>
<td>288</td>
<td>288</td>
<td>288</td>
<td>288</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)*

As seen in table 2, showed the correlation between learning style and academic achievement for the technical subject that is Electrical Technology (ET101). The findings show that there is no significant relationship between active, reflective, sensing, intuitive, visual, verbal, sequential and global learning styles with academic achievement for ET101. Findings showed p values for all four dimensions are in the range of p> 0.05 but not in the range of p <0.05.
iii) Relationship between Felder Silverman learning style and academic achievement of students in non-technical subjects at the polytechnic.

Table 3: Correlation between student learning styles and academic achievement in the non-technical subject

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>Learning Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Reflective</td>
<td>Sensing Intuitive</td>
</tr>
<tr>
<td>r</td>
<td>-0.030</td>
</tr>
<tr>
<td>p</td>
<td>0.616</td>
</tr>
<tr>
<td>N</td>
<td>288</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed)*

As seen in table 3, showed that the correlation between learning style and academic achievement for non-technical subjects, namely Polibriged. The findings showed that there is no significant relationship between active, reflective, visual, verbal, sequential and global learning styles with academic achievement for non-technical subjects. The findings showed a p-value for all three dimensions are within p>0.05 but not in the range p<0.05.

Difference with the analysis for sensing and intuitive learning styles where the p-value indicates that there is significant correlation between the learning style and academic achievement for the subject Polibriged (AR101) with the value of p=0.001. The correlation value for this pattern pair is 0.193. This analysis shows that there is a weak correlation.

4. Discussion and Conclusion

This study shows that the combination of active, sensing, visual and sequential are learning styles that electrical engineering students prefer to learn. This finding supported by other researchers study (Mohamad, Yee, Muhmad & Tee, 2014). The visual styles is the most dominant style possessed by the students and they were likely to learn with graphic, chart and writing to get better understanding and memorizing what they had learned (Kamaruddin & Mohamad, 2011).

The study also shows the electrical engineering students at the polytechnic tend to be socially learning, comfortable working in groups and prefer to provide information for their friends, and be able to remember things easily. This situation is supported by Mior Ismail (2003) where the curriculum at polytechnic give priority to practical work and theory. Engineering students are required to enter the engineering workshop to do the practical workshops. Active pattern being chosen by respondents as most engineering students have creative thinking (Buzan, 1976). Kamaruddin and Mohamad (2011), concluded based on studies for the Kolb model, the individual who adopts imaginative and creative learning style will always focus on available information and process the information in a response to the others. The findings showed that students who have creative minds tend to participate social activities, interaction and sharing of ideas. This is among the main reasons for the active pattern has become one of the learning styles that are often used in electrical engineering student at the polytechnic.

This study also show the sensing pattern have been selected by respondents because engineering students concerned with a reasonable accuracy in work. Each laboratory or workshop emphasized safety aspects in natural sciences or engineering field. According Jamaludin (2001), safety engineering also includes tools, machinery, instruments, environment and safety of other individuals who must be obeyed by students while they are in the workshop. In this situation exists meticulous nature.
Besides, selection of respondents to a sequential pattern coincides with the study by Felder (1988), which shows sequential pattern is the pattern of the fourth dimension, which is owned by engineering students. From this study, the most dominant pattern practiced by the respondents are visual patterns. The findings of this study are consistent with findings by Felder (1996), where students who like visual pattern due to the student’s desire refer to performances such as images, diagrams, graphs and flow charts.

The relationship between learning style and academic achievement for the subject ET101 significantly above the level selected. This finding indicates that there is no significant relationship between students’ learning styles and academic achievement for technical subjects. These findings prove that learning style does not affect academic achievement. Yusof, Othman and Karim (2005), stated that learning style cannot be used as a basis to evaluate the performance of a student but motivation, academic ability and approach when studying are the factors that affect student achievement. These findings are also supported by studies Num (1999) on the student University Technology Malaysia (UTM) which shows that the learning style of students with low, moderate and excellent achievement does not have significant difference.

Analysis for the four dimensions learning styles and academic achievement of non-technical subjects shows that active-reflective dimension, visual-verbal dimension, and sequential-global dimension does not have a significant relationship with achievement of Polibriged (non-technical subject) except for the sensing-intuitive dimension. Seven elements of soft skills have been implemented in higher education institutions namely communication skills, critical thinking and problem solving skills, teamwork skills, continuous learning and information management, entrepreneurial skills, professional ethics and leadership skills (Hussin, Zakaria, & Salleh, 2008). Sensing-intuitive dimension showed abnormalities relationship with AR101 subject because the subject has applied learning soft skills. Soft skills involved are teamwork skills, critical thinking and professional ethics. Soft skills that inherent in the study of this subject parallel with features sensing-intuitive patterns.

In conclusion, although the visual pattern is the most dominant pattern, but it is important for students to have the variety patterns to make learning more effective. Besides visual pattern, active, sequential and sensing, global patterns also required in era of technological advancement. Instructor and the Ministry of Education (MOE) should strive to ensure that teaching for students more holistically and have the ability to generate more innovative engineering. In addition, the main thing that needs to be implemented by institutions and instructors are incorporating a variety of learning styles with suitable teaching methods.

Not only that, the achievement of non-technical subjects (AR101) can be enhanced by combining sensing-intuitive patterns to meet the learning curriculum for activities that require soft skills. This combination can improve the academic achievement of curricular subjects.

Overall, learning styles are not have an important relationship with academic achievement but it can be used to identify the trend of learning styles that are owned by students and even can be used by instructors to improve teaching methods.

References


