THE EFFECT OF COOPERATIVE LEARNING TEAM ASSISTED INDIVIDUALIZATION WITH SAVI APPROACH TO THE STUDENTS' MATHEMATICS ACHIEVEMENT VIEWED FROM THEIR LEARNING STYLE

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Abstract

This research aims to determine the effect of teaching strategy to learning approach, mathematics learning style and the interaction between them to the students' mathematics achievement. This research design was a quasi-experimental research with a 2x3 factorial design. The population of this research is all students of eleventh grade students of private vocational school in Grobogan academic year 2016/2017. Sampling was done by stratified cluster random sampling. Data were analyzed using two-way analysis of variance with different cells. Based on the research results, it was obtained that: (1) the students' mathematics achievement who were taught by TAI learning model with SAVI approach better than direct instructional model, (2) the mathematics achievement of students with auditory learning styles were better than those with visual and kinesthetic learning style, whereas mathematics achievement of students with visual learning style were similar to those with kinesthetic. (3) in the visual and auditory learning styles, the students who were taught by using TAI with SAVI and direct instructional model had the same mathematical achievements, meanwhile for the students with kinesthetic learning style who were taught by using TAI with SAVI had better achievement than those who were taught by direct instructional model. (4) on TAI model with SAVI, students with all kinds of learning style had the similar mathematical achievement, while in direct instructional model, students with auditory learning style had better achievement than those with kinesthetic learning style. At each teaching strategy, the students with visual, auditorial or kinesthetic learning style had the same mathematical achievement.

Keywords: TAI SAVI, VAK Learning Style, Mathematics Achievement

Introduction

Mathematic education has a very important role in the successful development of the quality of education in Indonesia because mathematics is a basic science that is used widely in many areas of life. Mathematics is taught at every level of education, including vocational school. Vocational High School is a school that provides students with skill and to be ready to work in accordance with the expertise of the students. The subjects which the students learn are more dominant to vocational. Therefore, vocational students prefer vocational subjects / skills compared with mathematics. Mathematics is considered to be difficult for some students which make their results in

mathematics achievement is still unsatisfactory. The low mathematics achievement can be seen from the results of National examination.

Agency of National Education Standards (BSNP) state that the average value of mathematic National Examination (UN) of vocational high school in 2015 at the provincial level (Central Java Province) is the lowest compared to other subjects, namely 56.02. Additionally, BSNP (2015) also analyze the National Exam Integrity Index (IIUN). National Exam Integrity Index (IIUN) is the percentage rate of students who did not show a pattern of cheating. The measured cheating is a combination from cheating among students (cheating among individuals) and the percentage of answer pattern uniformity in national examination (systemic/organized fraud). The IIUN results of vocational high school stated that Grobogan is a regency in Central Java with the largest decline of IIUN compared to the previous year. The average Mathematics value of vocational high school in National Examination 2015 in Grobogan was also the lowest compared to other subjects, namely 56.24. The lowest students comprehension of vocational students is Statistics and Probability material. This indicated the need for improvement of the learning process in Grobogan related to the material. There are 36 vocational schools in Grobogan, which consists of 3 public vocational schools and 33 private vocational schools. The characteristics of public and private vocational school were different so that it required the selection to determine the population. Since the number of private school is larger than public school, then the researchers chose private schools as the research population.

The factors affecting students' mathematics achievement can come from inside or outside the student. Factors coming from inside the students including the student's learning style. According to DePorter and Hernacki (2015: 111-112), "learning style is a combination of how they absorb, and then organize and process information". In this research, the intended learning style is the style of learning mathematics by classification using a type of VAK (visual, auditory, and kinesthetic). Gilakjani (2012: 105) explains that visual students learning by seeing, auditory students learning by hearing, and kinesthetic students learning by doing. Further, Sze (2009: 361) states, "Every student's brain functions differently and processes information differently. Due to this, students have different types of learning styles. Once the teacher can understand the disability and the preffered learning styles of the student, they can better adapt to the student."

The factors coming from outside the students that can affect students' mathematics achievement are learning model and learning approaches. Soekamto (Trianto, 2011: 5) defines learning model as a conceptual framework that describes a systematic procedure in organizing learning experiences in achieving specific learning objectives, and serves as a guideline for designers and providers of learning in planning learning activities. One of learning model that can make students practice to hone their own capabilities without relying on others, believe in his own abilities and also makes learning meaningful is a cooperative learning model Team Assisted Individualization (TAI) type. TAI is a cooperative learning model developed by Slavin. This learning model combined the strength of cooperative learning and individual learning. Learning model equipped with the right learning approach will produce qualified learning process. Sapti and Suparwati (2011: 358) argues, "Essentially, the learning approach is a means to achieve learning goals and can develop and enhance the learning activities of teachers and students". Each student with a variety of characteristics must be served entirely so that they can maximize their abilities. One approach that can facilitate the learning characteristics of students in learning is Somatic, Auditory, Visual and Intellectual (SAVI) approach. The learning approach was pioneered by Dave Meier in 2002 consisting of somatic (learning to move and do activities), auditory (learning by speaking and hearing), visual (learning by observing and describing/imagining), intellectual (learning to solve

problems and create a reflection) (Kurniawati, Waluyo, and Andayani, 2013: 445). Based on previous explanation, it is necessary to do a research related to the use of learning model with an approach consistent with the characteristics of students and associated with different types of students' learning styles and their influence on mathematics achievement of students.

The purpose of this paper is to identify (1) which learning model among TAI SAVI, TAI, and direct instructional model gives the best mathematic achievement for the students, (2) which one has the best mathematic achievement among students with visual, auditory or kinesthetic learning style in each style of mathematics learning, (3) which learning model gives better mathematics learning achievement among students who were taught by TAI SAVI, TAI or direct instructional model on each learning model, and (4) which one has the better mathematics learning achievement among students with learning styles of visual, auditory, or kinesthetic.

Finding and Discussion

The research was conducted at private vocational schools located in Grobogan. The research subjects were students of eleventh grade in the academic year 2016/2017. The study was conducted as a quasi-experimental research with a 2x3 factorial design. The population in this study were all private vocational schools students of eleventh grade in Grobogan. The sampling technique in this study was stratified cluster random sampling. Samples were selected from three schools namely SMK Muhammadiyah, SMK Pembangunan Nasional and SMK Pancasila and for each school was taken two classes as experimental class and control class. Data collection methods used were methods of documentation to obtain data on students prior knowledge, the test method used to obtain data on mathematics achievement and questionnaires to obtain data on students' mathematics learning styles. Test requirements analysis in this study used a normality test method from Lilliefors and homogeneity test method from Bartlett, then balance test using the test one way analysis of variance with different cells. Furthermore, the hypothesis test using two-way Anova test with different cells and continued double comparison test with Scheffe method if the null hypothesis is rejected.

Based on the prerequisite test, it was concluded that the samples came from populations with normal distribution and had the same variance. After the normality and homogeneity test, the researcher did a balance test using F test. Based on the balance test of the initial ability of students, it was obtained that $F_{obs} = 0.9360$ and $F_{table} = 3.84$. Because Critical Region = $\{F \mid F > 3.84\}$ and $F_{obs} < 3.84$, then $F_{obs} \notin$ Critical Region. This indicated that both groups had the same initial ability or balance.

Analysis of experimental data in the form of mathematics achievement test results on opportunities material was done by using two-way analysis of variance with different cells. Prior to the analysis of variance of two different cell, prerequisite analysis such as normality and homogeneity were done first. Based on the prerequisite test, it is concluded that the samples came from populations with normal distribution and had the same variance. The results of two-way analysis of variance with different cells are presented in Table 1.

Table 1. The results of Two-Way Analysis of Variance with Different Cells

Source	*SS*	*df*	*MS*	F_{obs}	F_{α}	Test decision
Learning model (*A*)	2421,6622	1	2421,6622	14,23	3,84	H_{0A} rejected

Mathematic Learning style (*B*)	1830,9831	2	915,4916	5,38	3,00	H_{0B} rejected
Interaction (*AB*)	1565,2364	2	782,6182	4,60	3,00	H_{0AB} rejected
Error	29440,5528	173	170,1766	-	-	-
Total	35258,4345	178	-	-	-	-

Based on Table 1, it can be obtained that: (1) there were differences in mathematic achievement between students who were taught by using TAI SAVI learning model and direct instructional model, (2) there were differences in mathematic achievement between students who had visual, auditory, and kinesthetic learning style (3) there was an interaction between the learning model used and the style of mathematics learning to mathematics achievement.

Based on the results of two-way analysis of variance with different cell, it was obtained that the decision H_{0A} was rejected, H_{OB} was rejected, and H_{OAB} was rejected, so it was needed multiple comparison test between rows mean, mean multiple comparison test between columns, and mean multiple comparison test between cells in the same row and column. For the purposes of multiple comparison test, the data presented below are the cell mean and marginal mean mathematics achievement of students in Table 2.

Tabel 2. Cell Mean and Marginal Mean of Students' Mathematic Achievement

Learning Model	Learning Style			Marginal Mean
	Visual	Auditory	Kinesthetic	
TAI SAVI	56,1600	61,5135	60,4286	59,6889
Direct Instructional	52,5882	58,6667	44,5714	51,9101
Marginal Mean	54,1017	60,3125	52,5000	

The results of mean multiple comparison test between lines by Scheffe method that students mathematics who were taught by TAI SAVI learning model was better than those who were taught by using direct instructional model. This was because the direct model did not facilitate the students to participate actively in learning, students just quietly listened to the explanations of the teacher so that the gained understanding becomes meaningless, while on the TAI learning model with SAVI approach, students learned the activity, discussed, did exercises, and utilized the senses as much as possible and make the whole body or mind were involved in the learning process. Therefore TAI modified with SAVI approach would provide optimal results in the success of the learning process so that the mathematics achievement of students who were taught by using TAI SAVI was better than those who were taught by using direct instructional model. It was also reinforced by research conducted by Sapti and Suparwati (2011) which resulted in the conclusion that the use of SAVI approach in mathematics provided a better learning achievement compared to conventional approaches.

The results of mean multiple comparison test between columns with Scheffe method that students with auditory learning style had better mathematics learning achievement than students with visual and kinesthetic learning style. Students with visual and kinesthetic learning style had the same mathematical learning achievement. This was because almost all of the delivery of the material using verbal communication so that students with auditory learning style were easier in receiving

information or material taught than students with visual and kinesthetic learning style. Research that had been done before which supported this findings was research conducted by Baltaci, Yildiz, dan Ozcakir (2016) which resulted in the conclusion that there were significant differences between learning style and students' mathematics achievement.

The results of multiple comparison test mean between columns with *Scheffe* method was presented in Table 3.

Table 3. The Results of Multiple Comparison Test between Columns Mean

H_0	F_{obs}	$5F_{0,05;5,173}$	Test Decision
$\mu_{11} = \mu_{21}$	1,08	11,05	H_0 diterima
$\mu_{12} = \mu_{22}$	0,74	11,05	H_0 diterima
$\mu_{13} = \mu_{23}$	20,69	11,05	H_0 was rejected

Based on Table 3 and means in Table 2 be concluded that the students who had a kinesthetic learning style, mathematics achievement of students who were subject of TAI SAVI learning model was better than the mathematics achievement of students who were subject to direct learning model. In the students with mathematics learning styles of visual and auditory, both TAI SAVI or direct learning model provided the same mathematics learning achievement. This was because in the TAI with SAVI learning model, students with kinesthetic learning style aided by using props and worksheets that helped them understand the material through objects that could be touched. In the auditory learning style, the applications of any learning model would provide the same learning achievement. For students with auditory learning style were easier to receive information through hearing and to remember what was discussed, using different learning model would produce the same performance as well. In visual learning style, learning model application using TAI SAVI and direct model were still not optimal so that it would produce the same learning achievement with the direct model.

The result of multiple comparison of cells in the same rows mean with Scheffe method presented in Table 4.

Table 4. The Result of Average Multiple Comparison of Cells in the Same Rows

H_0	F_{obs}	$5F_{0,05;5,173}$	Test Decision
$\mu_{11} = \mu_{12}$	2,51	11,05	H_0 was accepted
$\mu_{11} = \mu_{13}$	1,41	11,05	H_0 was accepted
$\mu_{12} = \mu_{13}$	0,11	11,05	H_0 was accepted
$\mu_{21} = \mu_{22}$	3,27	11,05	H_0 was accepted
$\mu_{21} = \mu_{23}$	5,80	11,05	H_0 was accepted
$\mu_{22} = \mu_{23}$	16,05	11,05	H_0 was rejected

Based on Table 4 and mean on Table 2 it can be concluded that in the TAI SAVI learning model, students with visual, auditory, and kinesthetic learning styles gave similar achievement. This was because the TAI cooperative learning model with SAVI approach was a modification models so that students could take advantage of all the sensory organs possessed to obtain knowledge. This indicated that all students' learning styles: students with a visual learning style (learning by seeing), auditory (learning by hearing) and kinesthetic (learning by doing) were served through this

model. In the direct learning model, students with auditory learning style had better mathematics achievement than those with kinesthetic learning style. This was because students with auditory learning style was easy to understand the material by listening and direct model greatly facilitated the students' learning style, in contrast with kinesthetic students who were needed activity to be able to understand the material.

Conclusions

Based on the analysis of data and discussion that has been done, it is obtained several conclusions. First, the students' mathematics achievement who were taught by using TAI SAVI learning model was better than those who were taught by using direct instructional model. The students' mathematics achievement who had auditory learning styles was better than those with visual and kinesthetic learning style, and the students' mathematics achievement who had visual learning style was equally the same with those who had kinesthetic learning styles. In students with kinesthetic learning style, the students who were taught by using TAI SAVI had better mathematics achievement than those who were taught by using direct instructional model. In the students with visual and auditory learning styles, TAI SAVI learning model or direct instructional model provided the same mathematics learning achievement. In TAI SAVI learning model, all kinds of learning style gave the same achievement. In the direct instructional model, students with auditory learning style had better mathematics achievement than kinesthetic learning style, while students with visual and auditory learning styles as well as visual and kinesthetic have the same mathematics achievement.

Based on the conclusions on the above results, several suggestions are given as follows. Teachers need to be wise in choosing the suitable model and approach in the mathematics learning process. The choice also need to consider the characteristics of different students. One of the models and approaches that can be used by teachers in mathematics learning is TAI type of cooperative learning model with SAVI approach. In this research showed that the students' learning styles affect students' mathematics achievement. Therefore, teachers also need to know the students' learning style to design a suitable learning and can treat students with appropriate learning style they had. Students need to recognize their learning style so that students are able to maximize their ability and students need to practice solving the problems with their own ability to practice math skills. Other researchers who are interested in this research could develop this research using the different models and approaches of learning, applied at different levels of education, the different material and also uses other learning styles, other group than VAK, such as the model VARK, the model of Kolb (CE , AC, RO, AE), and the other models.

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