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Cawangan Terengganu



FORENSIC INVESTIGATION ON THE HIGH FAILURE RATE OF CIVIL ENGINEERING SOLID MECHANICS COURSE

by

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Outline

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1.0 Introduction

- Solid mechanics (ECS226) is a 3.0 credit hours course and it is a core subject for the program of Diploma in Civil Engineering, UiTM (EC110).
- Students are compulsory to take it during their second semester as it is a prerequisite for other structural course such as structural analysis in forth semester as well as link to the structural design course during fifth semester.
- Course outcomes (CO):
 - i. Students should be able to apply basic understanding of stresses and strains in solid body, beam, shafts and columns;
 - ii. Students should be able to develop solutions for problems related to statically determinate beam.
- Program outcomes (PO):
 - i. students should able to apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to wide practical procedures and practices;
 - ii. Students should be able to identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity.

1.0 Introduction

Table 1: Failure rate of ECS226

Semester	Number of students	Percentage of failure (%)
Mar 2018 - Jul 2018	240	65.0
Sep 2018 - Jan 2019	173	14.0
Mar 2019 - Jul 2019	288	37.0

For semester Sep 2018 – Jan 2019, number of students included those repeaters from previous semester. Most of the students passed the course when they are given a second chance.

2.0 Objectives

1. To investigate the impact of physics and maths scores on the students' performance of solid mechanics.
2. To find out the root causes that led to the high failure rate of solid mechanics.

3.0 Methodology

Analysis of students' result and PO attainment of ECS226

*Establish link between
ECS226 and PHY145
& MAT183*

Comparison of average mark score with Fundamental of Physics (PHY145) and Calculus 1 (MAT183)

Students of EC110

First semester:
PHY145*
MAT183



Second semester:
ECS226

* prerequisite

Quantitative approach survey conducted and data collected from 180 samples.

Section A - Respondent's background
Section B - Factors affecting the score of ECS226.

Investigate perception of students towards the factors affecting their performance of ECS226.

4.0 Results and Discussion

Table 2. Attainment of PO based on assignment, test and final exam

Semester	Number of student	Assignment (100%)		Test (100%)		Final exam (100%)		Attainment of PO (100%)	
		PO1	PO2	PO1	PO2	PO1	PO2	PO1	PO2
Mar 2018 - Jul 2018	240	92.0	92.0	50.0	49.0	45.0	36.0	51.2	45.5
Sep 2018 - Jan 2019	173	81.0	87.0	59.0	51.0	60.0	50.0	61.8	54.0
Mar 2019 - Jul 2019	288	86.0	82.0	57.0	43.0	50.0	32.0	55.7	40.3
Average		86.3	87.0	55.3	47.7	51.7	39.3	56.2	46.6

Overall, attainment of PO1 and PO2 for EC110 students in this course is considered as average and below average. PO1 is about applying knowledge of mathematics, natural science and engineering fundamentals while PO2 is the ability to analyse engineering problems. Thus, the competency of students in applying **mathematics** and **science knowledge** in solid mechanics become the concern that could affect the scores of ECS226.

4.0 Results and Discussion

Table 3. Average mark scores for ECS226, PHY145 and MAT183

Semester	Average Marks (%)		
	ECS226	PHY145	MAT183
Sep 2017 - Jan 2018	-	64.1 (247)	69.4 (256)
Mar 2018 - Jul 2018	39.1 (240)	59.8 (24)	57.4 (34)
Sep 2018 - Jan 2019	59.7 (173)	63.2 (298)	50.3 (299)
Mar 2019 - Jul 2019	48.1 (288)	-	-
Mean	49.0	62.3	59.0

Note: number in () refers to number of students

Result indicates that the students' performance in PHY145 and MAT183 directly linked to their score of ECS226 in the consecutive semesters. Therefore, one of the major causes that led to the poor performance of ECS226 can be confirmed as the lack of ability to apply basic science (physics) and maths knowledge into the problem analysis.

4.0 Results and Discussion

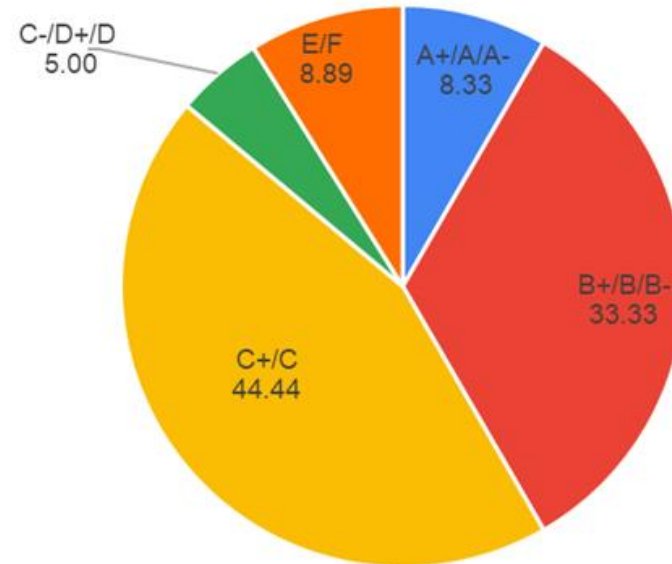


Figure 1. Respondents' grade score in ECS226

- 180 respondents were in their age between 19 to 20 years old
- 61% were female and the rest were male.
- Majority of respondents (59%) passed this course for their first time taken, 39% have taken for second time and merely 2% completed this course at their third time.
- Majority of the respondents i.e. 44% obtained grade C+/C, followed by 33% scored B+/B/B- and roughly 8-9% of respondents scored the highest grade and the lowest grade of ECS226.
- It agrees well with average mark scores as shown in Table 3 achieved by students throughout three semesters

4.0 Results and Discussion

Table 4. Student perception on factors affecting performances of ECS226

No.	Item	Mean Rate	Rank
1.	The syllabus is packed with too much content.	3.15	9
2.	Students had little time to acquire a deep understanding of this course.	3.62	1
3.	I lacked competent in applying the knowledge of mathematics and science in this course.	3.01	13
4.	I had difficulties to visualise the problem solving in this course because they are often complex.	3.44	3
5.	Final exam questions were too lengthy and tedious.	3.45	2
6.	I did not manage to solve all the final exam questions within the given time.	3.43	4
7.	Lecture notes/materials weren't helpful for my understanding about this course.	2.70	15
8.	Teaching method adopted by my lecturer was not able to gain my focus during lecture/tutorial.	3.04	12
9.	Lecturer was not approachable, ever ready to provide academic guidance and accessible for discussion.	2.56	18
10.	Most of the time, i lost concentration during lecture/tutorial.	3.14	10
11.	I lacked reading habit and reading plan for this course.	3.18	7
12.	I was fear to this course and i had no confidence throughout the semester.	3.30	6
13.	I was lazy to put more efforts for this course.	2.68	17
14.	I was not well-prepared for the final exam.	3.35	5
15.	I seldom took initiative to try other problem solving on top of the exercises given by lecturer.	3.17	8
16.	I felt reluctant to ask question or seek help if I don't understand or cannot solve the problems.	3.06	11
17.	I had no buddies to study together for this course.	2.40	19
18.	I had no interest to study this course.	2.19	20
19.	I think the equipment space for teaching and learning was not conducive.	2.69	16
20.	The method of assessments was not appropriate to address students' performance in this course.	2.98	14

4.0 Results and Discussion

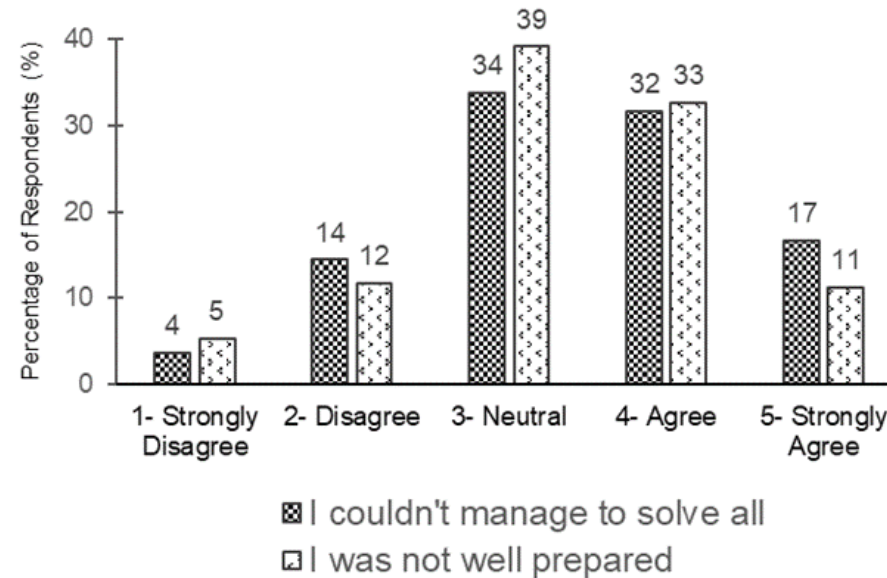


Figure 2. Responses for item 4 and 6

Item 6 (I did not manage to solve all the final exam questions within the given time) and 14 (I was not well-prepared for the final exam) are inter-related as shown in Fig. 2.

34% and 39% of the respondents have chosen to be neutral (neither agree nor disagree), probably due to the poor memory of their past experiences.

Nearly half of the respondents (49%) have admitted that they did not manage to solve all the final exam questions within the given time (Fig. 2). Also, nearly the same amount of the respondents (44%) agreed that they were not well prepared for the final exam.

4.0 Results and Discussion

Table 5. Respondents for item 9, 17 and 18

Likert scale	Percentage of respondents (%)		
	Item 9 Lecturer was not approachable	Item 17 I had no buddies to study	Item 18 I had no interest to study
1- Strongly Disagree	14	18	27
2- Disagree	35	35	37
3- Neutral	36	37	27
4- Agree	11	9	9
5- Strongly agree	4	1	1
Total	100	100	100

The least relevant factors that affecting the performance of ECS226 are recognised as item 9, 17 and 18 (Table 4). Notably, nearly 50% of the respondents were in the disagreement and strong disagreement to the statements about the lecturer was not approachable, I had no buddies to study, and I had no interest to study (Table 5).

5.0 Conclusion

The attainment of program outcomes for this course is unsatisfactory in which program outcome 2 (PO2) did not meet the minimum requirement of 50%. Conclusions can be drawn as:-

- i) Poor performance of students in solving solid mechanics problems are likely related to their average performance in fundamentals of science (physics) and maths (average mark scores of 62.3% and 59% in physics and maths, respectively).
- ii) Most of the students agreed that due to the limited time to acquire a deep understanding of this course, they could not perform well in solid mechanics.
- iii) Students perceived that they have interest to learn solid mechanics, lecturers were approachable and they had buddies to study with. Students aware of their responsibilities and they just need to be more positive and aggressive when they are difficulty in understanding the course. Therefore, the problem of high failure rate is feasible to be solved provided both lecturers and students making efforts in striving the success of this course.

Thank you for your attentions.

If you have any queries, please contact:

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