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# An analysis of group formation process in statistics course with cooperative model

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**Abstract.** Good group formation gives students enthusiasm for mathematics learning. Group formation often results in mathematics learning discomfort. Therefore, the mathematics teacher needs to review ways to form study groups. This study examines ways to create groups that are in line with student needs. This type of research is a qualitative study with the subject being a junior high school student. The instruments used were tests and interview guides. Based on the data obtained, this study concludes that there are two ways of forming learning groups, namely grouping by number-grouping and independent-grouping. One of the two methods is more effective in achieving learning objectives.

## 1. Introduction

The world of education is required to fulfill the needs of the times [1]. Education is responsible for preparing skilled human resources in various sciences and technologies. The Ministry of Education and Culture of Indonesia states that the 21st century is a century based on science and technology so that a country's human resources are needed to master various forms of skills, including critical thinking skills and problem-solving from a growing number of the issues. The objectives of mathematics learning contained in education curriculum are 1) improving intellectual abilities, 2) form the ability to solve problems systematically, 3) maximize learning outcomes, 4) training communication, especially in written form, and 5) develop character [2].

Cooperative learning is recommended to be implemented as an effort to improve the quality of human resources through the field of education. Indonesia's current national education curriculum emphasizes the formation of character through learning independence. Learners are told to find out knowledge based on various learning resources. Learners told to applies the principle that anyone is an educator, anyone is a student, and wherever are the class, recognition of individual differences, and cultural backgrounds of students [3]. Cooperative learning is considered suitable to meet these needs.

However, the results of a study at one school found that there were several problems in implementing cooperative learning, namely: 1) students were not comfortable learning with unsuitable group members; 2) the smartest students control) group learning activities; and 3) individual learning outcomes are not optimal. Differences in student backgrounds affect motivation to cooperate in learning [4]. Further Moges [5] states that education does not provide opportunities for the active role of students as a lack of cooperative learning. The process of forming groups following student characteristics has the potential to reduce deficiencies in cooperative learning. The formation of study groups must be one focus of cooperative learning so that conflicts do not occur between group members due to differences in student characteristics. The harmony of group members can help smooth student learning activities.



Learning should pay attention to the individual differences of the child [6]. Thus, the problem of student inconveniences and the formation of study groups is the focus of this study.

In hope is that group work develops a sense of identity in a setting where conflicts can be worked through in a safe environment [7]. Likewise, the teacher in this study applied Think Pair Square (TPS) type cooperative learning because it matched curriculum demands. TPS structural approach allows students to think, answer, and help one another. TPS of cooperative learning models allows students to work alone and collaborate with others. Learning by using the Think Pair Square model has three stages of activities that are different from other cooperative learning models. The first stage is the thinking stage; the thinking stage is carried out independently. When the thinking stage, students can fill in worksheet independently, it can anticipate students so that they do not talk to many other students.

In this study, statistics learning is analyzed reviewed based on the process of forming learning groups. The purpose of this study is to obtain an overview of the process of creating learning groups by student expectations. The expected outcome of the course is to get a more useful picture of learning grouping patterns.

## 2. Methods

The method used in this research is a case study. Data sources were obtained from junior high school students located in the city of East Jakarta. Participants involved in this study were 36 students, some of whom were asked in the interview session. Data collection techniques used in this study were by tests, interviews, and observation sheets. The test is conducted to determine the achievement of learning objectives. Interviews are used to obtain data about group formation techniques based on students' perceptions and educators themselves; then, the observation sheet aims to observe the achievement of learning objectives based on students' performance in learning. Data analysis in this study includes triangulation techniques, ranging from data reduction, data presentation to concluding.

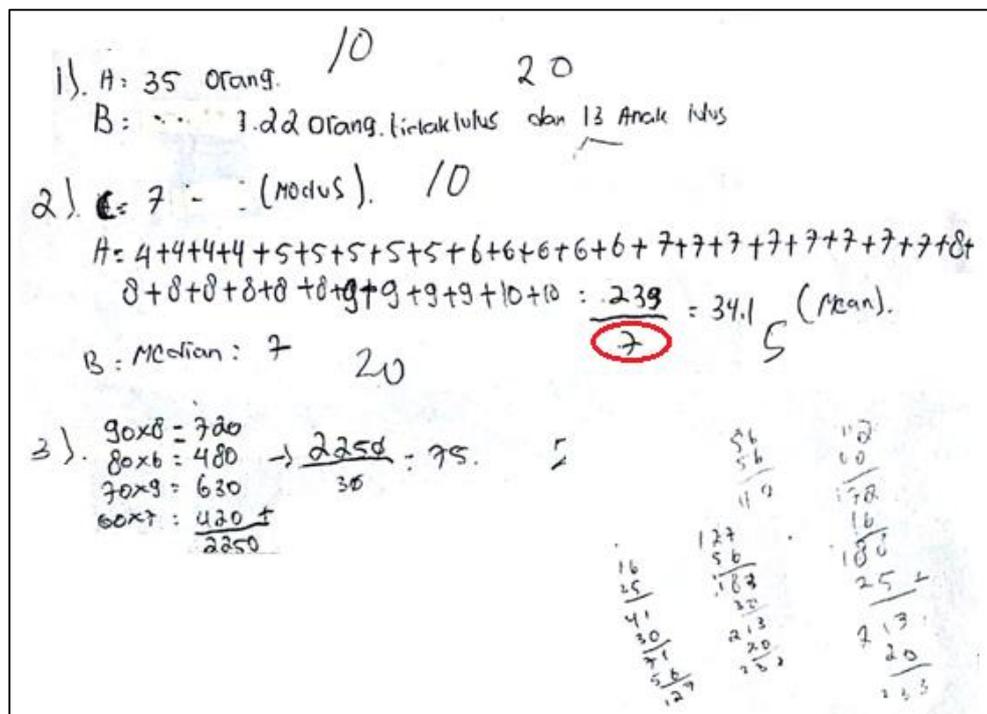
## 3. Result and discussion

There are four ways of grouping learning, namely 1) students-selected; 2) random-assign group; 3) homogeneously-assign group, and 4) heterogeneously-assign group [8]. Based on observations, it is known that the teacher groups students in one class into nine groups. Each group consists of 4 students. Initially, the grouping is done by enumerating, i.e., students are asked to list from number one to number nine. When all students already have their numbers, each student will gather with other students who have the same number. Therefore, each student cannot determine their group of friends because students cannot determine the numbers that they will get. Students should be able to learn together with whoever they are in groups. The technique of forming learning groups by themselves is the formation of learning groups that are formed based on the wishes of students to choose their group members. This method of grouping is applied at several meetings. The teacher gives a name for this grouping pattern with the number-grouping.

The teacher carries out the learning in the following order: orientation, apperception, giving references, core activities, and closing activities. 1) Orientation activities are filled with: opening lessons, checking attendance, and checking the classroom environment; 2) apperception is done by connecting the prerequisites with the topic to be taught; 3) giving references is realized by conveying target material that must be understood and learning objectives; 4) the core activity which is divided into 6 stages needs to be explicitly discussed, considering that the division of groups which is the main study of this research is in these activities; 5) the closing activity is divided into two parts: concluding learning outcomes regarding the distribution of mathematics induction by teachers and students, as well as giving assignments and notification of learning plans for the next meeting.

The description of learning presented by the teacher is as follows, stage 1, preliminary, that is a) The teacher explains the rules of learning instruction and the time limit for each activity, and motivates students to engage in problem-solving activities; b) The teacher divides groups of four people with group formation techniques in which students are free to determine their study groups, and c) students determine their discussion partners. Stage 2, think, a) the teacher explores the students' initial

knowledge; b) the teacher provides student worksheets to all students and c) students work on these worksheets individually. Stage 3, pair, that is, students discuss with their partners about the answers to tasks that were done separately. Step 4, share: two couples of students meet in one group to discuss the same problem. Stage 5: class discussion: several groups perform in front of the class to present their worksheet answers, and the teacher provides her responses. Stage 6: appreciation, that is, students are assessed individually and in groups. Awards will be given at the next meeting, considering that the teacher must scrutinize the students' work. The last activities are the evaluation test, which measures the achievement of learning objectives at each meeting; at the end of the lesson, students are given an evaluation test of the material being studied. Furthermore, the example result of students can be seen in figure 1 below.



**Figure 1.** Example of students' answers.

Figure 1 shows one of the answers to the formative test in statistics learning. In figure 1, the part marked with the red ellipse is the wrong answer. Students are still wrong in determining the frequency of the data from the problem presented. This mistake is possible because students are not accustomed to reviewing the answers they get. This fact can be seen because question number 3 is correct, even though the problems presented are equal. This means that students have not been able to connect the answers they get with the problems showed. In addition, the another example of students result can be shown in figure 2.

Figure 2 shows the answers to the formative test presented by students with a different way of thinking from the students' responses in figure 1. The part marked with a red ellipse in figure 2 shows the students' errors in determining the frequency of data. In answering this question, students added up the data scores, even though what was asked was the frequency of the data. The student's answer to question number 2, as shown in figure 2, was declared correct by the teacher. The way students answer to question number 2 in figure 2 is different from the student's answer in figure 1.

Figure 1 dan 2 shows that the way students answer is still in a mechanical way, namely by imitating the steps exemplified by learning resources. Students do not check the answers as solutions substantially to the problems presented. Reference to student answers is the steps to complete, as the example in the

book. This is seen as shown in figure 1 and 2; the answers presented show that students can write down the frequency of the data, but are wrong in calculating which involves the frequency.

Handwritten student work showing calculations for mean, median, and mode. The work includes several errors in arithmetic and notation.

1. a)  $4+5+5+8+7+4+2 = 32$  (circled in red)

b)  $7+2+4 = 13 \rightarrow$  lulus

$4+5+5+8 = 22$  anak  $\rightarrow$  tidak lulus 20

2. mean =  $\frac{(4 \times 4) + (5 \times 5) + (6 \times 5) + (7 \times 8) + (8 \times 7) + (9 \times 4) + (10 \times 2)}{35}$

$= \frac{16 + 25 + 30 + 56 + 56 + 36 + 20}{35} = \frac{219}{35} = 6,02$  20

median = 7 10 35

modus = 7 10

3.  $\frac{(8 \times 90) + (6 \times 80) + (3 \times 70) + (7 \times 60)}{30}$

$= \frac{720 + 480 + 210 + 420}{30} = \frac{1830}{30} = 61$  20

**Figure 2.** Examples of students work in different ways.

The results of subsequent observations note that in statistics learning, the teacher applies a different way of grouping. The teacher provides opportunities for students to group according to their initiative. Each group consists of four students, with one person as the leader. Other students who act as group members present themselves to the group leader to be accepted as members. The teacher gives a name for this grouping pattern with the independent-grouping.

Every change in the way the grouping is accompanied by the provision of tests of learning outcomes. Statistics learning achievement test data by two means of group shows different achievements. The average test score on statistics learning with numbering-grouping is 74.00 on a scale of 100. Simultaneously, the average test score on statistics learning with independent-grouping is 84.00 on a scale of 100.

Interviews were given to students from two study groups to get students' perceptions of group formation techniques. The information resulted from the interview that the grouping of independent learning is preferable to numbering-grouping. Students reasoned that by grouping independently obtained discussion partners following the wishes, comfortable, and smooth. Whereas when studying with group formation in number-grouping, enthusiasm for learning is very low, so only a few members participate in learning. Still, according to students, it is better to group with friends whose abilities are equal so that it becomes a motivation to learn together. Furthermore, the transcript of the group learning of the interview can be seen as follows.

Participant 1

Interviewer : at the time of dividing the group, what did you prefer?

Interviewee : formed by the students

Interviewer : why?

Interviewee : because it is by the heart

Interviewer : in a group formed by students, is the discussion comfortable?

Interviewee : yes, success

Participant 2

Interviewer : at the time of dividing the group, what did you prefer?

Interviewee : the group formation that I like best is the one formed by students

- Interviewer : why?  
 Interviewee : because we can choose friends who can work together  
 Interviewer : yes, success

Student participation in determining the statistics learning process can create a better atmosphere and learning outcomes. Students provide accurate information related to the inner atmosphere and learning outcomes obtained. This means students must be accustomed to reviewing the learning process to improve their problem-solving abilities [9]. Teachers have to provide facilities to be individually accountable for their thoughts [10][11]. Teachers and students must establish communication so that good study habits become the character for students. Character building, such as the right way of learning, must be communicated to students [11].

Cooperative learning is promoted as a way to improve the quality of human resources through education. This study examines the depth of applying cooperative learning, especially in the student grouping process. Based on the results of data analysis, the findings are obtained: 1) Based on the learning practices applied by the teacher in this study, there are two patterns of learning grouping in cooperative learning, namely a) group based number technic and b) group based on student perception, 2) students prefer group based on their perception rather than grouping by numbers.

There are many positive values when students are allowed to adjust the way of learning. Students shift from passive to be hard workers [12]; they see mathematics as a challenge, not a difficult subject. Likewise, students feel comfortable learning after they have selected members of their group. They prefer to study with friends who have the same abilities, at least not too much different. Students can share roles well because the smartest students do not dominate learning.

Furthermore, increased learning activities become a source of assessment for teachers, resulting in improved learning outcomes [13]. Based on his experience, teachers have a significant role in choosing the best learning strategy for students so that effective learning is obtained [14]. The results of the research show that the formation of study groups by students is more effective than the appearance of groups by teachers [15].

#### 4. Conclusion

Based on the results and discussion of this study, providing opportunities for students to adjust their learning methods has had a positive impact on learning. Learning shifts from passive learning to active learning; students feel comfortable in equal group discussions so that activity and learning outcomes increase. Likewise, the formation of groups selected by students gave better results than other methods of forming groups. They felt comfortable and optimal learning outcomes. This conclusion does not dispute the grouping technic of students that is commonly applied by the teacher. This conclusion illustrates that students can provide critical input to the improvement of learning. Students have an important role in evaluating the learning process. Researchers and other teachers can study other learning processes such as the assignment or evaluation stages so that a complete picture of improvement is obtained.

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