Evaluation of Self-directed Learning Readiness Among Engineering Undergraduates

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Abstract: Problem-Based Learning (PBL) is one of the best learning practices which has been adopted to overcome engineering graduates’ deficiencies, to name a few, in terms of the ability to work in multidisciplinary teams, transferring basic knowledge to real-life engineering scenarios, ability to think critically and creatively and problem solving. In implementing PBL, the level of self directed learning (SDL) readiness is measured beforehand in order to make the implementation of PBL more effective. This paper focuses on the level of readiness in SDL amongst first year undergraduate engineering students at University Kebangsaan Malaysia (UKM). The research centers on the evaluation of students’ self-directed learning readiness. Online – based questionnaire was distributed to undergraduate engineering students in Semester 1, 2014 at the UKM, Bangi, Malaysia. The Likert type instrument which consists of 27 items which have been translated into the Malay version was handed out to 112 participants. The overall comparison of SDLR score were performed by using Mann- Whitney U parametric test conducted at 5% significance level with demographic factors such as gender and type of secondary school. The results of this investigation showed that undergraduate engineering students at the UKM possess adequate level of self-directed learning readiness but specific coaching should be given to some of the respondents in order to provide necessary skills to SDL. This in turn can increase confidence and satisfaction level when PBL is being implemented.

Key-Words: - Problem-Based Learning, Self-Directed Learning, Self-directed Learning Readiness Scale (SDLRS)

1 Introduction

Gibbings et al.[1] as discussed in[2] pointed out that in recent years, engineering students were lack of ability in basic science and mathematical reasoning. The lack of knowledge retention has also been criticised. At the same time, engineering courses are sometimes unable to provide graduates with the necessary skills and competency in order to be successful in the current professional environment. Several important skills that are identified as required in a professional environment include working in multidisciplinary teams and global virtual environment, and transferring basic knowledge to real life engineering challenges. Hence, the needs of Problem Based Learning in engineering education have been one of the current issues persisting in higher level education. Problem Based Learning has been introduced in medical field back in the 60s to help medical students. It has now been adopted well in the field of engineering studies[3] and mathematics [4]. Problem-Based Learning is a method which is developed based on an investigation (questions) in which the students play the role to investigate and find solutions to the problems posed. PBL also builds basic knowledge, promotes effective cooperation, builds the problem-solving skills, creates intrinsic motivation to learn and develops Self-directed Learning skills [5, 6].

Knowles[7] describes Self-directed learning as a process where each individual takes the initiative, with the help of others or not, to determine their own needs of learning, set the goal of learning, determine the raw materials and human resources of learning, choose and implement suitable learning strategies and evaluate the outcomes of the learning. In implementing Problem-Based Learning, students will sit in small groups and they are
required to observe and discuss or solve problems [8], [9] proposes that mastering skills of self-directed learning allows individuals to contribute more effectively in group discussions. According to Schmidt [10] cited in Loyens et al [5], the definition of Self-Directed Learning in the context of Problem-Based Learning can be interpreted as the willingness of students to link learning activities that is defined by students themselves. The Self-directed Learning effects on individual learning depend on the extent to which the individual is engaged actively in the activities of Self-directed Learning implementation. Individuals with certain personal characteristics as listed in [11] have found to be more drawn to Self-Directed Learning and recorded excellent academic results. Furthermore, Self-directed Learning is a skill which can be improved (or cultivated) when the readiness of Self-directed Learning of students is measured. Readiness refers to the extent of individual's attitude, talent and personal characteristics needed for independent learning [12]. Problem-based Learning typically involves students in group learning activities. Each of the team members should always cooperate and contribute to ensure that each of the given tasks can be completed with excellence. The distribution of students at random by the instructor or the idea of letting students choose their own group members among themselves could lead to only certain students in a group or certain groups benefiting from the implementation of the problem-based learning approach. This can be due to the non-reassurance that each group has the same ability in the Self-directed Learning approach. The group which consists of students who have a high level of Self-directed Learning ability will achieve the learning goals. On the other hand, the moderate and low levels of the SDL ability will feel threatened after much time and effort is allocated to solve a variety of Problem-based Learning assignments. This would also lead to students becoming less motivated to complete the tasks. Therefore, a student distribution or grouping mechanism should be established.

In this article, the authors have described one of the ongoing efforts by The Fundamental Studies of Engineering Unit at the UKM aiming to improve the mechanism of grouping students according to their readiness in Self-directed learning. In this study, the readiness of students in Self-directed Learning before the implementation of Problem-Based Learning was analyzed. The aim of this study is to evaluate and validate the level of readiness of Self-directed Learning among first year engineering students at the UKM.

2 Method
2.1 Design
The study involved online-based questionnaire which was carried out using a convenience sample of undergraduate engineering students in Semester 1, 2014. The research was conducted in three phases in order to evaluate and validate SDL readiness which is shown as follows:

<table>
<thead>
<tr>
<th>Table 1: Research steps</th>
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<tbody>
<tr>
<td><strong>Process</strong></td>
</tr>
<tr>
<td>Phase 1</td>
</tr>
<tr>
<td>Phase 2</td>
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<tr>
<td>Phase 3</td>
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</tbody>
</table>

2.2 Participants
Students who were enrolled in undergraduate engineering courses of the National University of Malaysia (UKM), from the Department of Civil and Structural Engineering (JKAS), Department of Electrical, Electronic and System Engineering (JKEES), Department of Chemical and Process Engineering (JKP) and Department of Mechanical & Materials Engineering (JKMB) had provided data for the analysis. There were 334 students eligible for the involvement of the study but only 112 had participated in the questionnaire. The timeframe given to answer the questionnaire was within 2 weeks before the beginning of semester break in December 2013.

2.3 Instrumentation
In this study, we adopted previous work by Fisher et al [13] by using the original version of Self-directed
Learning Readiness Scale (SDLRS) contains 42 items covering three factors: self-management, desire to learn and self-control. The instrument has been translated into Malay Version (first version) for the purpose of having a better understanding in each instrument for Malaysian students. A pilot study session was held involving a total of 20 (5% of the population of students in a FKAB) voluntary respondents. They were requested to inform if there were any items deemed to mean almost the same or unclear by its meaning. Based on the feedback received, 13 items (self-management (3), desire for learning (2) and self-control (8)) were removed from the original SDLRS. Cronbach’s alpha coefficients for the revised instrument and subscales involved are recalculated and the results: 0.941 for the entire instrument, and 0.875, 0.876 and 0.787 for the subscales of self-management, desire for learning and self-control respectively. The benchmark for the scale reliability of 0.7 indicated that the items have been considered to be internally consistent [14].

Table 2: Comparison between 40 items Likert type SDL readiness questionnaire and first version

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Cronbach’s alpha for 40 items</th>
<th>Cronbach’s alpha for 27 items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total SDL readiness</td>
<td>0.92</td>
<td>0.941</td>
</tr>
<tr>
<td>Self-Management</td>
<td>0.857</td>
<td>0.875</td>
</tr>
<tr>
<td>Desire for Learning</td>
<td>0.847</td>
<td>0.876</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0.830</td>
<td>0.787</td>
</tr>
</tbody>
</table>

On the other hand, demographic information such as gender, age, ethnicity, former school (school category) and mode of entry into UKM are already in the database. This information is taken into consideration thinking that there might be other factors that can influence total SDLR score among students. Respondents were asked to respond to the degree of agreement with each statement by marking the item in SDLRS (click) on one of the five numbers as follows:

1. Almost not true about myself
2. Not always true about myself
3. Sometimes true about myself
4. Generally true about myself
5. Almost true about myself

As highlighted by Fisher et al [13], 5-point Likert scale of SDLRS has been verified to be reliable. Furthermore, the scale of this type are commonly used to get a response to items associated with the university environment [15]. The questionnaires were analyzed statistically using OpenStats software and Excel. The categorical variables were described as median and inter-quartile range. The overall comparison of SDLR score were performed using Mann-Whitney U parametric test conducted at 5% significance level.

3 Results

The discussion of the results begins with the participants’ profile. There were 112 undergraduate engineering students who fully completed the questionnaire where the response rate was 34%. Students from the JKAS and JKMB were reported to represent the least number of students who participated in this study. The majority of the students were female (64.3%) and most of them were from non-boarding schools. The full distribution of participants’ profile is given in Table 3.

Table 3: Distribution of participants’ profile

<table>
<thead>
<tr>
<th>Variable</th>
<th>Descriptor</th>
<th>N</th>
<th>Percentage(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department</td>
<td>JKAS</td>
<td>24</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>JKKP</td>
<td>36</td>
<td>32.1</td>
</tr>
<tr>
<td></td>
<td>JKEES</td>
<td>31</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>JKM</td>
<td>21</td>
<td>18.8</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>40</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>72</td>
<td>64.3</td>
</tr>
<tr>
<td>Former School</td>
<td>Boarding School</td>
<td>39</td>
<td>34.8</td>
</tr>
<tr>
<td></td>
<td>Non-boarding School</td>
<td>73</td>
<td>65.2</td>
</tr>
</tbody>
</table>

Fisher et al [13] observed that the total score of >150 (42 items) on the SDLRS is an acceptable level of SDL readiness. Instead, for the first version of SDL readiness instrument, the total score > 96 was considered an acceptable SDL level of
readiness for 27 items. Figure 1 shows that the result obtained after 13 items are removed. As shown below the total median score is 101 which is >96. Hence, the first-year undergraduate engineering students in the UKM had relatively high level of SDL readiness. For SM sub factor the score is 37, DL sub factor 38, while for SC sub factor the score is 27.

**Figure 1:** The result of total score of SDL readiness and each factor related to SDL readiness (n=27)

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Figure 2 shows the comparison of the level of SDL readiness in gender between male and female student. Result shows that the median score for female (100) illustrates slightly lower than male respondents (101) and the overall comparison of median score for this category was not statistically significant (p value=0.4920). Since the median of SDLR score is 100>96, 72.2% of female respondents are ready to SDL. Meanwhile, only 70% of male respondents are expected to have no difficulty to practice SDL.

**Figure 2:** Comparison of the level of SDL readiness between Male and Female participants

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Figure 3 shows that a total of 39 (34.8%) of respondents graduated from boarding school while the rest were from non-boarding school. The total median SDLR scores of non-boarding school students is 101, which is higher than the boarding school student (100), but the difference in the median value is not significant (p = 0.2843).

**Figure 3:** Comparison of the level of SDL readiness between boarding school and non-boarding school participants
4 Discussion
All information regarding the questionnaire is made available in an intranet system that is called as iFolio UKM (www.ifolio.ukm.my). The intranet system would inform registered students via e-mail if there are any announcements, memos, lecture materials, etc., which are uploaded by the administrators (lecturers and tutors). In case of no access to internet facilities, this may result in the student’s participation. Our finding revealed that the response rate was low at around 34% for online-based test. Besides that, there are few factors that may contribute to this problem, to name a few, not owning smart phones, limited access to internet, do not know internet access availability in campus or do not have the relevant skills to use the internet. Previous studies by Shaikh[16] and Ruiz-Gallardo[17] found that gender difference did not affect the SDLR scores. The finding was consistent with our finding that both median score between male and female were not statistically significant. John Beamish of Linden Boarding Schools in[18] described the exposure and concept of ‘life learning’ practices in boarding school. Students graduated from boarding schools were trained to make learning as their way of life. Thus, the good exposure to different type of learning approaches, as well as with the opportunity to learn in a disciplined environment should make the students more prepared for SDL. However, this relationship is not being observed in this study since the overall comparison of median score of respondent’s former school is not significant. Bigger amount of respondents with boarding school background are needed to confirm these findings. The finding provides evidence that 30% of the male respondents are not ready for SDL. This group needs guidance at the early stage of learning. Among the activities that to be carried out are, such as, encourage them to give opinions on new information, emphasize on the aspects of self-management and expose the use of technology in search of information. In addition, [19] showed that in ensuring a more effective learning activities for the targeted group, male facilitatorsshould be given priority in order to avoid incompatibility during the coaching session.

5 Conclusion
The objective of this paper is to gather information about student’s level of readiness for SDL before pursuing the PBL session. The main findings are summarized as follow: (1) First year engineering undergraduates at the UKM possess an adequate level of SDL readiness; (2) Some respondents are not ready for SDL. The findings of this study suggest that students who are not ready for SDL will be trained by facilitators, or will be placed under the guidance of skilled college friends. This will lead to improvement in the SDLR scores. The finding was consistent with our findings that both median score between male and female were not statistically significant. John Beamish of Linden Boarding Schools in[18] described the exposure and concept of ‘life learning’ practices in boarding school. Students graduated from boarding schools were trained to make learning as their way of life. Thus, the good exposure to different type of learning approaches, as well as with the opportunity to learn in a disciplined environment should make the students more prepared for SDL. However, this relationship is not being observed in this study since the overall comparison of median score of respondent’s former school is not significant. Bigger amount of respondents with boarding school background are needed to confirm these findings.

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