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UiTM Cawangan N. Sembilan, Kampus Seremban

STATISTICS EASY TOOL (SET)

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ABSTRACT

The concept of statistics which requires firm understanding of the application and memorizing formula is not easy for new learners, especially for social science background undergraduates. With existing learning tools, students still have problems utilizing it because they tend to forget formulas and the steps that need to be carried out to produce the analysis. This study explores the learning tool needed by undergraduates who are learning statistics courses. This study also aims to develop an interactive learning tool called Statistics Easy Tool (SET) based on Microsoft Excel on descriptive analysis and linear regression analysis. In this study, it is found that most of the students have difficulties understanding and memorizing the steps to extract value from a calculator by only watching the video or guideline given. Result also indicates that 85.5% of the students agree that they need one tool that helps find all values just in one-time data entry and most of them need a tool that provides an explanation about value calculated from the analysis. SET can be used as a powerful learning tool to undergraduates to explore abstract concepts in statistics, to run analysis with just one click and definitely to make learning statistics more interesting and effective. Moreover, it has the potential to be commercialized to undergraduates especially for non-science undergraduates as well as educators in Universiti Teknologi MARA.

Keywords: Microsoft Excel, Calculator, Regression, Descriptive

1. INTRODUCTION

During this Covid-19 pandemic, learning tools play an important role in education, especially in adapting to an open and distance learning (ODL) method. A learning tool or teaching tool is a tool that facilitates learning and teaching purposes through interactions between system and individual. It also acts as a catalyst for students to engage more in educational activities and helps students to be effective learners. Teaching tools have been found to be effective for learning (Gregory and Bannister-Tyrrell, 2017). The use of spreadsheets in Microsoft Excel as a learning tool was the key to enhancing students' higher-order thinking skills and mathematics concepts (Agyei, 2013). Many studies have been done to explore learning tools such as the use of Spreadsheet (Chaamwe and Shumbas, 2016) for teaching and e-learning to teach statistics courses.

In a statistics subject, traditionally students will learn the theory and practice for certain topics. Lecturers will explain the theory and give a set of problems as a practice. For example, in descriptive statistics and linear regression topics, the use of learning tools such as scientific calculators enables the students to produce important values for analysis. However, the students need to memorize formulas and steps in using the scientific calculator which is not covered in the syllabus. Besides that, lecturers still need to find time to show and explain step by step to produce the important values. Students also have been provided with printed guidelines and videos. However, different calculators have different functions and steps to fulfill the need to do analysis. Figure 1 shows step by step how to use a scientific calculator to enter data for two different models. The crucial parts were how to extract the information from the data entered. Since different models have different steps, it is tough for the lecturer to explain both at the same time. Imagine that there are other models used by students. Either lecturers have to find the solution or students, it can also make the learning session complicated.

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Figure 1. Step by step on how to use a scientific calculator to obtain descriptive statistics.

Table 1 summarizes the symbols for a statistic or important value based on two different scientific calculator brands. Students have to memorize this symbol and formula as is not provided in the calculator. It can be seen that students have to memorize too many steps, processes and symbols to extract important values.

Table 1. Descriptive statistics symbols for two brands of scientific calculator

Information	**Symbol Used**	
	Model: *fx-570ES PLUS*	**Model: *fx-570MS***
Sample Mean	$\overline{X}$	$\overline{X}$
Population Standard Deviation	σx	$x\sigma n$
Sample Standard Deviation	sx	$x\sigma n-1$

Moreover, as a requirement in the course's assessment, students are assigned with group projects. In this project, students need to implement the theory that they learned in class and run an analysis such as descriptive statistics and linear regression which requires them to use statistical software to produce the result. In this ODL period, students do not have access to the software which is only available in the computer lab. Students need a tool to run the analysis that can be accessed anywhere and anytime to complete their group project. Thus, an interactive learning tool called Statistics Easy Tool (SET) is introduced and developed based on Microsoft Excel to make learning statistics more interesting and specifically to facilitate students to perform analysis of descriptive statistics and linear regression. The data analysis is made easy since users only need to enter data and data analysis will be done automatically with just one click. Users do not have to memorize specific steps to produce important values. This study is intended to explore the learning tool that can help students to produce important values and learn statistics in a more fun way.

2. MATERIALS AND METHODS

The methodology to be used in this study consists of a few phases. This study begins with a preliminary study that is to identify the needs of learning tools among undergraduates enrolled in statistics courses. Next, a learning tool called SET is developed. Finally, a post-study is carried out to implement the learning tool for undergraduates.

In a preliminary study, the sample consists of 69 undergraduates who enrolled in STA404 subjects from the Faculty of Administration and Science Policy of Universiti Teknologi MARA Cawangan Negeri Sembilan, Seremban Campus. A survey was distributed through google form which includes questions on experience of using calculators as a main tool in calculating important values and the problem students are facing and the need for learning tools to learn statistics. The data were analysed using descriptive statistics (percentage).

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Microsoft Excel software was used to develop SET. The first step in the developing process begins with identifying topics and transferring all the formulas into Microsoft Excel. Then the interface of the spreadsheet has been developed to make it interactive. Two topics that are covered in SET are descriptive statistics and linear regression since these topics require students to use scientific calculators and the most common analysis used by students in group projects.

Descriptive statistics is a summary statistic that describes the characteristics of a data set. Data can be summarized and divided into two measures of central tendency and measures of variability. Measures of central tendency are used to describe the centre of the data and it includes the mean, median and mode. Measures of variability include variance, standard deviation and skewness. It can be used to describe the distribution of data, such as left-skewed, normal distributed and right-skewed. Linear regression is a statistical approach used to model a dependent variable and independent variables. The equation of the linear regression model can be written as

$$y = a + bx$$

Where y is the dependent variable, x is the independent variable, a is the intercept and b is the coefficient of the independent variables. It can be used to predict the independent variable given the value of the independent variable. Coefficient of dependent variable is explained how much changes in dependent variable can be affected by the changes of independent variable by one unit.

3. RESULTS AND DISCUSSION

The traditional way of gain information of descriptive analysis like mean, variance, standard deviation and all information needed in doing regression analysis such as $\sum x, \sum x^2, \sum y, \sum y^2, \sum xy,$ and regression equation are by using a calculator. The first thing students need to do is to understand how to enter the data by using the MODE setup. Students were given a video and listed step to follow to enter an input and extract the output. However, different calculators will have different functions which means there is no common step of generating all values needed. There are a lot of steps to understand thus memorizing it. In order to understand the level of difficulties faced by students, a set of questionnaires was distributed based on the experience of using a calculator as the main tool. The result in table 2 shows that more than 50% of students have difficulties in understanding the step by only watching video, memorize the step and function to be used. Moreover, 76.8% of them have trouble if they need to use a different model of calculator since the steps were different. Re-learn and memorize again will take a long time. Other than that, more than 60% of them cannot differentiate between population and sample mean, population and sample standard deviation since there are only symbols appear in calculators and students getting more confused since different calculators have different symbols. There are also some restrictions by using a calculator since the values are not available, for example, the value of variance and doing prediction in regression analysis.

Table 2. Student's experience of using calculator

Question	Difficult (%)	Easy (%)
Remember the steps to key in data	56.5	43.5
Remember the steps to find all values (i.e. mean and standard deviation)	50.7	49.3
Understand how to key in and find value based on video	52.2	47.8
Remember which function to be used on the calculator	52.2	47.8
Learn new steps and find values using different model of calculator with different function	76.8	23.2
Differentiate between population mean and sample mean	66.7	33.3
Differentiate between population standard deviation and sample standard deviation	60.9	39.1
Calculate value for variance since variance is not available by using a calculator.	71.0	29.0
Calculate all important values at once	69.6	30.4

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3.1: Statistic Easy Tool

Despite the calculator being a great tool previously, this study came out with new innovative tools that will help increase the motivation of the student in statistics courses. This idea arose after several questions were asked to students to find out their needs in solving problems in certain topics in the subject of statistics. Figure 2 below shows several questions asked to students and the result indicates that 85.5% of the students agree that they need one tool that helps find all values just in one-time data entry, moreover 79.7% of them need a tool that does not force them to memorize all the steps in extracting value. Additionally, more than 85% of the students need a tool that also provides the explanation and finds value in just one click only.

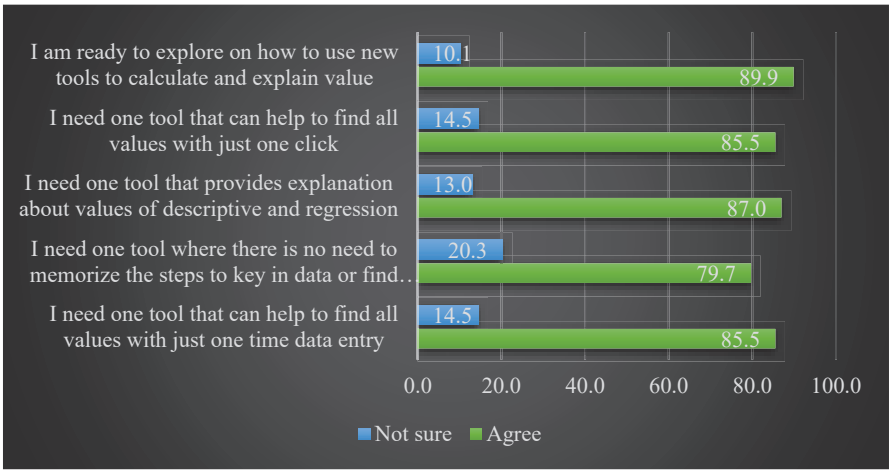

Figure 2. A list item needed for new tools

Lecturer believed that understanding subject matters help students to score in subjects instead of memorizing. SET comes with a detailed explanation of the topic interest rather than using symbols. Using this SET repeatedly will make students comprehend while recognizing symbols inadvertently. Indirectly students will be able to improve their performance in examinations. Almost 90% of them are ready to explore new tools that can help them during the study. Therefore, Statistic Easy Tool provides students an explanation for each term used and how to enter data correctly. After they understand the topic and start to give input, there is no other step included. Students just need to click one button and all the value needed will appear. This tool also helps them to do simple analysis which in turn helps them master the way to explain the numbers given.

4. COMMERCIALISATION

This learning tool has the potential to be commercialized to undergraduates and educators not only in Universiti Teknologi MARA Cawangan Negeri Sembilan but also other branches and other interested learners in secondary schools or other universities. It can be used for learning and teaching activity in class as well as for ODL and also for research. By using SET, it would help new learners, especially undergraduates who are taking statistics courses, to run an analysis with just one click without needing to write complex code. Since SET is in the form of a spreadsheet, it is very practical and applicable where users can access it anytime and anywhere. Moreover, since it is user-friendly it can be used for new learners who are interested to learn statistics.

5. CONCLUSION

SET is the best answer for the student who mostly has tough experience of using calculators as a main tool in topic descriptive and linear regression models. Since the lecturer cannot control the calculator model type being used by students, SET is the best solution for all lecturers and students to make learning more organized and more interesting. Since almost 90% of the students are ready to learn with the new tools that provide all needed in doing analysis, it is recommended that SET will be introduced

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as a new teaching aid that will help all lecturers. The researcher intends to conduct an efficacy study before and after the students use the SET for the next study.

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