

The Effectiveness of Nonparametric SPSS Based Statistic Practicum Module Development in Improving the Student Learning Result

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ABSTRACT

Knowledge of inferential statistics is incomplete without learning and fully comprehend the non-parametric statistic. This research is development research that aims to enlarge and give a non-parametric SPSS based statistic practicum module. This module is equipped with theory, a manual calculation sample, and the SPSS tutorial. This module is designed to elevate student ability in mastering non-parametric statistics. The outcome of the effectiveness from the practicum module sums up that the student post-test result after the learning treatment using the non-parametric SPSS based statistic practicum module is significantly higher than the pre-test result with 13,72 t-count value acquisition and $000 < 0,05$ Sig. value. This shows that the non-parametric SPSS based statistic practicum module is effective in increasing the result of student learning.

Keywords: Module, Statistic, Nonparametric, SPSS.

1. INTRODUCTION

The statistics role in planning, collecting, analyzing, interpreting, and presenting data to yield a fundamental decision for technology and knowledge development. With that role, statistics take a pivotal position in various disciplines of science, such as natural science, social science, and humanities as the bridge in developing logical and scientific thinking.

One of the teaching materials worth developing in college is statistics. [1], statistics are part of mathematics in particular talk about ways to collect, process, serve, analyze, and interpret data. Statistics are used in various science fields. Nonetheless, in most cases, students are not too fascinated to keep pace with the learning path. According to [2], throughout the time student having trouble with statistical data analysis. The hardship and the typical error of students include tests used in data analysis, the inaccuracy in doing the data analysis calculating, and the fidelity as well as the accuracy of the solutions that result in a deduction.

The difficulty in analyzing statistical data is also experienced by students at the Faculty of Economics, State University of Medan, based on the results of a survey with 20 students of Economics Education major who have conducted research, there are 65% of them experiencing difficulties in data processing, especially when the data does not meet the assumption test, such as data normality, data homogeneity, linearity, multicollinearity and so on.

This problem is understandable. Based on the reflection result, this happens because the material in statistics courses taught so far only prioritized the parametric statistical approach. Of course, this material is not enough to handle the problems that are going on in the field, for example, if there is research data that does not fulfill the pre-requisite data test.

To overcome that problem, it needs the education facilitator creativity, namely the lecturer. According to [3], he states that lecturers have a vital role in defining the quantity and the quality of teaching held by them. Therefore, lecturers need to think and plan

their teaching quality seriously, especially in statistics.

One of the alternatives to overcome the problem above is by developing the non-parametric statistics practicum module. The practicum module materials are a systematically arranged learning program and it refers to the measurable learning goal [4]. This is done to increase the students' research quality and also to add value to the data analyzing knowledge so that students not only comprehend in parametrical statistics approach but also balance the knowledge of non-parametric statistics. Certainly, this knowledge and module are expected to improve the capability of research data analysis that could directly contribute to the student research quality. So it is hoped that this module, could directly suppress the practicum of manipulating research data to force analysis using the parametrical statistics and be an alternative solution if the research that was held before does not meet the assumption research data test.

The development of this non-parametric statistics SPSS application-based module runs following the rapidly developing 4.0 industrial revolution era, where technology literacy is slowly being integrated into education. According to [5], the relevance of education and works needs to be adjusted to the development of technology and knowledge by remaining concerned about humanities aspects. To prepare the graduates to be competitive, the curriculum needs a new orientation, because the old literacy way (reading, writing, and mathematics) is not enough to be their basic asset in contributing to society. But students also need the new three literacy, such as data literacy (the ability to read, analyze, and using the information (Big Data) in the digital world), technology literacy (comprehending the working of machines, the applications of technology), and human literacy (humanities, communications, and design).

The SPSS (Statistical Package for the Social Sciences) is the most popular analytical device used to analyze data. As a result of this learning, students are expected to have skills in processing and analyzing data quickly, easily, and practically, having the knowledge and logic of a problem based on factual data, being able to use statistical software as computational AIDS, and being able to read and give a correct interpretation, rapidly, and accurately.

Studies on the development of teaching materials or statistics practicum modules using SPSS have been studied previously by [6], [7], the results of the study revealed that a developed textbook or

practicum module proved worthy to use for learning and increase the effectiveness of student study results. Other than that, the resulting textbooks or practicum module increases the motivations and the student learning independence.

So, this development of the non-parametric inferential statistics practicum module is urgent. This has to be done to improve the quality of student research, enhance knowledge of alternative research methods, and also increase student learning independence.

2. LITERATURE REVIEW

2.1. Modules

Modules are teaching materials that are systematically arranged in language that is easily understood by students, according to their age and level of knowledge so that they can learn independently with minimal guidance from educators [8]. The use of modules in learning aims for students to be able to learn independently with the least guidance from the teacher. Then Amri and Ahmadi [9], define textbooks as all forms of materials used to assist teachers/instructors in carrying out teaching and learning activities in the classroom.

In addition [10] explain the advantages of learning with modules, namely (a) the module can provide feedback so that students know their shortcomings and immediately make improvements, (b) in the module set clear learning objectives so that students learning performance is directed in achieving learning objectives, (c) modules that are designed to be attractive, easy to learn, and can answer needs will certainly lead to student motivation to learn, (d) modules are flexible because the module material can be learned by students in different ways and speeds, (e) cooperation can be established because with the module competition can be minimized and between students and learners, and (f) remedial can be done because the module provides sufficient opportunities for students to be able to find their weaknesses based on the given evaluation.

According to [11], the benefits obtained from learning with the application of the module are as follows: (1) Increasing student motivation. (2) After the evaluation, teachers and students can find out the parts that have not been understood by students and parts that have been understood by students. (3) Students achieve results according to their abilities.

(4) The subject matter is divided more evenly in one semester. (5) Education is more efficient because learning materials are arranged according to academic levels.

2.2. Nonparametric Statistics

The statistical approach is an integral part of the quantitative approach or paradigm. The quantitative paradigm places statistics as an important analytical technique or procedure for testing theories. According to Creswell [12], quantitative research is a method for testing theories by examining the relationship between variables. The variables were measured by research instruments that produce data in the form of numbers and analyzed by statistical procedures. The goal is to determine whether the predictive generalizations of the theory under investigation can be proven true.

Inferential statistics can be divided into 2 (two) namely parametric statistics and non-parametric statistics. Parametric statistics are statistics that consider the type of data distribution that is normally distributed and or has a homogeneous variance. The data used in parametric statistics are interval data and ratio data. Meanwhile, non-parametric statistics are statistics that do not consider the type of data distribution which are normally distributed (free distribution) and do not require homogeneous data variance. The data used in nonparametric statistics are nominal and ordinal. However, if the analyzed data does not meet the assumption test, for example, the data is not normally distributed, then the alternative data analysis technique used is non-parametric statistics.

A right understanding of the scale of data measurement will greatly assist researchers in choosing the right statistical technique to analyze research data. The selection of descriptive and inferential statistical analysis techniques in this study was based on the nominal, ordinal, interval, and ratio measurement scales.

Table 1. Differences in Parametric and Nonparametric Statistics

Information	Parametric Statistics	Nonparametric Statistics
Data Type	Interval and Ratio	Nominal and Ordinal
Normally distributed data	Must form a normal curve	No need
Parametric Assumption	Must be fulfilled according to the assumption of each test	No need

Based on this, the selection of inferential statistical analysis techniques is strongly influenced by the measurement scale of the data generated in the study, both measurement scales, nominal, ordinal, interval, and ratios. The inferential statistical analysis techniques based on the measurement scale are presented in the following table:

Table 2. Inferential Statistical Analysis Techniques Based on Data Measurement Scale

Scale	Comparative and Associative Research					
	Associative (Relationship)	Descriptive (1 variable)	Comparative (2 Samples)		Comparative (> 2 Samples)	
			Not Free	Free	Not Free	Free
Nominal	Soumer's d (ddy), Contingency Coef. C, Gamma, Tau a, b, c	Binomial, X ² for -1 Sample	McNemar	Fisher Exact, X ² for -2 Samples	X ² for -k Sample, Cochran Q	X ² for -k Sample
Ordinal	Spearman Correlation, Kendall, Tau	Run Test	Mark Test, Wilcoxon Test	Median Test, Mann-Whitney Kolmogorov Test	Friedman Two Ways Annova	Median Test, Kruskal Wallis
Interval/ Ratio	Product Moment, Pearson, Partial Correlation, Regression	t-Test, z-Test	t-Test (Correlation)	Free t-Test, Free z-Test	F-Test with Annova-1 Way, Annova ≥ 2 Ways	F-Test with Annova-1 way, Annova ≥ 2 Ways

Source: Kadir [13]

Based on the table above, non-parametric statistics are in inferential statistical analysis techniques on nominal and ordinal data measurement scales.

3. RESEARCH METHODS

This research is development research. The development model used in this study is the ADDIE model. According to Branch (2009) in [14], that the ADDIE development model consists of five stages, namely: analysis, design, development, implementation, and evaluation. In this case, it aims to develop a non-parametric Statistics practicum module that is feasible and effective in learning. The subjects of this research are third-semester students of the Economics Education Study Program, Faculty of Economics, Medan State University in the 2021/2022 academic year.

The research design used a quasi-experimental design in the non-equivalent group design type [15]. This design is almost the same as the pretest-posttest one group only design, only in this design, the experimental group is not chosen randomly. The research design can be described as follows:

Table 3. Research Design Table

Class	Pre-Test	Treatment	Post-Test
Experiment	O ₁	X	O ₂

Information

- O₁ : Pre-test score (before treatment) in the experimental class.
- O₂ : Post-test value (after treatment) in the experimental class.
- X : Lectures using web-based econometrics learning media.

The effectiveness test of this practicum module was carried out based on the results of the learning outcomes test in a small trial group with a limited group (15 students) using a paired sample t-test. The essence of the analysis of the difference between the two independent sample means is that the two data to be tested for differences come from the same group and produce two data distributions.

This before and after the experimental design is used to test the effectiveness of the practicum module on learning outcomes before and after treatment by using this SPSS-based non-parametric statistical tutorial practicum module in the form of a hypothesis:

Ho: There is no difference in learning outcomes before and after treatment using the SPSS-

based non-parametric statistical tutorial practicum module.

Ha: There are differences in learning outcomes before and after treatment using the SPSS-based non-parametric statistical tutorial practicum module.

4. RESULTS

The results of the research and development of this practicum module refer to the ADDIE model. The non-parametric statistical material developed in this practicum module is developed complete with theory, case examples, and manual calculations along with the application of the SPSS application with the following details:

CHAPTER 1 Introduction to Nonparametric Statistics

- Use of Nonparametric Statistics
- Typology of Data Based on Measurement Scale Hypothesis Test

CHAPTER 2 One-Sample Test: Manual Calculation Concepts and SPSS

- Kolmogorov-Smirnov test: Normal

CHAPTER 3 Two-Sample Test: Manual Calculation Concepts and SPSS

- Two-Sample Free Test (Wilcoxon Rank Sum Test and Mann-Whitney U Test)
- Paired Two-Sample Test (Sign Test and Wilcoxon Signed Rank Test)

CHAPTER 4 K-Sample Test: Manual Calculation Concepts and SPSS

- Free Sample K Test (Kruskall-Wallis H Test)
- Paired K Sample Test (Friedman Rank Test)

CHAPTER 5 Rank Association Test: Manual Calculation Concepts and SPSS

- Spearman Rank Correlation Test
- Kendall Tau's Rank Correlation Test

The draft cover for the non-parametric statistics practicum module is as follows:



Figure 1. Nonparametric Statistics Book Cover

4.1. Effectiveness Test

The effectiveness test was carried out using a quasi-experimental non-equivalent group design approach. This study tested the pretest-posttest on the independent and paired difference test material as much as 1 meeting from one class group. The test was conducted on 15 seventh semester students with the following results:

Table 4. Calculation Results of Pairwise Difference Test Paired Samples Test

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 Before - After	-23	6.49	1.67	13.72	14	0.00

Source: Processed Data

Based on the table above, the t-count value is 13.72 with a Sig value. $0.00 < 0.05$, then H_0 is rejected.

This means that the post-test student learning outcomes of learning treatment using the SPSS-based nonparametric statistical practicum module were significantly higher than the students' pretest results. This shows that the non-parametric statistics practicum module produced is proven to be effective in improving student learning outcomes.

4.3. Discussion

The results of the implementation of the SPSS-based nonparametric statistics practicum module stated that it was effective, meaning that there was a significant difference between before and after learning with the application of this practicum module. With this practicum module, students have a handle for independent study. This is in line with the results of research, Sufinah & Roviati [16] and Saídah and Yuslianti^[17] which state that the results of the analysis show that the application of practical learning modules can improve students' independent learning. In addition, this practicum module not only identifies cognitive abilities but also develops process skills. Learning by using this data analysis-based practicum module provides benefits not only for students but also for educators in terms of knowing students' real abilities through the practicum learning process.

In addition, the results of this study on the development of statistical practicum books/modules using SPSS have been studied previously including [18], [19], and [20], the results of the study revealed that the textbooks/practicum modules developed were feasible to use for learning and were effective in improving student learning outcomes. In addition, the textbooks/practicum modules produced increase students' motivation and independence in learning.

5. CONCLUSION

The rapid development of technology has entered the era of the Industrial Revolution 4.0. This requires the relevance and involvement of the role of academics in managing the classroom to achieve learning objectives, including inferential statistics material. Knowledge of inferential statistics is not complete if you only master parametric statistics, but you also need mastery and understanding of nonparametric statistics. This research is development research that aims to develop and produce a non-parametric statistical practicum module based on SPSS. This module is designed to improve students'

ability in mastering nonparametric statistics equipped with theory, examples of manual calculations, and tutorial guides with the SPSS application. The results of the practicum module effectiveness test concluded that the students' post-test results after learning treatment using the SPSS-based nonparametric statistical practicum module were significantly higher than the pretest results with the acquisition of an account value of 13.72 and a Sig value. $000 < 0.05$. This shows that the SPSS-based nonparametric statistics practicum module has proven to be effective in improving student learning outcomes.

AUTHOR'S CONTRIBUTIONS

The author has designed, revised, and tested the effectiveness of the *Statistika Non-Parametrik Terapan: Teori, Contoh Kasus, Perhitungan Manual dan Aplikasi SPSS*.

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