A Diagnostic Programmeme for Student Improvement: SIMPLE Implementation in Faculty of Civil Engineering

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ABSTRACT

'SIMPLE' (Student Learning Improvement Programme) was developed to motivate and to assist civil engineering students especially the students who failed civil engineering subjects and with CGPA of less than 2.3. As part of the programme, a workshop was organised by the Faculty of Civil Engineering, UiTM Pahang (FCE) by focusing on students who failed civil engineering subjects in order to enhance their understanding of the subjects and as a preparation for the coming final examination. This workshop was divided into four (4) divisions or sub-disciplines namely Structural and Materials, Construction, Business and Project Management, Geotechnical and Highway Engineering as well as Water Resources and Environmental System. Generally, the nature of civil engineering subjects is descriptive-based, analysis-based, project-based and laboratory-based. Thus, the module of the workshop was prepared by focusing on the method of approaching the students according to the nature of the subjects, answering techniques for final examination and identification of common mistakes. Facilitators were selected among FCE lecturers. A survey was done to assess the success of SIMPLE workshop and to identify causes of subject failure. The questionnaire analysis showed that the failure of descriptive-based subjects such as Construction, Business and Project Management as well as Geotechnical and Highway Engineering was because the students had no interest in theoretical/ reading subjects. In addition, the analysis for Water Resources and Environmental System as well as Structural and Materials showed that the major cause contributed to the failure was that the students had difficulties to discard laziness. Overall, SIMPLE workshop had showed a significant change (p-value < 0.05) on the students' interest on the subject, excitement of the subject, level of understanding and confidence to succeed in the subject.

Keywords: SIMPLE, student improvement, civil engineering

Introduction

Civil Engineering programme is important to support wide range of profession in various fields of industries. The curriculum of the programme was designed to cover multi-disciplinary skills acquisition. Megat Johari *et al.*(2002) reported that the objectives of engineering training is to provide students with abilities to acquire criteria such as scientific strength, professional competency, multi-skilling, well respected and potential industry leadership skills, as well as moral and ethical soundness. The skills are needed to comply with the Board of Engineers Malaysia (BEM) as a requirement for contemporary practices including the ability to apply mathematics, science and engineering, science in solving engineering tasks, the ability to understand environmental, economics and community impacts on development, and the ability to communicate effectively and ethically in discharging duties (Johari *et al.*, 2002). Thus, students have been exposed to multiple disciplines and various natures of subjects within three years of training at the Faculty of Civil Engineering, UiTM Pahang (FCE). In addition, the students will also achieve academic excellence through the

practice of active teaching and learning process, exploration of new knowledge and rigorous but structured training programmes for future engineers, technologist and entrepreneur (Tamin, 2005).

The Faculty of Civil Engineering Experience: Nature of Courses

Civil Engineering programme started to adapt Outcome Based Education (OBE) in their curriculum in July 2006. Currently, FCE is in its second phase of OBE system after the completion of Continual Quality Improvement (CQI) practices in early 2010. In the second phase, FCE had made some improvement on its diploma programme curriculum through course delivery. There are 26 courses offered and clustered into four broad categories which are descriptive-based, analysis-based, laboratory-based and project based. The purpose of clustering is to provide general framework for FCE academic staff to formulate approaches in teaching and learning, and methods of course assessment. Table 1 shows the nature, description and list of courses.

Table 1: Cluster of Courses in FCE

Nature of Course	Description	Courses
Descriptive Based	• Show that they can employ general principles, theories, concepts, and/or formulas from mathematics, science, and engineering problems. For particular problem, graduates should demonstrate that they can: define and describe the pertinent principles and appropriate assumptions, theories, concepts, and/or formulas: explain how they are appropriate to the problem.	Introduction to Civil Engineering (ECM107); Geology (ECG103); Engineering Materials (ECM206); Building Services (ECM216); Introduction to Construction Management (ECM307); Water and Waste Water Engineering (ECW311)
Analysis Based	• Show that they can employ general principles, theories, concepts, and/or formulas from mathematics, science, and engineering problems. For particular problem, graduates should demonstrate that they can: define and describe the pertinent principles and appropriate assumptions, theories, concepts, and/or formulas: explain how they are appropriate to the problem; and demonstrate how they have been applied in the solution of the problem. • Respond positively, to the instruction and guidance they receive in applying the knowledge of mathematics, science, and engineering to the particular engineering problems that they encounter.	Basic Soil Mechanics (ECG203); Basic Solid Mechanics (ECS208); Soil Engineering (ECG213); Mechanics of Structures (ECM228); Basic Fluid Mechanics (ECW211); Basic Hydraulics (ECW301); Surveying (ECG305); Structural Analysis (ECS308), Structural Concrete Design (ECS318); Highway Engineering (ECG304); Basic Civil Engineering Quantities (ECM306); Structural Steelwork and Timber Design (ECS328)

Project Based	• Show that they can acquire skills for project based; i.e: determine their work, conceptualise and organised their work, and time management. • Show that they need to learn to work in community. Able to exhibit good leadership with managerial qualities and can participate actively as an individual and also in a group work. • Show that they can collaborate in multi-disciplinary components, recognise their responsibilities and perform their tasks. • Show that they can summarise effective strategies for dealing with a variety of interpersonal and communication problems that commonly arise. Able to choose the best of several given strategies for a specified problem and justify the choice.	Civil Engineering Drawing (ECM106); Survey Practical (ECG315); Civil Engineering Construction Project (ECM317); Civil Engineering Design Project (ECS316)
Laboratory Based	• Show that they can take an experimental problem and develop a hypothesis, define the pertinent dependent and independent variables, and establish a sound experimental method that will allow them to measure the variables and test the hypothesis. • Show that they can conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations in a laboratory notebook, and describe the procedure clearly • Show that they can measure and record raw experimental data and analyse those data for the purposes of understanding and explaining the data. Graduates should be able to represent data in both verbal and visual forms (equations, tables, graphs, figures, etc) in a way that is both an accurate and an honest reflection of the data • Show that they can render the data meaningfully by discussing the data in the context of the hypothesis and appropriate theories and principles and by stating clearly and concisely, conclusions that can be drawn from the experiment.	Structures and Material Laboratory (ECS218); Hydraulics and Water Quality Laboratory (ECW201); Building Services Laboratory (ECM206); Soil Engineering Laboratory (ECG223)

SIMPLE: A Way Forward

Since some students are having difficulties to complete the programme because they cannot catch up with the programme complexity and multiple skills requirement as it has been a limitation for some students. Thus, a programme for student improvement called PDCA (plan-do-check-act) was initiated in semester July-November 2008 and had been reviewed, improved and changed to Student Learning Improvement Programme (SIMPLE) in early 2010. The programme has been conducted objectively to improve student learning in civil engineering programme. Figure 1 shows a flow chart of SIMPLE implementation.

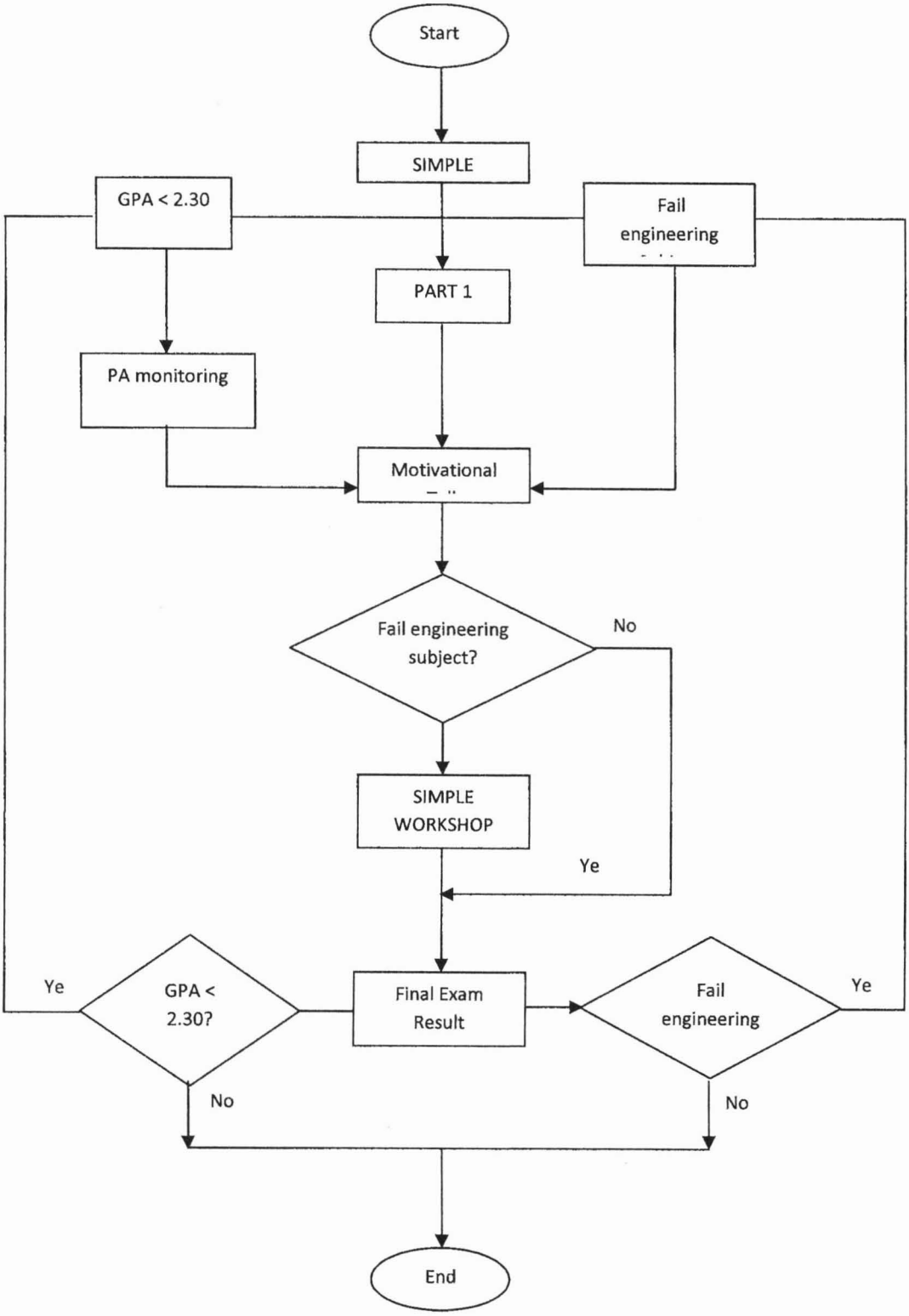

Figure 1: SIMPLE Implementation

SIMPLE was divided into three categories of treatment for learning improvement namely, SIMPLE Motivational talk, SIMPLE Monitoring through Academic Advisor (PA) and SIMPLE Workshop.

SIMPLE Motivational Talk

The objectives of the talk were to motivate students in the aspects of teaching and learning, preparation towards continuous assessment and final examination, advice them on the importance of time management, participate in learning, application of knowledge management, demonstration of generic skills and counsel academic problems. Target groups for motivational talk were the students of semester 1, with CGPA < 2.30 and failure in engineering subjects. Students in Semester 1 were compulsory to participate because their lack of knowledge concerning engineering entails. Yorke and Longden (2008) stated that there are numerous ways to enhance the first year experience of education such as teaching approach has to be focused on student development within the subject areas concerned.

SIMPLE Monitoring through Academic Advisor (PA)

In FCE practice, a specific academic advisor (PA) among FCE members is appointed for all students in order to help and consult them in academic affairs. At the end of academic semester, SIMPLE committee will collect and analyse the students' final examination results. Students with CGPA <2.30 and their PA will be identified. They will be grouped under SIMPLE Monitoring system and their PA will be informed about this. Hence, PAs should monitor their academic performance and advise them to improve their result with at least 2.30 or higher in the next examination. SIMPLE had set a key performance index (KPI) with 30% of targeted group obtaining at least 2.30 or higher in the next examination. If the students are successful in achieving a minimum of 2.30 CGPA, they will be excluded from SIMPLE Monitoring.

SIMPLE Workshop

SIMPLE Workshop is specifically designed to help students who failed in engineering subjects. The module of the workshop was prepared based on the nature of the subject. The students were divided into groups according to the failed subject in the respective sub-discipline. The students were briefed on learning strategies and assessment methods. They were also exposed to examination answering strategies/techniques, common mistakes, important formulas and improvement in learning approaches (i.e. mind mapping, flow chart, picture, etc).

The objectives of this paper were to identify causes that contributed to student failure in civil engineering subject (based on December 2009 – April 2010 final examination result) and to analyse the success of SIMPLE Workshop towards improving students' interests in the civil engineering subjects.

Methodology

1. Student Selection for SIMPLE Workshop

Identification and selection of courses and students for SIMPLE Workshop were based on the final examination result in Semester December 2009 - April 2010. The students were classified into groups as shown in Table 2. Students who failed civil engineering subjects were selected to attend SIMPLE Workshop and the subjects were classified according to its nature i.e. descriptive-based, analysis-based, laboratory-based and project based. Subjects that

obtained more than four (4) failures were selected to be included in the workshop. The module of workshop was prepared based on nature of the subject. The students were divided into groups according to the failed subject in respective sub-disciplines. The students were briefed on learning strategies and assessment methods. They were also exposed to examination answering strategies/techniques, common mistakes, important formula and improvement in learning approaches (i.e. mind mapping, flow chart, picture, etc).

2. Questionnaire Analysis

Questionnaires were distributed to students during the workshop to obtain some feedback on the workshop and to discover reasons they failed the subjects. The data were analysed using Statistical Package for the Social Sciences (SPSS) software version 18.

Results and Discussion

1. Student Selection for SIMPLE Workshop

The results for final examination semester December 2009 – April 2010 were analyzed and summarised as shown in Table 2.

Table 2: Student Failure according to Nature of Course

Division	Nature of courses			
	Descriptive-based	Analysis-based	Project-based	Laboratory-based
Water Resource and Environment System		ECW211 (9 students) ECW301 (1student)		
Construction, Business and Project Management	ECM216 (15 students)		ECM106 (3 students) ECM317 (2 students)	
Geotechnical and Highway Engineering	ECG103 (5 students)	ECG203 (4 students)		
Structural and Material Division		ECS208 (7 students) ECS228 (6 students) ECS318 (3 students) ECS308 (6 students)	ECS316 (2students)	ECS218 (2students)

Table 2 shows that descriptive- and analysis-based courses had greater numbers of failures. These nature of courses required students to understand the basic principles, theories, concepts and formulas for engineering courses as well as demonstrating and applying the basic fundamentals in science, mathematics and engineering in the engineering problems. Thus, these results agree with a study done by Hashim *et al.* (2009) that reported less interests in theory or reading subjects and calculation subjects are the most influential factors contributing to lower results of the students. The subjects involved in the SIMPLE workshop were highlighted in Table 2 according to its sub-discipline.

2. Questionnaire Analysis

Questionnaire analysis was based on the level of effectivenes that was set as in Table 3 below:-

Table 3: Level of Effectiveness

Level of effectiveness	Score
Strongly disagree	1.0 - 1.99
Disagree	2.0 - 2.99
Neutral	3.0 - 3.99
Agree	4.0 – 4.99
Strongly agree	5.0

a) Suitability of SIMPLE Workshop Implementation

The analysis of workshop implementation based on suitability of venue, time and workshop planning is shown in Table 4. The respondents agreed that this workshop was well planned and the implementation of this workshop had been done smoothly and the environment of course venues were suitable/ conducive as its mean values are 4.1351 and 4.1622 respectively. However, the respondents stated neutral for the allocation time (mean value = 3.6757) which explained that the students were unsure whether the time allocated was enough or not, in order for the time to be adjusted according to the suitability of the course and its sub-disciplines.

Table 4: Analysis on the suitability of SIMPLE Workshop Implementation

Evaluation	Mean value
The environment of course venue is suitable / conducive	4.1622
The workshop planning and implementation has been done smoothly	4.1351
The time for every module is enough	3.6757

Table 5 shows the mean value of evaluation on facilitators' performance. It shows that the respondents were satisfied with the content and the teaching aids used in the workshop. The respondents agreed that the facilitator assisted them effectively and provided sufficient course contents.

Table 5: Analysis of facilitators' performance

Evaluation	**Mean value**
Course content e.g task/training/ workshop is sufficient	3.9730
The facilitator is effective and satisfy	4.0000
The teaching aids is sufficient	3.8108

b) Analysis of the Success of SIMPLE Workshop

The success of SIMPLE Workshop was analysed based on the entrance and exit questionnaires. A Paired Sample *t*-Test was carried out to evaluate the success of SIMPLE Workshop. This test was chosen to analyse students' changes before and after they attended the workshop. The confidence level set for this analysis was 95% and the hypothesis used were as follows:-

H_0 = There was no difference before and after the workshop

H_i= There were differences before and after the workshop

Acceptance and rejection of the hypothesis depended on the *P*- value. H_i was accepted and H_0 was rejected when $P \leq 0.05$.

Table 6 shows the *P*-value to evaluate the effectiveness of SIMPLE Programme. Based on the questionnaires, there were significant changes to the students who attended SIMPLE workshop except for the items no. 6 and 9 that had given insignificant values in which its *P*-value is > 0.05. These might happen as some of the respondents did not have proper study skills to improve their performance and they had some negative thinking about their studies.

Table 6: P value for each item to evaluate SIMPLE Programme

No.	Item	*P*- value
1	I am interested in this subject	0.000
2	I am excited to learn this subject.	0.001
3	I am confident of success in the subject.	0.040
4	I clearly understand the subject.	0.001
5	I am able to solve problems related to this subject.	0.001
6	I am using the proper techniques to improve my performance in this subject.	0.067
7	This workshop will help me academically.	0.009
8	I am sure I can get an excellent GPA this semester	0.000
9	I think positively in this workshop.	0.054
10	I manage my time properly.	0.013
11	I am working hard for this subject.	0.030

c) Analysis on Reason of Failure

The analysis was done for the whole sub-disciplines/ divisions. There were sixteen selected (16) causes to the subject failure that normally faced by the students and had been asked among respondents. The mean values of root causes of the subject failure were given in Table 7. The respondents agreed that they had less interest in theoretical/ reading subjects and felt difficult to discard laziness. Meanwhile, the respondents disagreed on the causes of loss of interest in their studies and this showed that they still loved to gain knowledge but due to some factors such as unable to discard the laziness and less interest in theoretical/ reading subject had made them unable to perform well in their studies. A previous study by Hidi and Harackiewicz (2000) highlighted that students' lack of effort will contribute to low academic achievement.

Table 7: Mean value for the Root Causes on the Subject Failure

Cause of Subject Failure	Mean value
I have lost interests in studies	1.7027
I have chosen a wrong course	1.9189
I have love/relationship problem that disrupts my focus on learning	2.0000
There are uncommitted lecturers in teaching	2.0541
Staying out of campus disrupts my focus on learning	2.0811
I have less interest in calculation subject	2.1351
I have a family problem that distracts my focus on learning	2.1622
I really do not know what my personal goals are for the future	2.2162
I am not comfortable with the available classroom/lectures hall (not conducive)	2.2432
I am surrounded by unhelpful friend in my learning process	2.4054

I do not understand what is being taught by the lecturer in the classroom	2.4865
I have chosen wrong peer group (they are also like me)	2.5405
I cannot follow my lecturer's teaching method/technique	2.6486
The tough subject's assignment and test are a burden on me	3.1081
I have difficulties to discard laziness	3.5946
I have less interest in theory/reading subject	3.7297

Analysis for each sub-discipline was also done to identify the causes of the failure. Thus, lecturers or facilitators can figure out the solution to solve the problems. Table 8, Table 9, Table 10 and Table 11 show the causes of subject failure according to the divisions of the Construction, Business and Project Management, Water Resources and Environmental System, Structural and Materials as well as Geotechnical and Highway Engineering respectively. The analysis shown in Table 8 indicates that the respondents agreed with the cause of failure in subject of Construction, Business and Project Management division which was because they had less interest in theoretical/ reading subject with its mean value of 4.5. Other causes that can contribute to the failure were burden in doing assignments and test for tough subjects and difficulty to discard laziness. As the subject nature for Geotechnical and Highway Engineering division is also descriptive-based that requires students to memorise, the reason of failure was also similar to the reason in Construction, Business and Project Management division (Table 11).

On the other hand, mean values for Water Resources and Environmental System and Structural and Materials shown in Table 9 and 10 respectively indicate that the difficulty to discard the laziness was the major cause of student failed the subject. The nature of both divisions is analysis-based subjects. The results showed that the attitude of students contributed a lot in the failure of courses compared to other reasons. A previous study discovered that difficulties in managing study time, laziness, choose wrong peer group and surrounded by unhelpful friends in learning process were the contributing factors in low performance results (Hashim *et al.*, 2009).

Table 8: Cause of Failure for Construction, Business and Project Management Division

Item	Mean Value
I have lost interest in study	1.9
I have chosen a wrong course	1.9
I have love/relationship problem that disrupts my focus on learning	2.0
There are uncommitted lecturers in teaching	2.0
Staying out of campus disrupts my focus on learning	2.1
I have less interest in calculation subject	2.1
I have a family problem that distracts my focus on learning	2.3
I really do not know what my personal goals are for the future	2.3
I am not comfortable with the available classroom/lectures hall (not conducive)	2.5
I am surrounded by unhelpful friend in my learning process	2.5
I do not understand what is being taught by the lecturer in the classroom	2.8

I have chosen wrong peer group (they are also like me)	2.8
I cannot follow my lecturer's teaching method/technique	2.9
The tough subject's assignment and test are a burden to me	3.6
I have difficulties in discarding laziness	3.7
I have less interest in theory/reading subject	4.5

Table 9: Cause of Failure for Water Resources and Environmental System Division

Item	Mean Value
I have lost interest in study	1.6
I have chosen a wrong course	2.1
I have love/relationship problem that bothered me focusing on learning	2.1
I found there are uncommitted lecturer during teaching	2.1
I am staying out of campus that disrupted me focusing on learning	2.1
I have less interest in calculation subject	2.3
I have a family problem that distracted my focus on learning	2.4
I really do not know what my personal goals are for the future	2.4
I am not comfortable with the available classroom/lectures hall (not conducive)	2.4
I am surrounded by unhelpful friend in my learning process	2.6
I do not understand what is being taught by lecturer in the classroom	2.6
I have chosen wrong peer group (they are also like me)	2.6
I cannot follow my lecturer's teaching method/technique	3.1
The tough subject's assignment and test are burden to me	3.1
I have difficulties in discarding laziness	3.3
I have less interest in theory/reading subject	3.6

Table 10: Cause of Failure for Structural and Materials Division

Item	Mean value
I have lost interest in study	1.4
I have chosen a wrong course	1.6
I have love/relationship problem that bothered me focusing on learning	1.6
I found there are uncommitted lecturer during teaching	1.7
I am staying out of campus that disrupted me focusing on learning	1.9
I have less interest in calculation subject	1.9
I have a family problem that distracted my focus on learning	2.0
I really do not know what my personal goals are for the future	2.0
I am not comfortable with the available classroom/lectures hall (not conducive)	2.2
I am surrounded by unhelpful friend in my learning process	2.2
I do not understand what is being taught by lecturer in the classroom	2.4
I have chosen wrong peer group (they are also like me)	2.5
I cannot follow my lecturer's teaching method/technique	2.5

The tough subject's assignment and test are a burden to me	2.7
I have difficulties in discarding laziness	3.3
I have less interest in theory/reading subject	3.8

Table 11: Cause of Failure for Geotechnical and Highway Engineering Division

Item	Mean Value
I have lost interest in study	1.6
I have chosen a wrong course	1.6
I have love/relationship problem that disrupts my focus on learning	1.7
There are uncommitted lecturers in teaching	1.9
Staying out of campus disrupts my focus on learning	2.0
I have less interest in calculation subject	2.1
I have a family problem that distracts my focus on learning	2.1
I really do not know what my personal goals are for the future	2.3
I am not comfortable with the available classroom/lectures hall (not conducive)	2.3
I am surrounded by unhelpful friend in my learning process	2.3
I do not understand what is being taught by the lecturer in the classroom	2.3
I have chosen wrong peer group (they are also like me)	2.3
I cannot follow my lecturer's teaching method/technique	2.6
The tough subject's assignment and test are a burden to me	2.6
I have difficulties in discarding laziness	3.6
I have less interest in theory/reading subject	3.6

Conclusion

Overall, SIMPLE Workshop organised by FCE had successfully achieved its aim. This were proven based on the analysis carried out before and after the workshop. Most of the participants agreed that the workshop had given lots of benefits and awareness to succeed in their academic field. Besides, there were some suggestions by the students to improve the workshop in the future as listed below:-

- The duration of the workshop should be extended instead of 2 hours
- This workshop should also open to all interested students, not only repeaters
- Module/ note of the workshop should be provided to all the participants
- This workshop should focus more on final examination answering techniques

Besides, a solution to the reasons of failure e.g. difficult to discard laziness, no interest in theoretical subject, etc among this group of students has to be discovered. Thus, the solutions can be implemented in teaching method and future workshop . In conclusion, FCE should continue to conduct this workshop in the future since it has given lots of positive impacts on the participants. In addition, there is still hope that this workshop will contribute to the improvement of their final examination result. Besides, we hope that the top management of UiTM Pahang will give their continuous support in order to ensure the success of this kind of academic workshop in the future.

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