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A Study on Engineering Undergraduate Learning Styles towards Mathematics Engineering

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Abstract

Mathematics is an essential subject in engineering studies. The ability to comprehend mathematics in themselves are very important to ensure their successes in other engineering subject. The student performance in mathematics is close related to the learning styles. Therefore, a study on learning behavior is very important to see the relation in between their achievement and learning styles. Thus the focus of this study is to investigate the learning styles of the fourth year engineering students towards mathematics. The factors of learning style to be investigated are formal learning approach, informal learning approach, time management and academic discipline. A formal learning approach includes habits and practices that students employ in classroom situations whereas informal ones are the learning that takes place outside the classroom. It was found that formal learning had a higher overall score, 5.02, followed by academic discipline, 5.00; informal learning, 4.85; and time management, 4.64.

Keywords: learning style; mathematics; engineering studies; formal learning approach; informal learning approach

1. Introduction

Mathematics is an important component in the field of engineering. Thus, Mathematics education at the school level should lay the groundwork for effective study and application at the professional ranks. Many factors have been identified in studies of students’ attitudes toward Mathematics. There is a strong correlation between a student’s performance and his attitude as well as strategies that he employs in Mathematics study (Swetz et al. 1983) A South Western University study observed that a student with positive time management skills and effective examination strategies was able to achieve educational success (Kern et al. 1998) Some studies, however, reveal that effective learning strategies do not necessarily contribute to academic excellence (Entwistle & Wilson 1977).
Sloan et al (2002) investigated the relationship between elementary preservice teachers' mathematics anxiety levels and learning style preferences found that positive correlation between mathematics anxiety and a global (right-brain dominant) learning style. As global orientation scores increased, mathematics anxiety scores increased as well. In Crawford et al (2010) look into the conceptions of mathematics, orientations to studying it and experiences of learning it of first year university students and found that differences in students' conceptions of mathematics were shown to be related to their approaches to learning mathematics, their experiences of studying the subject and their performance on assessments.

A relationship between the assessment practices used in classrooms and what or how students learn is study by Segers et al (2010). The focuses on the importance of pre-, post-, and pure assessment effects on learning. The influence of assessment on student learning, it is stressed that attention should be paid to the quality of current classroom assessment practices by using quality indicators that align with the features of these classroom assessment practices (Segers et al. 2010).

The objective of this study is to investigate the performance and learning styles of engineering students in Mathematics at the Faculty of Engineering and Built Environment, UKM.

2. Research Methodology

The subject of the study is the fourth year students (Semester 1 2006_2007) from the four engineering departments. Which are, Civil & Structural (JKAS) Department of Electric, Electronics & Systems (JKEES) Department of Chemical & Process (JKKP) and Department of Mechanical & Materials (JKMB). A total of 215 students were the respondents in this study where a set of questionnaire were given to them with questions related to learning styles in informal and formal style. The questionnaires were distributed to them during the last week of semester. The lecturers and the tutors conducted this session in their classroom in order to ensure that all students involved in this research.

3. Analysis and Findings

It is found from the analysis that the respondents were consists of Civil & Structural (JKAS) were 20%, Electric, Electronics & Systems (JKEES) were 28.8%, Chemical & Process were 27.9% and, Mechanical & Materials (JKMB) were 23.3%. as shown in figure 1. Figure 2 shows the distribution of respondents in gender. There were 54% female respondents and 46% male respondents in this research.

![Figure 1. Students based on department](image-url)
3.1. Students’ Attitude

This study also focused on students’ interest and attitude towards Mathematics. For students’ interest, 22 items related to their interest in mathematics were identified, each employed a scale of 1 to 7, where 1 denotes strongly disagree and 7, strongly agree. From Figure 3, the majority of the students felt that Mathematics is one of the important knowledge in engineering, with average scores of 6.5. The students do not agree that their first semester mathematics results truly reflect my understanding and mastery of the course, they also does not agree that mathematics is very difficult compared to the other courses. Overall average scores for the interest factor were 4.5 and 4.1 respectively.
Key:

b1: Mathematics an important knowledge in engineering
b2: Learning mathematics takes too much of my time
b3: Impossible to be a good engineer without sound mathematical knowledge
b4: Enthusiastic to start math exercises as soon as possible too.

b5: Very worried about failing mathematics subject
b6: Very confident to pass mathematics subject
b7: Would still learn math even if it is not a compulsory subject
b8: Spent most time (at home) on mathematics compared to other subjects
b9: I am of the type who can excel in mathematics
b10: Compared to other courses mathematics is very difficult
b11: Very confident that I can excel in mathematics
b12: Enjoy learning new things in mathematics
b13: I often ask lecturers about things I don’t understand in mathematics
b14: Often try to solve mathematics questions from text book or other reference besides the ones assigned by lecturers.

b15: Try to understand fully every topic learnt in the mathematics course
b16: Confident with my ability to learn higher-level mathematics
b17: Impossible to fail my mathematics course
b18: Very confident of my ability
b19: When I obtain good grades for mathematics, this is due to my effort and natural talent
b20: It makes me proud to be good in mathematics

b21: I have sufficient mathematical knowledge obtained at school and matriculation college to enable me to do the engineering mathematics course
b22: My first semester mathematics results truly reflects my understanding and mastery of the course

For students’ attitude, only 16 items were studied, each employed a scale of 1 to 7, where 1 denotes strongly disagree and 7, strongly agree. From figure 4, the finding shows that the element Mathematics has many applications in everyday life has the highest score with 5.9. The groups disagreed that the reason why they don’t perform well in mathematics was because they do not have the natural talent for mathematics. This is evident from the low score on item no. 13 in the attitude scale. This item is the lowest score, 3.5.

Figure 4. Average score for students’ attitude
Key:
c1 : Mathematics has many applications in everyday life

c2 : Mathematics is an interesting subjects.

c3 : Learning mathematics at university differs from that at school.

c4 : My mathematics class is interesting.

c5 : Mathematics is exciting and enjoyable.

c6 : The learning method used does not bore me.

c7 : I enjoy learning mathematics compared to other subjects.

c8 : My mathematics lecturer triggered my interest to deepen my knowledge of mathematics.

c9 : I learnt many interesting things in my mathematics course.

c10 : I give full attention in my mathematics class.

c11 : If I don’t understand any topic in mathematics I usually look for other references.

c12 : When I do well in a mathematics test, it is because the question interests me.

If I don’t perform well in mathematics, it is because I do not have the natural talent for mathematics.

c13 : Mathematics problems are very difficult to solve.

c14 : If I get good grades in mathematics, it is because the lecturer makes the subject interesting.

4. Learning styles

There were four components that make up student learning styles, that is, (1) time management, (2) formal learning, (3) informal learning, and (4) academic discipline. Each style employed a scale of 1 to 7, where 1 denotes strongly disagree and 7, strongly agree. Figure 5 demonstrates the results of students’ time management competency. In this component, 10 items were analysed. From the results obtained, it was found that there are 3 main techniques employed by the students were the setting aside of time for finishing up class assignments, dividing equal study time for each subject and limiting time for entertainment and this element received an average score of 4.9. Another interesting aspect is that the lowest score for this research was possess a daily timetable for studying. On the whole, the level of time distribution was moderate in nature where the average score for this component was 4.64.

Figure 5. Average score for time management
Key:
d1 : Posses a daily timetable for studying.
d2 : Dividing equal study time for each subject.
d3 : Setting aside time for finishing up class assignments.
d4 : Studying at a pre-determined time.
d5 : Setting aside enough time for studies.
d6 : Limiting time for recreation/ sports.
d7 : Limiting time for club activities.
d8 : Limiting time for social activities.
d9 : Limiting time for entertainment.
d10 : Limiting time for hobbies.

Figure 6, on the other hand, displays the scores for formal learning. All in all, 14 items were studied. For this category, an unusual uniformity occurred. Across the board all students said tutorials help student understand the concept, as the top scorers. The scores for this item were: Malay-Muslim students, 6.02; non Malay-Muslim, 5.60. The same goes for the bottom scorers: All ranks of students were weak at asking relevant questions to check understanding as evidenced by this detail receiving the lowest scores. Overall the average score tabulated was 5.02.

![Figure 6. Average scores for formal learning](image)

Figure 7, meanwhile, presents the scores for informal learning techniques of students. In this category, 16 items were weighed. The most common informal learning technique for the students was the reading of lecture notes as the main revision technique with scores of 5.8. On the bottom rung, doing exercises on topic under discussion was the least favoured method of both groups of students. Looking at the overall picture, the average score for this section was 4.8.
Figure 7. Average scores for informal learning

Key:

d11 : Sitting in the front rows during lectures.
d12 : Conferring with class mates concerning class problems.
d13 : Asking relevant questions to check understanding.
d14 : Making important notes.
d15 : Not indulging in irrelevant talk with classmates.
d16 : Do not focus only on favourite topic/ subject.
d17 : Able to understand lectures.
d18 : Asking lecturer questions both in & out of class.
d19 : Asking classmate questions.
d20 : Writing notes for future reference.
d21 : Tutorials help student understand the concept.
d22 : Tutorials should be given twice a week.
d23 : Tutorials help to improve the basic of calculus and trigonometry.
d24 : Tutorials help to solve questions in the exercises given.
d25 : Reading up on topic before lectures.
d26 : Doing exercises on topic under discussion.
d27 : Writing down notes during readings.
d28 : Reading notes immediately after lectures.
d29 : Doing exercises immediately after lectures.
d30 : Discussing with classmates immediately after lectures.
d31 : Reading textbooks immediately after lectures.
d32 : Doing exercises is main revision technique.
d33 : Answering past year exams is main revision technique.
d34 : Reading reference/ text books is main revision technique.
d35 : Reading lecture notes is main revision technique.
d36 : Discussing with classmates is main revision technique.
d37 : Discussing with lecturers is main revision technique.
d38 : Memorizing solutions is main revision technique.
d39 : Utilizing the library during spare time.
d40 : Using the Internet for additional information gathering.
Finally, Figure 8 shows the scores of students’ personal academic discipline. In this component, a total of 15 items were scrutinised. Evidence points out that Doing exercises immediately after lectures and Discussing with classmates immediately after lectures has the highest marks of 5.7. Just as for the formal learning component, the lowest score were shared. The average score for this set was 5.00.

![Figure 8. Average scores for academic discipline](image)

**Key:**
- d41 : Reading up on topic before lectures.
- d42 : Doing exercises on topic under discussion.
- d43 : Writing down notes during readings.
- d44 : Reading notes immediately after lectures.
- d45 : Doing exercises immediately after lectures.
- d46 : Discussing with classmates immediately after lectures.
- d47 : Reading textbooks immediately after lectures.
- d48 : Doing exercises is main revision technique.
- d49 : Answering past year exams is main revision technique.
- d50 : Reading reference/ text books is main revision technique.
- d51 : Reading lecture notes is main revision technique.
- d52 : Discussing with classmates is main revision technique.
- d53 : Discussing with lecturers is main revision technique.
- d54 : Memorizing solutions is main revision technique.
- d55 : Utilizing the library during spare time.
- d56 : Using the Internet for additional information gathering.

**5. Conclusions**

This study limits itself to only four types of learning styles used by the students, that is, time management, formal learning, informal learning and academic discipline. Out of the four learning styles, it was found that formal learning
had a higher overall score, 5.02, followed by academic discipline, 5.00; informal learning, 4.85; and time management, 4.64.

The students agree that Mathematics is important. However, they do not agree that lower Mathematics results relate to natural talent for Mathematics. Generally, they do not do their assignment individually and most important, they do not make preparation before class. Both groups do not like to be late to lecture and tutorial classes.

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References


