PROCEEDINGS

International Conference
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

Theme:

"Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0"

Surabaya, 11-14 July 2018

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UNESA
Faculty of Engineering
Universitas Negeri Surabaya
2018

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Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

Theme:

"Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0"

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PREFACE

All praises be to Allah SWT, so that the 2018 International Conference of ***Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia*** **(APTEKINDO)** could be held in Surabaya during 11-14 July 2018. APTEKINDO International Conference isconducted biennially in which this year host is Faculty of Engineering, State University of Surabaya. Therewere sixteen colleges attending this year Conference, most of which were former Institutes of Teacher's Education (LPTK).

This year theme is *"Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0"* aimed to respond to the development and acceleration of the industrial revolution 4.0 that has become the most discussed issues inmany countries. Industrial revolution connects machines with internet systems. In regard to facing such phenomena, Indonesian government through the Ministry of Industry has launched "Making Indonesia 4.0", of whichthe program focuses on industries that are driving the development of the industrial revolution 4.0 such as food and beverages, electronics, automotive, textiles and chemicals. To achieve better results of the program actualization, vocational education helps to prepare compatible and competitive workers for the areas of the aforementioned industries. Henceforth, numbers of Conferences, conventions, and meetings amongIndonesian practitioners in FPTK / FT-IPTK need to be held to initiate ideas in strengthening the role of LPTK within industrial revolution 4.0 era.

The Conference's proceedings contain 121 research papers and ideas that are relevant to the following nine sub-themes: *Technical and Vocational Teacher Competencies, Technical and Vocational Education Curricula, Technical and Vocational Education Models, Technical and Vocational Education Evaluation, Technical and Vocational Education Policy, Public-private Partnership in Technical and Vocational Education, Technical and Vocational Education Management, Technopreneurship*, and *Competencies Certification*.

Finally, all the committees send their gratitude to the participating speakers and all parties who support the run of the Conference. They also apologize for any inconvenience and wish a better undertaking event next year.

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Spreadsheet Based Module for Statistics Course

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Abstract— **The development of spreadsheet based Statistics course modules that are innovative and applicable is inevitable. Research was started by developing draft of spreadsheet based Statistics modul. The draft has been validated; the next stage of this research would be assessment or validation of the material prior trial. The research was objected both to examine the expert judgment to draft spreadsheet-based statistical modules and to revise the draft based on the recommendation. The students response after using the module showed that most of them agree that the spreadsheet-based module can simplify (60%), save time (66.67%) as well as help students study independently (46.67%) in statistics learning.**

Keywords—module; spreadsheet; statistics; learning; course

I. INTRODUCTION

A number of factors that determine the success of the learning process at a university is the existence of teaching materials. Module is among the type of teaching materials. A learning module is an organised collection of course material in one location. It consists of a series of learning activities designed to help students achieve the learning objectives. Another definition of module given by Purwanto [1] stating that module is a teaching material that is designed systematically based on a particular curriculum thus enable students study independently. Rizkiawan [2] stated that the use of modules has a high effect on student learning outcomes. The statement is supported by Ali, et. al [3] who concluded that teaching using modules are more effective than traditional methods because students are given learning opportunities according to their ability level and needs. The existence of modules in learning is expected to be a learning resource that is able to overcome the problem of time limitations, resources and diversity of students' competencies [4].

Some studies showed that the use of modules in learning could improve student learning achievement. Mujiati [5] concluded that the material on the module could help students in developing thinking skills, problem solving, as well as intellectual skills. Similar conclusions were found by Wicaksono, et.al. [6] that the use of modules on thinking pair share (independent thinking, pairing, sharing) has a significant effect on understanding concept of learners. Thus, it is expected to improve the achievement students.

For the Statistics Course given to many courses at university, the modules can be spreadsheet based. Spreadsheet software is widely used in the field of education. The course involving table calculations such as accounting and statistics could use spreadsheet software. Spreadsheet software is increasingly being used for statistical analysis due to its ubiquity [7]. A common application of the spreadsheet is in the organisation, presentation and analysis of data [8].

Spreadsheet could assist students in learning critical aspects of algebra more effectively. Student difficulties in algebra are long-standing, with teaching approaches that tend towards the imposition of the algebraic method, and accompanied by an over-emphasis on the manipulation of symbols, appearing to be only successful for the minority of students. One way that seems to help students move from a non-algebraic to an algebraic approach is through work with spreadsheets. The use of the tool is helpful in learning more readily compared to those by using paper and pencil. General mathematical relationships could be expressed using the symbolic language in the spreadsheet environment. Spreadsheet provides a useful educational environment. This is due to statistical concepts and procedures using a spreadsheet may be more transparent to students, allowing them to look inside the "black box" of statistical techniques. Moreover, students could access the spreadsheet software at home [9]. Statistical spreadsheets also simplify teachers in preparing templates in advance for students to follow for certain calculations. The tool offers real time update of calculation when data is changed. The spreadsheet program package also equipped by general statistical calculations [10]. Some important topics in statistics subject could be covered by statistical spreadsheet, from descriptive statistics to multiple regressions.

Although the availability of learning module is of important, however not all courses are equipped with modules including Statistics courses. The unavailability of a source of learning in the form of statistical modules complicates students in understanding and doing calculations to get the results of the formulas. To facilitate it, tables are needed to elaborate the long formulas and can be easily applied to spreadsheet program packages.

The development of spreadsheet based Statistics course modules that are innovative and applicable is inevitable. Research was started by developing draft of spreadsheet based Statistics module. The draft has been validated; the next stage of this research would be assessment or validation of the

material prior trial. The research was objected both to examine the expert judgment to draft spreadsheet-based statistical modules and to revise the draft based on the recommendation. The students' response towards draft of module was also considered.

II. METHOD

The research was initiated by analysing the curriculum analysis phase followed by needs analysis and initial validation. The development procedure was done following that of Gall, et.al. [11] i.e. (1) conducting preliminary research and information collection, 2) planning, (3) developing the initial product, (4) conducting initial trials, (5) making revisions to the main product, (6) conducting primary field test, 7) revisions to operational products, (8) conducting operational field tests, (9) performing the final product (10) Disseminate and implement the product.

Seven draft modules that have received initial validation with the module title: statistical data, data normality, central tendency, correlation, regression, research instruments, and data interpretation. In this following stage, the validated seven drafts of modules were then revised, and assessed or validated by expert. Assessment or validation of experts was done by five aspects of assessment: preliminary aspects, learning, content, tasks, evaluation, assessment, and summary [12]. Each aspect of the assessment consists of several items to be scored using a Likert scale scale of 5. The average scores and categories of the assessment results on each aspect was determined.

Table I. Criteria of the rating category [13]

Scale	Score Interval	Category
5	$x > 4.08$	Excellent
4	$3.36 < x \leq 4.08$	Very Good
3	$2.64 < x \leq 3.36$	Good
2	$1.92 < x \leq 2.64$	Fair
1	$x \leq 1.92$	Poor

The validated modules were then tested to two small groups of students. The third stage was field trials involving more students. The final step at this stage was development of a prototype of spreadsheet-based statistics module.

The population was thirth semester students of Home Economic Department Universitas Negeri Semarang, in total of 184 students. From 6 classes, sample was taken using the cluster method by taking two classes at random. From each selected class 30 people were taken as samples for limited trial participants that the total samples were 60. The first glass was treated by giving module while the second group as control was not given module in the statistic class. Data was collected by evaluation test result in each module using scale of 100. The data first was descriptively analysed by descriptive statistic (mean and standard deviation) from each group on each module.

The average value of each module as well as total module of first and second group was tested by t test. The mean of first group was higher than that of second group if $t > t_{table}$

III. RESULTS AND DISCUSSION

Based on expert scoring, the average score in total was 3.976. The highest score was 4.35 for content aspect while the lowest score was 3.71 for summary aspect, as given in Table II.

Tabel II. Scoring Results of Expert

No	Scored Aspect	Average Score
1	Introduction	4.15
2	Learning	4.01
3	Content	4.35
4	Task, evaluation, scoring	3.76
5	Summary	3.71
	Average Score	3.996

It is therefore, in average, this statistics module was categorised as excellent, since the score was $x > 4{,}08$. The first aspect, i.e introduction composed of 5 scoring items, got average score of 4.15 in which the highest score was 5 and the lowest score was 3.39. The second aspect, i.e. learning had 10 scoring items with average score of 4.01 while the highest and lowest scores were 5 and 3.36, respectively. The overall statistics module of learning was considered to be very good for having score of $3{,}36 < x \leq 4{,}08$. The third scoring of module was content. This part was able to obtain score of 4.35. Using 7 scoring items, content had the highest score of 5 and lowest score of 3.76. It meant that the overall aspect of content was categorised as excellent as having item score of $x > 4{,}08$. For the fourth scoring aspect, task, evaluation, scoring, 6 scoring items reached average score of 3.76. The highest score was 5 and the lowest score was 3. With average score of $3{,}36 < x \leq 4{,}08$, this fourth aspect was concluded as very good. The latest aspect was summary which was evaluated by 4 points of assessment resulted in very good category by reaching average score of 3.71. The highest and lowest score were 5 and 2.92, respectively.

The scoring results of expert for the available modules gave the highest average score for first module of statistics data and the lowest score for data normality as given in table III. The table shows that all module are categorised as excellent and very good.

Tabel III. Scoring Results of Expert Based on Module

Module	Scored Aspect	Average Score
1	statistical data	4.35
2	data normality	3.39
3	central tendency	4.27
4	correlation	4.19
5	regression	4.09
6	research instruments	3.51
7	data interpretation	3.64
	Average Score	3.92

In line with expert assessment, a number of recommendations were given as reveal from Table IV.

Table IV. Summary of Revision in Each Aspect

No	Scored Aspect	Average Score
1	Introduction	6
2	Learning	7
3	Content	4
4	Task, evaluation, scoring	13
5	Summary	14

Average Score	8.8

Based on Table II about the results of expert assessment and Table IV about recapitulation of revision recommendations, it can be seen there was a relationship between scoring results and the number of revision. Higher scoring results led to less number of revisions. It was content part which reached the highest scoring results (4.35), that part got the lowest number of revisions. While summary as the lowest score got the highest number of revision. Suggestion of improvement was given by the expert on Introduction aspect about the addition of prerequisite in each module. Improvements have been made by adding statistical data modules as the basic skills before studying data normality. In module III, it was mentioned that student has to understand data normality before starting central tendency. Correlation module has to be initiated by mastering central tendency. Similarly, module V (regression) could only be studied after student understanding module IV (correlation). The basic skills of research instruments are module I to V. Before studying data interpretation, all the previous modules have to be mastered.

In the learning aspect, experts recommended the clarity of user target of the modules. The experts also suggested the improvements of the content aspect, particularly in terms of the scope (breadth and depth) of the content in each module. Another suggestion on the content aspect was related to the item of clarity and adequacy of the samples. Furthermore, improvements on the aspects of task, evaluation, scoring suggestions of given in terms of difficulty level in each module. Finally, the expert suggested the improvements to the summary aspect especially in terms of clarity of module, comprehensively. References for the whole modules needed to be completed.

Using the revised modul, limited test was carried out and resulted in the average of first group (given module) for statistics data x_1 = 82.37, higher than that of second group (control, wasn't given module) x_2 = 72.59. It showed that the average score of given module-group was significantly higher than that of non-module group. The overall results are showed in Table V and Table VI.

Table VI reveals that all modules gave significant difference for group I and group II. It meant, the results of those of given module group were significantly different with those of non-given module group. The results of limited trial showed that in average, group I got x_1 = 81.869, higher than that of group II x_2 = 73.076. The ttest obtained t of 2.28, higher than t_{table} of 1.67, so the in average, the score of group I was significantly different than group II. The spreadsheet based modules resulted in better performance of students.

Table V. Test Results of Modules

Module	Group I		Group II	
	x_1	s_1	x_2	s_2
I	82.37	3.29	72.59	4.38
II	83.54	4.18	73.18	4.25
III	82.97	3.39	71.82	4.72
IV	81.46	4.29	73.89	5.29
V	79.39	3.48	72.38	4.36
VI	80.16	4.48	74.39	5.26
VII	83.19	4.59	73.28	3.47
Average	81.869	3.957	73.076	4.533

Table VI. t_{test} Results of Modules

Module	t	t_{table}	Keterangan
I	2.39	1.67	significant
II	1.91	1.67	significant
III	1.69	1.67	significant
IV	1.98	1.67	significant
V	1.78	1.67	significant
VI	1.87	1.67	significant
VII	2.09	1.67	significant
Overall	2.28	1.67	significant

Table VII. Distribution of students score in group I

Category	Interval	Frequency	%
A	86-100	8	26.67
AB	81-85	12	40
B	71-80	4	13.33
BC	66-70	6	20
C	61-65	0	0
CD	56-60	0	0
D	51-55	0	0
E	≤ 50	0	0
		30	100

Table VIII. Distribution of students score in group II

Category	Interval	Frequency	%
A	86-100	2	6,67

AB	81-85	2	6,67
B	71-80	10	33,33
BC	66-70	16	53,33
C	61-65	0	0
CD	56-60	0	0
D	51-55	0	0
E	≤ 50	0	0
		30	100

Furthermore, in this study, response of group I was also examined. The results are shown in Table IX.

Table IX. Students response: spreadsheet based module fascilitate statistics course

Category	Frequency	%
strongly agree	12	40
agree	18	60
neither agree nor disagree	0	0
disagree	0	0
strongly disagree	0	0
	30	100

Table X. Students response: spreadsheet based module saving time of statistics learning

Category	Frequency	%
strongly agree	10	33.33
agree	20	66.67
neither agree nor disagree	0	0
disagree	0	0
strongly disagree	0	0
	30	100

Table IX shows that most students in group I (60%) agree that spreadsheet-based modules simplifed statistics learning. Furthermore, majority of students (66.67%) felt that the use of spreadsheet-based module could save time in learning statistics as shown in Table X. This certainly supports the module's expectations as a resource that can overcome the problem of time constraints as stated Rhosyida and Jailani [4].

The use of spreadsheet-based modules could help students in independently learning statistics as shown in Table XI.

Table XI. Students response: spreadsheet based module help students independently learning statistics

Category	Frequency	%
strongly agree	10	33,33
agree	14	46,67
neither agree nor disagree	6	20
disagree	0	0
strongly disagree	0	0
	30	100

In line with Purwanto [1], the use of spreadsheet-based modules simplify the learning process thus students could study independently. Table X shows that 46.67% students agree it.

IV. CONCLUSION

Based on the achieve results in the previous parts the following conclusions can be taken: (1) The expert assessment showed that overall modules were categorised good with an average score of 3.996, (2) The necessary revisions to improve the quality of these statistics courses module were in the introduction aspect, especially in terms of interrelationship with previous modules, on the aspects of learning, especially in terms of clarity the objectives of the users, on the content aspect, especially in terms of the scope (breadth and depth) of the material content, on the aspects of the task, evaluation, assessment especially in terms of difficulty level, and on the aspect of the summary especially in terms of clarity of summary and bibliography, and (3) In overall, these statistical course modules resulted in significantly better grades for students. The seven modules provided significantly better grades for students. The students response after using the module showed that most of them agree that the spreadsheet-based module can simplify (60%), save time (66.67%) as well as help students study independently (46.67%) in statistics learning.

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