Experimental Research Methods

"Anava and Factorial Experiment Psychology Research Design"

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ABSTRAK

The experimental research method is an approach used to examine the effect of certain treatments on other variables under controlled conditions. In experiments, researchers manipulate a stimulus or treatment, then observe its impact on the variable under study. This research discusses experimental design and its purpose, including ANOVA and factorial experimental psychology research designs. Experimental design allows researchers to test hypotheses with well-defined steps before conducting experiments. There are several types of experimental designs, including pre-experimental, true experimental, factorial experimental, and quasi-experimental. Analysis of Variance (ANOVA) is a statistical method for comparing the means of several groups of data with respect to their variances. Factorial design involves the simultaneous manipulation of several factors to study the effect on the dependent variable. This study describes the characteristics, objectives, and types of factorial designs as well as their advantages and disadvantages. The experimental design and statistical analysis used help researchers understand and analyze data more comprehensively and objectively.

Kata Kunci : Psychology Research Design, Anava Experiment, Factorial Experiment

INTRODUCTION

The experimental research method is a research method used to seek the effect of certain treatments on others in controlled conditions (Sugiyono, 2012: 109). In conducting an experiment, researchers manipulate a stimulus, treatment or experimental conditions, then make observations about the effects that arise due to the treatment or manipulation.

According to Sudjana (1991), experimental design is a complete step that is important to take long before an experiment is carried out so that the data needed for research can be obtained so that it will lead to objective analysis and conclusions that apply to the problem discussed or studied. In general, there are 3 experimental research designs, namely pre-experiment which is an impure experiment because there is no control group and the selection of samples is not randomized, then quasi-experiment which is a semi-experimental research because there are still variables

Certain uncontrollable conditions, and true-experimental which is a pure experiment, but this experimental research design is difficult to carry out.

DISCUSSION

Definition of Experimental Design

An experimental design is an experimental design in which each step of the action is completely defined in such a way that the necessary information for the problem being studied can be obtained. In other words, an experimental design is a complete set of steps that are important to take long before an experiment is conducted. It is intended that the necessary data can be achieved so that it will lead to objective analysis and conclusions that apply to the problem being discussed (Sudjana, 1991). Basically, the experimental design provides an overview of the procedures that allow researchers to test their research hypotheses.

According to Sugiyono (2016), there are 4 experimental research designs, namely :

1. Pre-Experimental Design

   In this experimental design there are still external variables that affect the formation of the dependent variable. This may occur because there are no control variables and the selection of samples is not random.

2. *True-Experimental Design*

   In this design the researcher can control all external variables that influence the course of the experiment. This design has the main characteristics that the samples used for experiments and as a control group are randomly selected from a certain population, and in this design there is a control group.

3. Factorial Experimental Design

   This design is a modification of the true-experimental design, where this design considers the possibility of moderator variables that influence the treatment (independent variable) on the results (dependent variable). In this design, all groups are drawn randomly.

4. Quasi Experimental Design

   This design is a development of the true-experimental design which is difficult to do. This design has a control group but is not fully

It controls external variables that influence the course of the experiment.

A. Anava

Analysis of variance is a statistical analysis method included in the inference statistics branch. In Indonesian literature, this method is often known by various other names such as analysis of variance, variance analysis, and analysis of variance. In practice, analysis of variance can be a hypothesis test (more commonly used) or estimation, especially in the field of applied genetics. Analysis of variance or ANOVA is one of the multivariate analysis techniques that serves to distinguish the mean of more than two groups of data by comparing their variances. Analysis of variance belongs to the category of parametric statistics. As a parametric statistical tool, to be able to use the anova formula, it is necessary to first test assumptions including normality, heteroscedasticity and random sampling.

Analysis of variance can be carried out to analyze data derived from various types and designs of research. Analysis of variance is widely used in studies that involve a lot of comparative testing, namely testing related variables by comparing them in groups of observed independent samples. Analysis of variance is widely used in survey research and experimental research. In general, analysis of variance tests two variants, namely variance between samples and variance within each sample.

In order for the results of the analysis of variance to be interpreted validly, it must rely on assumptions that must be met in the design of the experiment.

1) *Homogeneity of variance, the dependent variable must have the same variance in each category of the independent variable*.
2) Random sampling: for the purpose of testing significance, the subjects within each group must be randomly drawn.
3) Multivariate normality: for the purpose of significance testing, the variables must follow a multivariate normal distribution.

1. One Path Analysis

One-way analysis of variance is a parametric statistical technique used for testing differences in several average groups, where there is only one independent or independent variable divided into several groups and one dependent or dependent variable. The one-way ANOVA technique is usually used in experimental or Ex-Post-Facto research (Widiyanto, 2013).

The hypothesis in ANOVA will compare the means of several populations represented by several sample groups together, so the mathematical hypothesis is:

$H_0 : \mu_1 = \mu_2 \ldots = \mu_k$

- All population means are equal
- No treatment effect (no within-group mean variance)

H_1 :not all population means are equal

- There is at least 1 distinct population mean
- There is a treatment effect
- Not all population means are different (some pairs may be the same).

The alternative hypothesis as mentioned above is a flexible hypothesis, because it does not specify which μ is different from the others. This means that which μ is not the same is not a problem in rejecting the null hypothesis

H0 in One Way ANOVA is that there is no significant difference in the means of the samples. If H0 is rejected, then the analysis is not complete so further analysis is needed. Further analysis after ANOVA is often called Post Hoc or post-ANOVA is as follows :

1) LSD (Least Significance Difference), is used to perform a t-test between all pairs of group means. This test is particularly good when the test means to be compared have been previously planned.
2) *Tukey (HSD: Honestly Significant Difference), this test is called the real difference test which is an improvement of LSD because this test is to compare means without prior planning.*
3) *Tukey's-b, another alternative to Tukey's test*.

4) Duncan, was used to test for differences between all available treatment pairs of the experiment and still maintain a set level of significance.

5) S-N-K (Student Newman Keuls), a development of LSD and Duncan's.

6) *Dunnet*, digunakan untuk membandingkan mean dari semua perlakuan dengan mean perlakuan control.

7) Scheffe, used for comparisons that do not need to be orthogonal.

2. Analysis of Variance Testing

The calculations in ANOVA are based on variance, even though the goal is to test for multiple differences in means. We can only say that the means are different if we have also looked at the variability. A good measure of variability is standard deviation or variance. Therefore, the test here is also based on the variance.

Measuring the total variability of existing data can be categorized into three parts:

1. Inter-group variability, which is the variation of the sample group's average against its overall average. This variation is more affected by differences in treatment between groups.
2. Within-group variability is the variation that exists within each group. The amount of variation will depend on the number of groups, and this variation is not affected by treatment differences between groups.
3. The sum of the squares of total deviations, is the sum of the squares of the differences between individual scores and their total mean.

Since there are three kinds of variability, there are also three kinds of dk:

1. Degrees of freedom for between-group variables, n-1.
2. Degrees of freedom for within-group variables dk within group = $\sum$ (n-1)
3. In addition, the dk in the group can also be found by the formula: Degrees of freedom of variables in groups = n-kk

Description :

k: is the number of groups

n: is the total sample size

F= variance between samples/variance within samples

F= dk1/dk2

B. Factorial Design

Factorial design is an action on one or more variables that are manipulated simultaneously in order to study the effect of each variable on the dependent variable or the effect that arises due to the interaction between several variables (Noor, 2014). According to Emzir (2015), the term factorial refers to the fact that the design involves several factors. Each factor has two or more levels.

This design has several characteristics, namely:

1. The sample used for the experiment was determined randomly, both the control group and the experimental group.
2. Pretest and post-test were conducted on each group and experiment.
3. There are other variables that are usually referred to as moderate variables where these variables are also given treatment.
4. This design is a modification of the pretest-posttest control group design.
5. Consists of several factors (treatments).
6. Each factor consists of multiple levels and is investigated simultaneously.

In general, the design or design of this factorial experiment has three main objectives, namely:

1. Measuring the influence of variables on results.
2. Determining the variables that have the most influence on the results.
3. Measuring the interaction between variables on the outcome. This is important to assess because the possible influence of a factor on the outcome is influenced by the number of factors or the presence or absence of other factors..

The factorial design paradigm can be described as follows:

R	O_1	X	Y_1	O_2
R	O_3		Y_1	O_4
R	O_3		Y_2	O_6
R	O_7	X	Y_2	O_8

In this factorial design all groups are randomly selected, then each is given a pretest. Groups for research can be declared good if each group has the same pretest score. Thus, O1 = O3 = O5 = O7. Moderator variables in this case are Y1 and Y2. X here is treatment.

There are two types of factorial designs, namely:

1. 2k factorial design, a factorial design analysis of k factorials (treatments) with each factor consisting of only 2 levels. For example, an experimental design with 2 factors, A and B, each consisting of 2 levels would be written as a 22 factorial design. So, if 3 factors then 23, and so on.
2. 3k factorial design, a factorial design analysis of k factors (treatments) with each factor consisting of only 3 levels.

In designing an experiment, the use of factorial design has several advantages and disadvantages, as follows:

a. Excess:
    1) More efficient use of resources.
    2) The information obtained is more comprehensive because the researcher can study the main effects of the interaction.
    3) Experimental results can be applied to a wider range of conditions because researchers can study combinations of various factors.
b. Disadvantages:
    1) Statistical analysis becomes more complex
    2) Terdapat kesulitan dalam menyediakan satuan percobaan yang relatif homogen.
    3) There are difficulties in providing relatively homogeneous experimental units.

CONCLUSIONS

An experimental design is an experimental design in which each action step is completely defined in such a way that the necessary information for the problem being studied can be obtained. There are two designs described in this paper, the first of which is anava. Analysis of variance is a statistical analysis method that belongs to the branch of inference statistics. Analysis of variance or anova is one of the multivariate analysis techniques that serves to distinguish the mean of more than two groups of data by comparing their variances. The second design is factorial design. Factorial design is an action on one or more variables that are manipulated simultaneously in order to study the effect of each variable on the dependent variable or the effect that arises.

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