Geometry Problem Solving Ability and Tolerance Character of Students 8th Grade with Assessment Project

Masrukan¹ and N A Mufidah

Mathematics Department, Faculty of Mathematics and Natural Sciences
Universitas Negeri Semarang, Semarang, Central Java, Indonesia

¹Corresponding author: masrukan.mat@mail.unnes.ac.id

Abstract. The 4K model is a learning model that is characterized by character, performance, creative and conservative. The use of a 4K model in this research is to improve the character of tolerance and Geometry problem-solving ability of students. Assessment of learning done thoroughly and during the learning process, using project assessment that includes assessment at the time of student do the project and assessment of students' project report. The result that the ability of geometry problem solving and tolerance character of students with project assessment achieve mastery and improved by project assessment.

1. Introduction
The school is a social system in which students learn to interact with each other, learn to understand social norms, learn to cooperate, learn to appreciate and learn various aspects of life in the community as appropriate. Within school students have very diverse backgrounds, whether religious, ethnic, socio-economic background, educational background of parents, areas, including customs and culture. Under conditions of this diversity are certainly going to find much of a difference in the attitudes and behavior of students. This difference must be understood and respected each other, thus allowing the growth of solidarity and unity among fellow students. Therefore, the value of tolerance become one of the pillars that need to be developed in the school.

The responsibility to develop the values of tolerance in students is a shared responsibility of all educators in the schools. However, such efforts more systematic and planned should become an integral part of the learning activities. Character education is a deliberate attempt to help people understand and care about the values of ethical/moral values [1]. So, teacher intentionally needs to design learning models to develop tolerance values of students. Character education can be integrated into the classroom [2]. Research conducted by a research team CDP also mentions a class that uses a character-based curriculum show a positive attitude in the student's character [2]. The integration of tolerance character through learning also does not give a negative impact on students' academic achievement. In this study observe at the tolerance character of 8th grade students, represented by three samples of the experimental class 1, experimental class 2 and control class. Tolerance is an attitude and action that respects differences of religion, race, ethnicity, opinions, attitudes, and actions of others who are different from themselves. Indicators of achievement character of tolerance, namely: (1) work in groups with friends of the opposite sex, religion, race, and level of ability, (2) does not impose any opinion or the will to others, (3) mutual respect, and (4) speaks with polite and courteous. Fourth indicators are then developed into eight faceted tolerance observed, namely (1) the attitude of students to cooperate in a group with friends of the opposite sex, religion, race, and level of ability, (2) the attitude of the students want to help friends who have difficulty in learning, (3) the attitude of students willing to give a chance someone else expression, (4) the attitude of students to appreciate others who have different views, (5) the attitude of students to respect other people who are talking, (6) the attitude of students never mock / blame...
others, (7) the attitude of students speaking politely to others, (8) the polite demeanor of students to teachers to answer when the teacher asked [3]. In addition to observing the tolerance character of students, this research will raise the problem-solving ability as a measure of academic achievement of students. According to Permendiknas 22 of 2006 on the Content Standards (SI) Subjects, one of the junior high school mathematics courses goal is that the students were able to solve problems that include the ability to understand the problem, devised a mathematical model, solve the model, and interpret the obtained solution [4].

The geometry is a branch of mathematics that is taught with the aim that students can understand the properties and relationships between geometric elements and can be good problem solvers [5]. A branch of mathematics geometry is very precise in measuring the students' problem-solving abilities. This is by Bobango [6] which says that one of the objectives of learning geometry is for students to become good problem solvers. However, geometry is considered to be elusive and tend to be hated by most students. Mathematics materials that are considered difficult and dreaded students in math is a matter of geometry [7]. This resulted in reluctant students learn geometry, and ultimately learning objectives geometry to develop problem-solving skills can not be achieved. Problem solving is usually defined as formulating new answers, going beyond the simple application of previously learned rules to achieve a goal [8]. This means the problem is defined as formulating a new answer, beyond the simple application of a previous learning process to achieve the goal. The solution about problem solving includes a four-step phase of completion, which is to understand the problem, obtain eventually a plan of the solution, carry out the plan, and examine the solution obtained [9].

The learning model is a plan or pattern that can be used by teachers in implementing the learning in the classroom, ranging from preparing a learning device, media, and tools to evaluation tools that lead to the achievement of learning objectives [10]. The learning model used in this study is the 4K model. 4K model is a learning model that charged character, creative, performance, and conservative. This learning model integrates character education learning activities. This learning model nuanced conservative, this means that in learning activities using teaching aids from recycled materials. Teaching aids is a learning media is best used in the material geometry. The 4K model syntax is (1) character development illustration, (2) investigation, (3) collaborative exploration, (4) creative activity, (5) communication, and (6) appreciation. In addition to the use of a model of learning, assessment of learners also need to be considered as one important aspect of the learning process. As Zainul said in [11] that the assessment of learning outcomes is not only connected with the result but more importantly it is an important part of the learning process. The assessment used in this study is the project assessment that includes assessment at the time of student projects and assessment tasks student project report. Assessment of the project is an assessment of the tasks to be completed within a period/time, the task in the form of an investigation into something that includes planning, data collection, organizing, processing, and presentation. During the project, students prepare a plan, implement the plan, and discuss. During the project implementation process, students are expected to develop problem-solving skills. The most obvious benefit obtained by students from the project works their increasing interest towards science and technology class [12]. The most significant change seen by students regarding project preparation is their increasing grades in exams during and following the project works.

The use of the 4K model and project assessment in this research is expected to improve the character of tolerance and geometry students' problem-solving abilities. Aim of the study are (1) to test the completeness of the geometry problem solving ability of students and to determine the completeness of the tolerance character of students through 4K learning with project assessment, 4K model, and cooperative model; (2) to examine differences in geometry problem solving ability and tolerance character of students through 4K learning with project assessment, 4K model, and cooperative model; (3) to test the highest geometry problem solving ability and tolerance character of students through 4K learning with project assessment, 4K model, and cooperative model.

2. Methods
The method used in this study is quantitative. The population in this study is all students 8th grade in State Junior High School 22 Semarang and the sample is a student in class VIII E (experimental class 1), VIII B (experimental class 2), and VIII F (control class). The variables in this study are the independent variable and the dependent variable. The independent variables, namely: 4K learning model with project assessment, 4K learning model, and cooperative learning model. The dependent variable,
namely: tolerance character and problem-solving ability of students in the geometry after obtaining learning by using 4K learning model with project assessment, 4K learning model, and cooperative learning model. The data collection techniques are used documentation, testing, and observation. The data used in this study is a data of problem-solving ability in geometry and tolerance character of students. The data of geometry problem-solving ability of students gathered with the test method. Meanwhile, students’ tolerance character data collected by observation. The observations were made using the observation sheet to reveal the tolerance character of students. In this study the documents used in the form of video recordings of learning. The results of analysis of observations and tests conducted by researchers. Recorded video can view the event and listen to as a whole and can repeat events seen or heard repeatedly.

In this study, the test developed by the researchers own customized teaching materials studied. The tests will be used to obtain geometry problem-solving ability data of students has met the criteria of valid and reliable. Grains contained in the test also meets the criteria of validity, the level of difficulty, and a good of distinguishing. The research design used in this study is Posttest-Only Control Design. The first group was given a treatment called experimental class 1 is the class by learning the 4K model with project assessment. The second group is the experimental class 2 by learning 4K models. While the third group is called a control class is the class by cooperative learning model. Test steps are performed in this study are (1) test for normality, (2) test of homogeneity, (3) test of mastery learning, (4) the three means equality test (parametric and non-parametric), (5) advanced test (parametric and non-parametric).

3. Results and Discussion
Before the study conducted, researchers tested the initial data (students’ final mathematics examination score in the 1st semester) of the experimental class 1, experimental class 2, and control class. Hypothesis testing results indicate that the initial data were normally distributed and homogeneous. One Way Analysis of Varian’s test for equality of three means showed no difference in the initial mean ability of students. So that the experimental class 1, experimental class 2, and control class departs from the same knowledge. Once the researchers conducted learning as much as four meetings, then the students of three classes were given a test. The test results provide data on the geometry problem-solving ability scores of students experimental class 1 (E1), experiment class 2 (E2), and control class (K). The graph of the data is presented in the form of a diagram in Figure 1.

Figure 1 shows that the geometry problem-solving ability of the three classes is different. The highest score obtained by the experimental class 1 with a score of 58. The lowest score obtained by a control class with a score of 45. The data showed that all students in experimental class 1 could write down what is known and what is asked of all questions correctly and complete. Students can understand the problem (P1) solving by 81.25%, which means most of the students have been able to write a formula or strategy to be used in solving the problem. This is because students at the time of project tasks type 1, which is making props cubes and blocks using second-hand goods, helped students to find the concept of cubes and cuboid, ranging from the elements, surface area, and volume. This is in line with the opinion of Hung-His Wu that said to prepare students better to learn how to solve problems must begin by teaching purely mathematical problem solving, in this case about the concept of geometric surface area and volume of a cube and cuboid [13].
The ability to plan the completion (P2) of all three classes showed a degree that says that the experimental class 1 regarding planning will be more than an experimental class 2, and the experimental class 2 regarding planning will be more than the control class. From the data obtained, the experimental class 1 got a score of 13; the experimental class 2 got a score of 11, and the control class got a score of 9. Students in the control class lack to remember the formula that caused the students wrong to determine the formula that will be used to solve the problem. Step resolve the problems correlated with completion planned steps. The accuracy of the students in solving the problem (P2) greatly influenced by the ability to plan resolution (P3). If the planning is already better then the solution is also good, and vice versa. From the data obtained, the experimental class 1 got a score of 13 in P2 and got a score of 22 in P3. The experimental class 2 got a score of 11 in P2 and got a score of 19 in P3. Moreover, the control class got a score of 9 in P2, so that got a score of 16 in P3. The ability to re-examine the completion of the steps (P4) that have been carried out experimental class 1 and experimental 2 is good as it gets a score of 7 out of a total of 8 scores. It is better than the control class that received a score of 5. Thus, the ability to understand and re-examine of the experimental class 1 and the experimental class 2 higher than the control class. While the ability to plan and solve problems of the experimental class 1 higher than the experimental class 2 and class control.

Higher overall mathematics achievement was found among students who conceived that assessment makes students themselves accountable for learning and who conceived of assessment as good for them. In mathematics, students who conceived of assessment as a means of taking responsibility for learning, who did not ignore assessment, and who used it to improve their learning, tended to get higher achievement scores [14]. This is in line with the result of this experiment that the problem-solving abilities experimental class 1 higher than the experimental class 2 and experimental class 3 or the problem-solving ability of the experimental class 1 is the best one. This is reinforced by the test results of problem-solving ability data. The data testing aims to answer the hypothesis in this research. The hypothesis test result of students’ problem-solving ability data of the experimental class 1, the experimental class 2, and the control classes contained in Table 1.

During the learning process, the character of tolerance was observed by the observation sheet that's been made. The observations provide tolerance character data of the students then analyzed to determine tolerance character of the experimental class 1, the experimental class 2, and the control class. Table 2 below show the tolerance character score improvement of the experimental class 1, the experimental class 2, and the control class.

The character tolerance score of the experimental class 1 and the experimental class 2 shows the high and very high criteria. Characters of tolerance in this study (in the experimental class 1 and the experimental class 2) were grown through habituation and reinforcement strategies. This is done by showing students a video about the character of tolerance displayed by teachers and scantlings of the teachers by providing advice to the students to always have the character of tolerance. In contrast, the tolerance character of control class indicates the criteria of the medium. This is because 4 of 8 tolerance character aspects of the control class indicate the medium criteria. Students in the control group are less regarding tolerance when working together in groups and discussion. They promiscuous friends during the discussion and did not cooperate with anyone. They are also lacking regarding helping a friend with learning difficulties. Also, they are lacking regarding accepting the opinions of others and tend to regard their opinions most correct. However, they demonstrate a positive attitude regarding respecting the teacher who was teaching the class. This happens because there is no habituation strategy and the strengthening of tolerance character in the control class exercised by the teacher. Tests were also conducted on the data of tolerance character to answer the hypothesis in this research. Data were analyzed using non-parametric tests. The result of the test then showed in Table 3.

| Table 1 The Hypothesis Test Result of Students’ Problem Solving Ability Data |
|-----------------------------|-------------------------------------------------|
| No. | Examination | Result |
|-----|-------------|--------|
| 1   | Hypothesis 1: Mastery Test of Experimental Class 1 | Percentage of students’ problem-solving ability in geometry through the 4K model with project assessment more than 74.5% (complete). |
|     | Hypothesis 1: Mastery Test of Experimental Class 2 | Percentage of students’ problem-solving ability in geometry through 4K model more than 74.5% (complete). |
Hypothesis 1: Mastery Test of Control Class
Percentage of students’ problem-solving ability in geometry through cooperative learning model is less than or equal to 74.5% (not complete).

Hypothesis 2: Three Mean Similarity Test One-Way Anova
Students’ problem-solving ability in geometry through the 4K model with project assessment, 4K model, and cooperative learning are the difference.

Hypothesis 3: Advanced Post Hoc Test
Geometry problem-solving ability of students through the 4K model with project assessment better than geometry problem-solving ability of students through the 4K model.

Hypothesis 4: Advanced Post Hoc Test
The problem-solving ability of students through 4K model better than geometry problem-solving ability of students through cooperative learning model.

| Table 2 Score of Tolerance Characters |
|---------------------------------------|
| Indicator | 1st Meeting | 2nd Meeting | 3rd Meeting | 4th Meeting |
|           | E1 | E2 | C | E1 | E2 | C | E1 | E2 | C | E1 | E2 | C |
| T1.1      | 2.9 | 2 | 2 | 3.2 | 2.6 | 2.6 | 3.3 | 2.7 | 2.9 | 3.8 | 3 | 2.6 |
| T1.2      | 2.9 | 2.3 | 2.3 | 3.1 | 2.5 | 2.5 | 3.5 | 2.7 | 2.7 | 3.5 | 3.2 | 2.7 |
| T2.1      | 3.2 | 2.3 | 2.4 | 3.1 | 2.8 | 2.5 | 3.3 | 3 | 2.6 | 3.8 | 3.2 | 2.6 |
| T2.2      | 3.1 | 2.4 | 2.5 | 3.3 | 2.8 | 2.7 | 3.6 | 3.2 | 2.7 | 3.8 | 3.3 | 2.8 |
| T3.1      | 2.6 | 2.4 | 2.8 | 2.8 | 2.6 | 2.9 | 3 | 3 | 3.2 | 3.4 | 3.3 | 3.2 |
| T3.2      | 2.6 | 2.2 | 2.6 | 2.6 | 2.6 | 2.7 | 3 | 3 | 3 | 3.2 | 3.3 | 3.2 |
| T3.4      | 2.6 | 2.2 | 2.6 | 2.9 | 2.6 | 2.7 | 3.2 | 2.7 | 2.8 | 3.6 | 3.1 | 2.9 |
| T3.5      | 2.5 | 2.4 | 2.5 | 2.8 | 2.8 | 2.5 | 3.3 | 3 | 2.7 | 3.4 | 3.2 | 2.9 |

| Table 3 The Hypothesis Test Result of Students’ Tolerance Character Data |
|------------------------------------------------------|
| No. | Examination | Result |
| 1 | Hypothesis 5: Kruskal-Wallis Test | There are differences in the tolerance character of students through the 4K model with project assessment, 4K model, and cooperative learning model. |
| 2 | Hypothesis 6: Mann-Whitney U Test | There is no difference in the tolerance character of students through the 4K model with project assessment and 4K model. |
| 3 | Hypothesis 7: Mann-Whitney U Test | Tolerance characters of students through 4K model are better than the character of tolerance of students in cooperative learning model. |

4. Conclusion
Based on the results of research and discussion, several conclusions can be drawn. Geometry problem-solving ability and tolerance character of students through the 4K model with project assessment achieve mastery, through 4K model achieve mastery, and through the cooperative learning model not achieve mastery. Geometry problem-solving ability and tolerance character of students through the 4K model with project assessment, 4K model learning, and cooperative learning is different. Geometry problem-solving ability and tolerance character of students through the 4K model with project assessment is highest of the 4K model learning and cooperative learning. The integration of tolerance character education in learning activities provides a good influence on the students’ tolerance character. Also, the learning-laden character is also not allowed to leave the cognitive aspects of the students so that learning is designed will give good character without compromising students' academic. Learning strategies exemplary, habituation, and strengthening can foster the tolerance character so well. Thus, teachers can use those strategies in the learning process to instill students’ tolerance character.

References
[1] Elkind D H and Sweet F 2004 *How to do character education.* (Mill Valley, CA USA: Live Wire Media)
[2] Suzanne N 2014 *Proceeding of the Third International Seminar on Languages and Arts Padang* (Padang: Universitas Negeri Padang) ISBN: 978-602-17017-4-4
[3] Lidyasari A T 2014 *Procedia - Social and Behavioral Sciences* **123** 189
[4] Depdiknas 2006 *Permendiknas No 22 Tahun 2006* (Jakarta: Depdiknas)
[5] Safrina K, Ikhsan M and Ahmad A 2014 *Jurnal Didaktik Matematika* 1 9
[6] Oktorizal, Elniati S, and Suherman 2012 *Jurnal Pendidikan Matematika* 1 60
[7] Adolphus T 2011 *International Journal of Emerging Sciences* 1 143
[8] Woolfolk-Hoy A 2005 *Educational Psychology* (Boston: Pearson Allyn & Bacon) ISBN: 0-205-43529-7
[9] Polya G 1973 *How to Solve It* (New Jersey: Princeton University Press)
[10] Joyce B and Weil M 2003 *Models of Teaching* (New Jersey: Prentice-Hall, Inc.)
[11] Masrukan 2015 *International Conference on Mathematics, Science, and Education* p M-328 (Semarang: Universitas Negeri Semarang)
[12] Akinoglu O 2008 *International Journal of Instruction* 1 1
[13] Brown G, Hirschfeld G 2007 *Australian Journal of Educational & Developmental* 7 63
[14] Wu H 2012 *Journal of Mathematics Education at Teachers College* 3 14