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# The Impact of Team Assisted Individualization Learning Model with Scientific Approach Toward Mathematical Communication Based on Student's Cooperative Personality Orientation

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*Abstract*—The purposes of this study were to describe: 1) the impact of using TAI learning model with scientific approach towards mathematical communication, 2) the impact of student's cooperative personality orientation towards mathematical communication, 3) the interaction between the learning model and student's cooperative orientation towards mathematical communication. This study is type of quasi-experimental research. Research population is students of Class XI of State Vocational Schools in Karanganyar Regency (SMK N Matesih). Sampling technique utilized is cluster random sampling. The data collection techniques are tests and questionnaires. Data analysis technique used is two ways analysis of variance with unequal cell. The significance level applied is 5%. The results of this study were: 1) TAI learning model with scientific approach give better mathematical communication than direct learning, 2) student with cooperative personality orientation have better mathematical communication than student with competitive or individualistic personality, 3)There is no interaction between learning models and student's cooperative orientation towards mathematical communication. In each learning model, students with cooperative personalities have better mathematical communication than students with competitive or individualistic personality. In any personality orientation, TAI learning model with scientific approach is resulted better mathematical communication than direct model.

*Keywords: cooperative personality, TAI, scientific approach, mathematical communication*

## I. INTRODUCTION

The problems that arise in the 21st century or known as the era of the 4.0 industrial revolution are increasingly complicated, ranging from the difficulties of surviving to the difficulties of education. At The World Economic Forum's Annual Meeting 2018, Jack Ma, CEO of Alibaba Group, stated that education is the toughest challenge of the century. If we do not change the way we educate and teach, it can be assured that in the next 30 years we will experience great difficulties [1]. Education is closely related to learning in school. The nature of learning is an activity that is consciously done to produce a transformation, including knowledge and skills. Mathematics is one of the subjects that learned by students in every level of education, so it makes mathematics have an important role in education especially in the 21st century. Therefore, mathematics is not only a subject that teaches facts, but also must be able to play a role in developing student's skills. In accordance with the demands of the 21st century, students should have the competencies such as communication, collaboration, critical thinking and problem solving, creativity and innovation [2].

Communication skills are important proficiency in dealing with the 21st century that are more open, interactive, multidimensional and participatory [3]. Along with the goals of learning mathematics in middle school, mathematical communication is a basic mathematical abilities that students need to have [4]- [5]. Mathematics is an symbolic language that is efficient, organized, and have qualitative analysis. Awareness of the importance of paying attention to students' ability to communicate using mathematics learned in school needs to be cultivated, as one of the functions of mathematical learning is to communicate the idea in a practical, systematic, and efficient manner.

In order to achieve ideal learning conditions, the quality of teaching is closely related to the optimal use of learning models. The role of teachers as "teachers" must be proportional to other roles as facilitators, participants and even companions in the class. Teachers need to build a community in the classroom so that students feel free to be more active to express their thoughts [5]. The efforts to create a mathematical community that is conducive to the growth and development of communication skills using mathematics, can be achieved through cooperative learning.

TAI is a cooperative learning model developed by Slavin. This model is a group learning which puts the students in small groups consisting of two or more heterogeneous students to help each other in learning the material. This model also emphasize on the positive interdependence among students, their individual responsibility, face to face meeting, intensive communication, and group evaluation process so that the classroom management becomes more

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effective [6]. TAI learning model combines the advantages of cooperative learning and individual learning. TAI learning model collaborated with the SAVI approach produces better mathematics learning achievement compared to the TAI learning model and the direct learning model in vocational high school students of class XI [7].

Along with the implementation of curriculum 2013 that is part of 21st education, scientific approach is very appropriate to be implemented in learning process. The improvement of mathematical problem solving abilities obtained by learning using scientific approach. Through this scientific approach students are also required to be able to present or deliver the results of their discussions in front of the class. Research results from [8] also stated Research results from X also stated the ability to understand the trigonometric concepts of students who learn through a scientific approach is higher than students as a whole and without a scientific approach. This shows that the scientific approach has an impact on student learning outcomes.

In addition to the use of appropriate learning models and approaches, there are other factors that can also affect the success of mathematics learning, one of which is the personality orientation of students who are unique in cooperation will give different responses. Personality orientation in cooperation is divided into 3 namely competitive, individual, and cooperative [9]- [10]. Based on those explanation, this paper will discuss the results of research on the effect of TAI type cooperative learning with scientific approach towards mathematical communication based on student's cooperative personality orientation.

## II. Method

Based on research problem, this research is categorized as quasi-experimental research. This research provides

treatment on samples, so researchers want to know the effectiveness of each treatment. The treatment mentioned in this study is 2, namely, the use of Team Assisted Individualization (TAI) learning model with the scientific approach and direct Instruction model (DI) on mathematics learning for vocational high school students. The population in this research is the XI grade students of Matesih Vocational School 2019/2020. From the population, 2 classes were selected as samples, one class being the experimental class and the other class being the control class.

Data collection techniques used in this study were questionnaire and test methods. The test is given to students as a test of mathematical communication skills and a questionnaire is given to students to determine student's cooperative personality orientation. From the data obtained, we perform normality and homogeneity test as a prerequisite of two way analysis of variance using SPSS.

## III. Results and Discussion

The result of data analysis will be visualized using multiple tables.

TABLE 1. NORMALITY TEST RESULT ON THE MODEL VARIABLE

| | Model | Kolmogorov-Smirnova[a] Statistic | df | Sig. | Shapiro-Wilk Statistic | df | Sig. |
|---|---|---|---|---|---|---|---|
| Value | TAI Scientific | ,095 | 32 | ,200[b] | ,953 | 32 | ,178 |
| | DI | ,099 | 34 | ,200[b] | ,978 | 34 | ,706 |

[a]Lilliefors Significance Correction
[b]This is a lower bound of the true significance.

As displayed in table 1, for each p value or Sig TAI Scientific = 0,200 with Lilliefors (Kolmogorov-Smirnov) test and sig TAI Scientifc = 0,178 with Shapiro-Wilk. Therefore, the H0 test result was accepted and it was concluded that TAI sample with scientific approach are came from a population that has a normal distribution. Then p value

or sig DL = 0,200 with Lilliefors (Kolmogorov-Smirnov) test and sig DI = 0,200 and p value DI with Sahpiro-Wilk = 0,706. Therefore, the H0 test result was accepted and it was concluded that the DI sample are came from a population that has a normal distribution.

TABLE 2. NORMALITY TEST RESULT ON PERSONALITY VARIABLE

| | Personality | Kolmogorov-Smirnova[a] Statistic | df | Sig. | Shapiro-Wilk Statistic | df | Sig. |
|---|---|---|---|---|---|---|---|
| Value | Cooperative | ,143 | 26 | ,180 | ,959 | 26 | 0,375 |
| | Competitive | ,139 | 17 | ,200[b] | ,934 | 17 | 0,255 |
| | Individualist | ,118 | 23 | ,200[b] | ,940 | 23 | 0,179 |

[a]Lilliefors Significance Correction
[b]This is a lower bound of the true significance.

As per seen from table 2 , the result of p value or Sig on every personality with Lilliefors test and Shapiro Wilk are greater than 0,05. It can be concluded than for each sample on personality type came from a population that has a normal distribution.

TABLE 3. LEVENE'S TEST OF EQUALITY OF ERROR VARIANCESA

| F | df1 | df2 | Sig. |
|---|---|---|---|
| 1,953 | 5 | 60 | ,099 |

As per seen from table 3, p value = 0,099 are greater than 0,005. It can be inferred that the data have same variance.

TABLE 4. TESTS OF BETWEEN-SUBJECTS EFFECTS

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 1447,827[a] | 5 | 289,565 | 3,563 | ,007 |
| Intercept | 345511,023 | 1 | 345511,023 | 4251,104 | ,000 |
| Model | 498,778 | 1 | 498,778 | 6,137 | ,016 |
| Kepribadian | 816,024 | 2 | 408,012 | 5,020 | ,010 |
| Model * Kperibadian | 170,201 | 2 | 85,100 | 1,047 | ,357 |
| Error | 4876,536 | 60 | 81,276 | | |
| Total | 373088,000 | 66 | | | |
| Corrected Total | 6324,364 | 65 | | | |

[a]R Squared = ,229 (Adjusted R Squared = ,165)

As displayed in table 4, ANOVA test results show that there is a direct influence between the independent variables of the model and personality. Pada variabel independen model memberikan p value sebesar 0,016 (p < 0,05). This means that there are differences in mathematical communication skills between models. From independent variable on personality gives a p value of 0,010 (p < 0,05). It can be inferred that there are differences in mathematical communication skills toward student's cooperative personality. The interaction between models and personality shows p value of 0,357 (p>0,05). It can be concluded that there is no relationship between models variable and student's personality toward mathematical communication.

TABLE 5. ESTIMATED MARGINAL MEANS

| Model | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|
| | | | Lower Bound | Upper Bound |
| TAI Scientific | 77,088 | 1,595 | 73,897 | 80,279 |
| DI | 71,444 | 1,626 | 68,191 | 74,697 |

As per seen in table 5. It shows that the Mean of TAI Scientific is greater than mean of DI. It can be inferred that mathematical communication skills of students with TAI scientific learning are better than students with DI learning model.

TABLE 6. MULTIPLE COMPARISONS

| | (I) Personality | (J) Personality | Mean Difference (I-J) | Std. Error | 95% Confidence Interval | | Sig. |
|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | |
| Tukey HSD | Cooperative | Competitive | 2,96 | 2,812 | ,548 | -3,80 | 9,71 |
| | | Individualist | 8,28[a] | 2,581 | ,006 | 2,08 | 14,48 |
| | Competitive | Cooperative | -2,96 | 2,812 | ,548 | -9,71 | 3,80 |
| | | Individualist | 5,32 | 2,884 | ,164 | -1,61 | 12,25 |
| | Individualist | Cooperative | -8,28[a] | 2,581 | ,006 | -14,48 | -2,08 |
| | | Competitive | -5,32 | 2,884 | ,164 | -12,25 | 1,61 |
| Bonferroni | Cooperative | Competitive | 2,96 | 2,812 | ,892 | -3,97 | 9,88 |
| | | Individualist | 8,28[a] | 2,581 | ,006 | 1,92 | 14,64 |
| | Competitive | Cooperative | -2,96 | 2,812 | ,892 | -9,88 | 3,97 |
| | | Individualist | 5,32 | 2,884 | ,210 | -1,78 | 12,42 |
| | Individualist | Cooperative | -8,28[a] | 2,581 | ,006 | -14,64 | -1,92 |
| | | Competitive | -5,32 | 2,884 | ,210 | -12,42 | 1,78 |

[a]The mean difference is significant at the ,05 level.

As per displayed on table 6, the result of Turkey HSD and Banferroni shows that there are differences on mathematical communication of student's with cooperative and individualist personality type with value of 8,28 and statistically have a significance value of p = 0,006.

Mathematical communication skills of cooperative students are higher than individualist students. Thus, it can be concluded that the mathematical communication skills of cooperative students are better than individualist students.

## IV. Conclusion

Mathematics plays an important role in developing communication skills. Mathematics learning using models that are tailored to the needs of the 21st century can hone students' mathematical communication skills. Based on the results of the study it can be concluded that: 1) The use of the TAI model with a scientific approach provides better mathematical communication results than direct learning. Meanwhile 2) Mathematical communication skills of students with cooperative personality types are better than Individualists, and 3) there is no interaction between learning models and the orientation of students' cooperative personality towards mathematical communication

## Aknowledgments

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