

ANALYSIS OF UNDERSTANDING COMPUTATIONAL METHODS STUDENTS' AT UNIVERSITI TEKNOLOGI PETRONAS

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Abstract: *Computational Methods subject is offered to students in Year 2 Semester 1 at Universiti Teknologi PETRONAS (UTP). Throughout this subject, the students are tested on their skills in various numerical techniques to solve many scientific problems by using MATLAB programming. Since this our early study, we only have one data set comprising 365 respondents for September 2017 semester. We give questionnaires to all students, but only 223 students are participated. We use basics description statistics and data analysis to present the finding of this study. Based comparison with OBE for the final exam results of the subject; we found that students are less familiar with Chapter 7 than the other chapters. Some action plans are suggested at the end of the study.*

Keywords: *Computational Methods; Data Analysis; Descriptive Statistics; Data Science.*

1. Introduction

The progress of computer methods for the solution of scientific and engineering disciplines was one of the boundless in the Industrial 4.0 era. This can be achieved through some innovative Teaching and Learning (T&L) techniques in mathematical modelling and numerical methods with mathematical software such as MATLAB, Python, Octave and Mathematica. The students will be taught theoretically and at the same time they must be able to solve the numerical problem by writing their own coding in that software. Each topic/chapters will have its own assessment, in order to measure the understanding of the students and perhaps, to prepare an action plan to improve students' performance. Some recent studies in Mathematics education include Ismail et. al. 0 and 0 Khalid et. al. 00. They all try to analysts and study some common problems in students' learning in subject Mathematics.

The Computational Method subject is offered to students Chemical Engineering, Petroleum Engineering, Electrical Engineering and Computer Engineering. In this subject, there are seven subtopics: Error Analysis, Roots of Equations, Linear Algebraic Equations, Interpolation, Numerical Differentiation and Integration, Numerical Methods for Ordinary Differential Equations, and Partial Differential Equation. Additionally, students are also given knowledge about the use of MATLAB software to solve numerical problems. Some problem based learning (PBL) is given to the students involving some MATLAB programing.

2. Methodology

The Framework is divided into two stages:

- (1) Use google form to collect the data at the end of September 2017 Semester.
- (2) Use data science tools to extract the information (big data analytics).

Data Collection

The data is collected from set of questionnaires given at the end of Semester September 2017. Only 223 students have been participating in the surveys. Table 1 summarize the total of respondents with respect to the respective program.

Course	Number of Students
Chemical Engineering	98
Electrical Engineering	23
Petroleum Engineering	102

Table 1: Number of Students for Every Courses

The students are required to answer set of question by choosing the appropriate scale based on a Likert's scale such as 5 (Excellent Understanding), 4 (Good Understanding), 3 (Medium), 2 (Poor Understanding), and 1 (Very Poor Understanding). Questionnaires are divided into 3 sections consist of Section A, Section B and Section C and in total there are 45 questions. To extract the data, we use some **data science** tools since basically the data are big. All the data are collected from Google Form. We use basic description statistics (in term of percentage) and data analysis (using Microsoft Excel) to present the finding of the present study. OBE software is used to compare the results and to provide some insight as well as conclusion to the study.

3. Results and Discussion

Basically, we divided each chapters to several sub-chapters. For instance in Chapter 1 there are 6 sub-chapters. All students must answer all 6 questions for Chapter 1 and so on. Then we calculate the percentage as well as the average of each rank based on Likert's scale and presenting the results into Pie Chart.

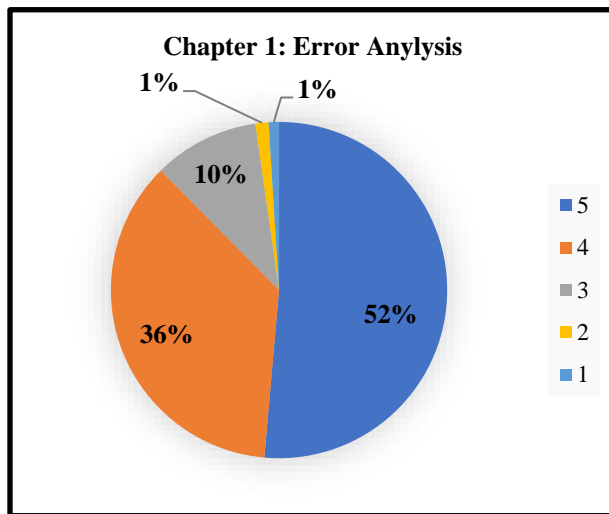


Fig. 1: Pie Chart for Chapter 1

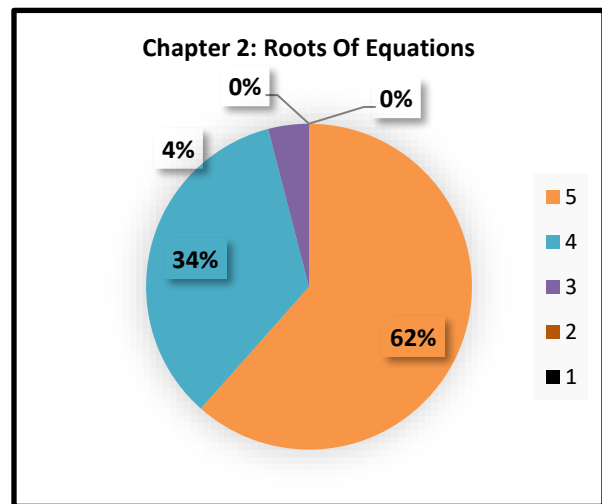


Fig. 2: Pie Chart for Chapter 2

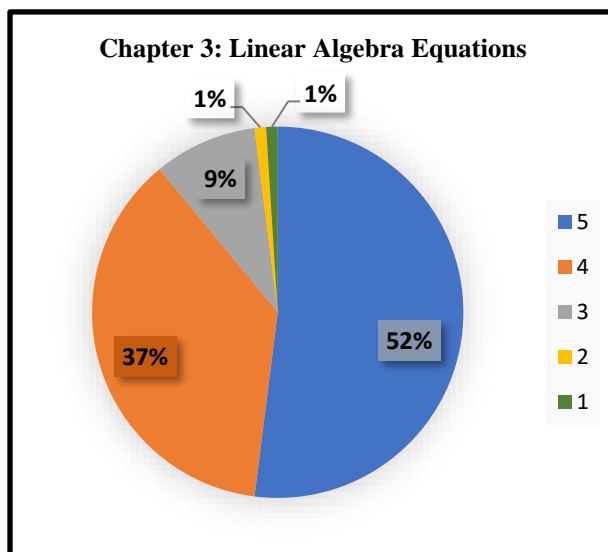


Fig. 3: Pie Chart for Chapter 3

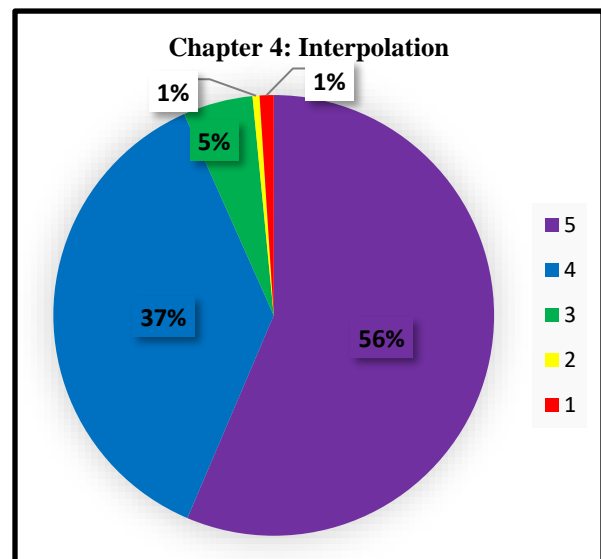


Fig. 4: Pie Chart for Chapter 4

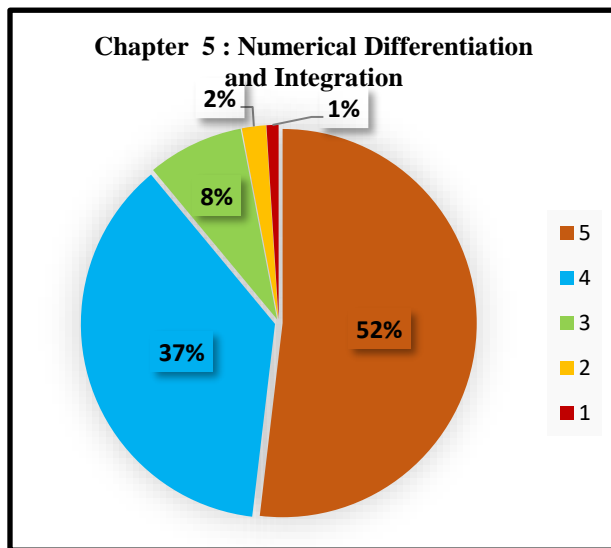


Fig. 5: Pie Chart for Chapter 5

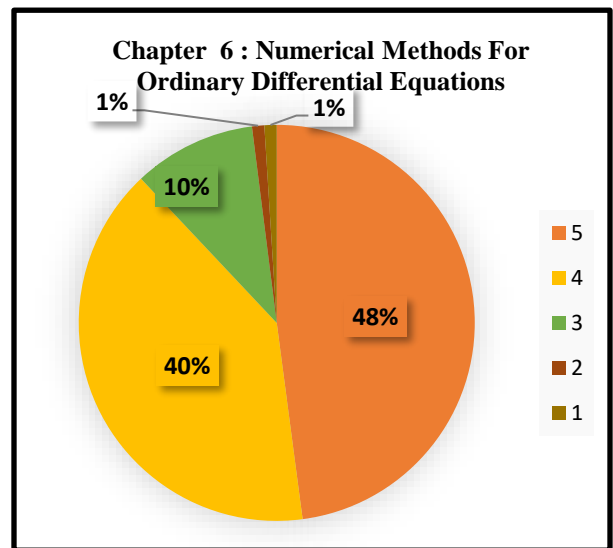


Fig. 6: Pie Chart for Chapter 6

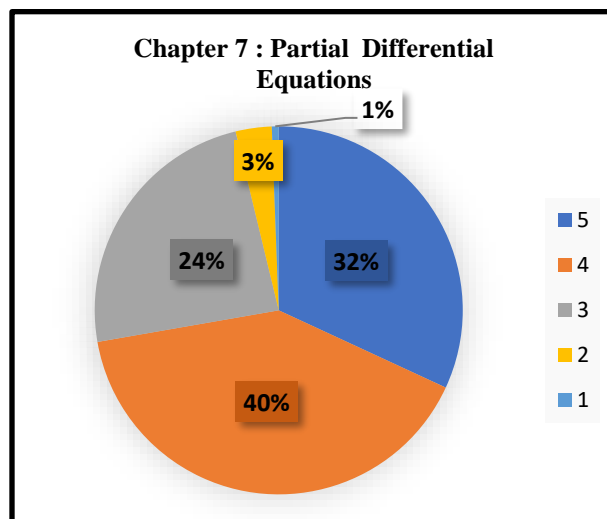


Fig. 7: Pie Chart for Chapter7

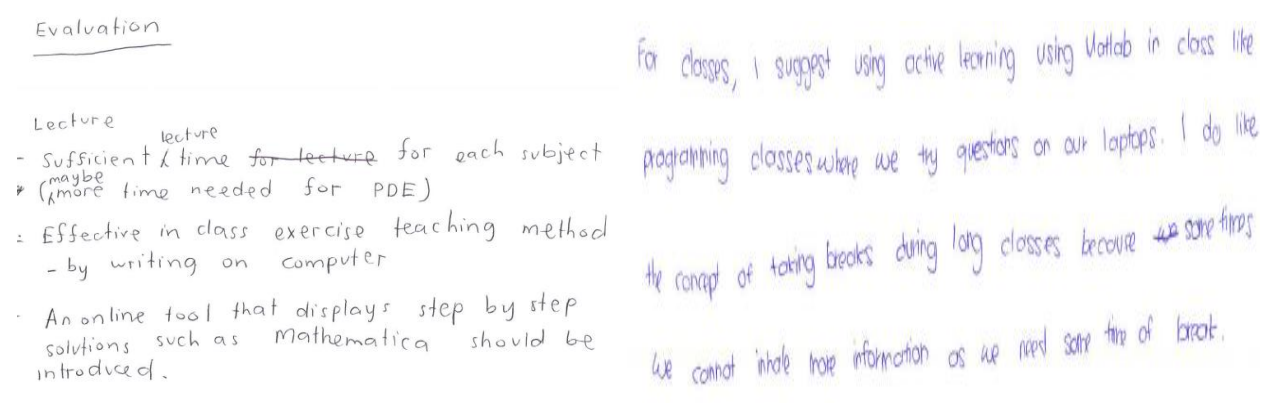


Fig. 8: Excerpts from Student's reflection during lectures

Based on the survey that have been conducted at the end of September 2017 semester as well as some reflection from the students, we have notified that the students did express their concern on Chapter 7 as well as MATLAB programming. Furthermore, based on OBE software at UTP, we also found that, the results for PDE (Question No 5 in the Final Exam) also shows that around 32% students have problem in the topics. Thus some action plan is proposed such as provide step by step explanation to the subject and get instant feedback from the students by giving them online exercises during lectures. Active learning activities also can be used that should be incorporated with latest T&L technology. This will improve students' understanding especially for May 2018 and September 2018. The other chapter, students seem have less problem.

4. Conclusion

From this early study as well as UTP OBE software, we obtain some idea and insight on students' understanding about the subject matter. We also did apply some basic data science tools in order to extract information from the collected data i.e. thousands. This data also can be considered as a big data. Thus some basic concept and method in big data analytics can be used to analyst's further. This will enable us to prepare some predictive continuous quality improvement to the Computational Methods course. This is our main research in the future. Furthermore, our main intention in the forthcoming semester is to integrate the T&L with some active learning activities as well as online assessments (quiz, assignment, exercises) via outcome based education (OBE).

5. Acknowledgement

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6. References

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