The effectiveness of Team Assisted Individualization (TAI) based Assessment for Learning (AfL) in Student’s Mathematical Reasoning Ability of Junior High School

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Abstract. This research aims (1) to examine the completeness of classical learning classroom with learning model Team Assisted Individualization based Assessment for Learning, and (2) to examine the comparison of the ability of student’s mathematical reasoning with learning model Assisted Individualization based on Assessment for Learning and direct learning model. This research uses a quasi experimental design method with posttest-control-group design. The population in this study was the regular students of grade VIII SMP Negeri 3 Pati in academic year 2016/2017. By cluster random sampling technique, VIII D and VIII E were selected as a sample. The data collection techniques used observation, tests, and documentation. Quantitative data analysis uses z-test and t-test. The result of the research shows that (1) student’s mathematical reasoning ability with learning model Team Assessed Individualization based on Assessment for Learning model achieves classical completeness, and (2) the student’s mathematical reasoning ability with the Assessed Individualization based on Assessment for Learning is better than the direct learning model.

1. Introduction
Education has a very important role to sharpen human person. Indonesian National Education System education is a conscious and planned effort to create a situation of learning and learning process so that students develop actively their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, as well as the skills required by theirself, society, nation, and state [1]. One of the required subjects of education that are contained in Permendikbud No 58 [2] is mathematics. Every student at the level of Primary and Secondary Education is required to take mathematics lessons. Mathematics has an important role in education because mathematics is very related to other subjects and related to everyday life. Mathematics is a universal discipline that is useful for human life, underlies the development of modern technology, has an important role in various disciplines, and advances thought power of human [3]. Meanwhile, Nizami and Mahmudi stated that learning mathematics can give students the freedom to sharpen skills such as the ability to abstract, analyze, and reason [4]. Therefore, it can be concluded that reasoning ability is one of the objects on mathematics learning which must be developed. According to Rizki et al, logical thinking skills refer to the ability to produce conjectures, whereas the ability to reflect refers to the ability to check the correctness of procedures or mathematical arguments [5]. In addition, According to Rizki
et al., students are invited to reflect and use reasoning skills to examine the truth of their solution processes and explore other points of view that can be used to solve problems more effectively and efficiently [6]. However, the fact shows that the mathematical reasoning ability in some schools is still low. One of them was in SMP Negeri 3 Pati. Based on observations, students in regular class still have low ability of mathematical reasoning in solving problems, and their enthusiasm to engage in mathematics learning was not optimal. This causes the learning outcomes of regular-class students to be still below the KKM (minimum completeness criteria) set by the school. The KKM set for Mathematics was 80. In addition, the UAS results in semester 2016/2017 academic year were not optimal, only 20.58% in regular classes that reached KKM. It was known that students still have difficulty compiling evidence, giving reasons and were not yet skilled at drawing conclusions from a mathematical statement. Those three skills are indicators of reasoning ability.

Based on the results of an interview on January 30, 2017, with one of the Mathematics teachers in class VIII informing that SMP Negeri 3 Pati implemented a superior class system so that it had heterogeneous student characteristics. While based on the results of observations, it was known that the teacher in giving material applied a different way between regular classes and superior classes. Teachers teaching in regular classes still use the direct-learning model. Fani and Rosnawati stated that by teacher-centered learning, student activity is not optimal. Interaction between students and teachers or between other students is rare. Student activities still depend on the instructions given by the teacher. Teachers should not help directly but give problems to build students' knowledge in teaching and learning activities [7]. Applying the right learning model will greatly assist students in receiving material. This is consistent with Watkins et al that learning will influence the mastery of concepts such as knowledge, understanding, application of facts and procedures, and creativity. This opinion is reinforced by Arends that the learning model is an overall plan or pattern to help students learn certain types of knowledge, attitudes or skills [9]. One learning model that can support interactive learning and develop students' abilities is a cooperative learning model. Cooperative learning model is a learning model that prioritizes cooperation between students to achieve learning objectives. According to Wena, cooperative learning is one model of group learning that has certain rules. There are several types of cooperative learning models, one of which is the cooperative learning model Team Assisted Individualization (TAI). TAI cooperative learning is a learning model that combines individual and group learning models [10]. The stages of the TAI learning model according to Slavin [11] are (1) teams, the formation of heterogeneous groups consisting of 4 to 5 students; (2) placement test, pre-test distribution to students to see student grades and so that teachers know students’ weaknesses; (3) student creative, Implementation of tasks in a group by creating a situation where the success of an individual is determined or influenced by the success of the group; (4) team study, learning actions that must be carried out by groups and teachers provide individual assistance to students in need; (5) team scores and team recognition, Giving scores to group work results and providing criteria of appreciation for groups that are brilliantly successful and groups that are considered less successful in completing tasks; (6) teaching group, giving material briefly around 10-15 minutes to students; (7) fact tests, small tests based on facts obtained by students; and (8) whole-class units, Provision of material by teachers at the end of learning time with problem solving strategies. In addition, the advantages of TAI are (1) more likely to give assistance rather than receiving it during cooperative seat work, (2) placement according to mathematics achievement, (3) flexible pacing possible [12].

However, according to Apriyani [13], the TAI learning alone is not much different from direct learning, so it is necessary to vary the cooperative learning model based on formative assessment. One of the formative assessments is Assessment for Learning (AfL) [13]. AfL is an assessment specifically used to improve the learning process or performance [14]. According to Willis [15], AfL is a beneficial pedagogical-practice such as increasing motivation, mastery and autonomy as students to develop their capacity to monitor and plan their own learning progress [15]. AfL is carried out throughout the learning process and is usually used as a basis for improving teaching and learning processes. Examples of AfL formative assessment are assignments, presentations, projects, and quizzes [16]. The advantages of AfL will direct students to increase quality of students’ knowledge and understanding. In the TAI based AfL learning model, students are designed to work in
heterogeneous groups and endure responsibility for managing activities and routinely correcting the results of their own work. Students motivate and help each other in solving problems. The syntax of the TAI based AFL learning model, namely informing learning objectives and success criteria, initial tests, grouping, giving worksheets, doing task sheets, giving quizzes, and whole-class unit. The strengths of the TAI based AFL are (1) students get learning from the questions given, (2) students better understand their weaknesses and strengths, and (3) teachers can reflect on the model [18].

Pratiwi et al [19] stated that TAI with AFL had better learning outcomes compared to the TAI learning model and direct learning. In line with Slavin's [11] statement that TAI is designed to solve theoretical and practical problems of individual learning and working in groups. Whereas for AFL, students actively engage in learning, streamline feedback, use assessment results to motivate and make students aware of wanting to learn to achieve success [21]. In addition, TAI type cooperative learning is effective in terms of reasoning abilities and mathematics learning attitudes [22]. Thus, AFL-based TAI learning will be effective to improve mathematical reasoning ability, because students will be actively involved and motivated in learning so that it improves student learning outcomes.

Based on the description above, mathematics learning using the TAI based AFL learning model can be a solution to the problem of low mathematical reasoning abilities. The purpose of this research are to (1) test the classical completeness of students' mathematical reasoning ability with using the TAI based AFL learning model and (2) test the comparison of mathematical reasoning abilities between students taught using the TAI based AFL learning model and students taught using direct learning in the regular class on cubes and cuboid material.

2. Methodology
The research method used was quasi-experimental design with posttest only control group. The study was conducted in SMP Negeri 3 Pati on the 20th-29th of April, 2017. The population in this study was the regular VIII class of 2nd semester of SMP Negeri 3 Pati in the academic year 2017/2018. In this case, the population of the study was VIII C – VIII H class. The sample technique used was cluster random sampling. In the cluster random sampling technique, 1 class namely VIII D was selected as the experimental class and 1 other class namely VIII E was selected as the control class. The study was started by collecting initial data to determine the diversity of sample abilities. Then the implementation phase was carried out to determine the effectiveness learning of TAI based AFL. The experimental class was treated by using the TAI based AFL learning model and the control class was treated by using the direct learning model. After the implementation phase, a post test was conducted in the form of a mathematical reasoning ability test.

The data collection techniques used in this research were tests and documentation. Test aims to collect data about students' mathematical reasoning abilities. The test instrument was in the form of a description with 4 items that included indicators of mathematical reasoning ability on cube and cuboid material. The documentation was used as authentic evidence of the research conducted in SMP Negeri 3 Pati and the collection of initial data. Data analysis techniques in the initial stages used the normality and homogeneity test. The data analyzed were data on the UAS (final examine) results of VIII D and VIII E students at SMP Negeri 3 Pati in the 2016/2017 school year. Then the prerequisite tests namely normality and homogeneity are performed. Next, the classical completeness test uses a one-side proportion test, the right-side test. The classical completeness test criteria was $\geq 75\%$. The effectiveness of the TAI based AFL learning model used the t test.

3. Results and Discussion
From the initial data results for normality test using SPSS 16.0, it was obtained $sig = 0.187 > 0.05$. From this significant value, it means that $H_0$ is accepted, meaning that the data is normally distributed. While the homogeneity test was obtained $sig = 0.792 > 0.05$. It means that $H_0$ is received. This shows that the initial data population is homogeneous or has the same variance. The test results of normality prerequisite was obtained $sig = 0.266 > 0.05$. It means that $H_0$ is accepted, So the data
has normal distribution. The result of homogeneity test was obtained $\text{sig} = 0.065 > 0.05$. It means that $H_0$ is accepted. Based on the analysis, it can be concluded that the data is homogeneous or has the same variance.

The results of the right-side proportion test gave the value of $z_{\text{count}} = 1.97$, $z_{(0.5-\alpha)} = 1.64$, and $z_{\text{count}} \geq z_{(0.5-\alpha)}$ so that $H_0$ is rejected. This shows that more than 75% of all students get grades that reach $KKM$ on the mathematical reasoning ability test using the TAI based AFL learning model. From the results of the t test, it was obtained the value of $t_{\text{count}} = 4.303$ and $t_{\text{table}} = 1.67022$. Because of $t_{\text{count}} > t_{\text{table}}$, $H_1$ is accepted. This shows that the mathematical reasoning ability of students with the TAI based AFL learning model is better than the students using direct learning.

Based on the results of mathematical reasoning ability tests it is known that 24 of 31 students with TAI based AFL learning achieved mastery learning individually or 90.32% of students scored more than or equal to 80. In addition, TAI based AFL achieved classical predetermined completeness which is 75%. The achievement of the results in this study is in accordance with Uno [23] that the process of changing one's behavior or personality is based on interactions between individuals and their environment that are carried out formally, informally, and informally. The TAI learning model is more communicative which allows students to share information so that the learning atmosphere is more conducive and students can understand the material better than direct learning whose activities tend to be passive [17]. AFL is carried out during the learning process and is used as a basis for improving teaching and learning processes [16]. Students who are given TAI based AFL learning experience changes in behavior because with TAI based AFL learning students are measured and grouped for group learning so that students experience changes in behavior that is usually studied individually, they are required to be responsible individually or in groups. The use of TAI based AFL learning models is a discovery that is very important for students in the process of constructing the knowledge they already have. Based on the results of the study it was found that the average mathematical reasoning ability of students who use the TAI based AFL learning model is 88 while the average mathematical reasoning ability of students with direct learning models is 80. In calculations, the average results of tests of mathematical reasoning ability with TAI based AFL learning models are higher than those of direct learning models. This is consistent with the results of research Manapa et al. [17] and Siregar et al. [27] that TAI learning is effective than direct learning in mathematics. In addition, the direct learning model does not really motivate students to obtain optimal learning achievement [17].

According to Apriyani et al. [13] the learning model is TAI not much different from direct learning, so a cooperative learning model based on formative assessment is needed. AFL is the use of ongoing evidence about student learning to direct and improve student practice in the classroom. This is in accordance with the opinion of Stiggins et al. [24] that AFL is the process of finding and interpreting the evidence available for students and teachers to determine the position where students have learned, what must be done later, and how to best achieve the desired goals. This is in line with Hermawan & Winarti’s [25] research that direct learning is centered on researchers so that student activity becomes less than optimal. In addition, the learning model TAI based AFL requires active students to find concepts in cube and block material. This is in line with Bruner’s learning theory [26] that learning emphasizes the active involvement of students, thus helping and facilitating students to find or construct their new knowledge. This gives positive results on students' mathematical reasoning abilities. The TAI learning model that combines cooperative learning and individual learning in the learning process. This is consistent with Slavin's opinion that TAI uses heterogeneous groups to complete the assigned group assignments. Assignments to increase knowledge are given before and / or during the learning process [16]. In addition, the advantages of learning model TAI based AFL by Nugroho [28] the model of learning TAI based AFL makes students gain experience through the questions given for AFL, students better understand the advantages and disadvantages on themselves, their AFL in model TAI can be used individually as an indication of their readiness to take the unit test phase, and can be used by teachers to reflect on the models and strategies that have been used. Based
on these students the TAI based AfL learning model has better mathematical reasoning abilities than students with a direct learning model.

4. Conclusion

Based on the discussions that have been conducted by researchers obtained the following conclusions (1) students' mathematical reasoning ability with the learning model TAI based AfL can achieve mastery learning in cube material and class VIII regular SMP Negeri 3 Pati, (2) reasoning ability Mathematical students with learning model TAI based AfL is better than the mathematical reasoning ability of students with direct learning class VIII regular SMP Negeri 3 Pati cube and cuboid material.

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