ARTICLE INFO

ABSTRACT
This research is classroom action research. The purpose of this research is to describe verbal and visual physics representation (VVPR) students after using quantum teaching model with student worksheet based on multiple representation on physics learning in class XI Science 1 SMAN 1 Pakusari. The design of this research is using Hopkins cycle. Methods of data collection in this research are interviews, observation, documentation, and test. Data obtained from this research are the verbal representation and visual representation. Data analysis technique is used descriptive analysis techniques. Increasing the capability of representation from each cycle using the formula normalized gain. The results of this research from the N-gain value on per cycle to cycle III for verbal representation is 0.82 in high category and visual representation is 0.82 in the high category. The conclusion of this research is an increase of verbal representation and visual representation ability students after using Quantum Teaching model with student worksheet based on multiple representations on physics learning in class XI Science 1 SMAN 1 Pakusari.

INTRODUCTION
Physics is a science that studies objects in nature, and studies interaction that objects exist in the natural. In essence, physics seen as a process and product, a process is a procedure for finding physics products in the form of facts, concepts, principles, theories or laws obtained through scientific measures such as identification problems, formulate hypothesis, design experiments, collect data, analyzed data, and draw conclusions (Indrawati, 2011). Physical learning should be appropriate to the nature of physics where students can find their own knowledge to produce physics products through scientific steps. Learning planning is important aspect that must be considered because of its affects.
on learning process. Therefore, in learning physics teachers should plan a strategy and learning methods used in accordance with the character of students and the character of physics material so that students easier to understand the concept of physics.

Based on the result of preliminary observation at odd semester of year 2016 at SMAN 1 Pakusari, the result of learning outcomes physics student of class XI Science 1 that is 2 student from 33 student that reach score 76, whereas 31 student get value below 76. This shows that result of learning outcomes physics student of class XI Science 1 are low category.

According to the limited interviews with teachers of physics studies at SMAN 1 Pakusari was obtained information that the problems often faced by teachers in the learning process are the low ability in verbal and visual physics representation students. The low ability of multiple representation students in the learning process because teachers have not integrated multiple representation in the teaching process, in addition teachers tend to give the questions physics concerned with mathematical representation without involving other physics representation such as images. This is proven by students difficult in working out physics problems with verbal and visual representations. One alternative to anticipate the low of learning outcomes physics student is quantum teaching model.

The quantum teaching model is a learning model that includes specific guidelines that create an effective learning environment, design curriculum, deliver content, and to ease the learning process (DePorter, et al., 2014). Quantum teaching refers to a lesson plan that consists of six learning stages (1) Grow, growing interest student to learn (2) Experience, bring a common experience that can be understood all students, (3) Name, provide keywords, concept, model, formula, strategy, or an "input", (4) Demonstrate, provide an opportunity students to show that a students know, (5) Repeat, show students ways of repeating the material, (6) Celebrate, admitting a resolution, participation, and acquisition skills, and knowledge obtained (DePorter, et al., 2014). Based on the design of learning above the material will be repeated three times at the name stage, demonstrate, and repeat, so students more understanding the concept taught. This can make it easier for teachers to explain the concept of physics by using multiple representation in verbal, visual, mathematics, and graph.

Application of a learning model had never left the role of supporting factors. One of the supporting factors in the learning process to solve the problems in class XI Science 1 is by using learning media in the form of student worksheet based on multiple representation (verbal, visual, mathematics, and graph). This is because student worksheet in the school has not explained the concept of physics with various representations such as visual representation and graphical representation. According Munadi (2012) image is an important visual media and easy to obtain. The visual is important because it can replace verbal words, turning the abstract into concrete, and limit human observations. In addition verbal representation skills are important by students as they can help students understand the problem before using mathematical equations and explain the graph.

According to Suhandi and Wibowo (Sari, et al., 2015) learning using multirepresentative approach can sharpen and strengthen the understanding of the concept because the meaning of a concept will be clearly when presented with various representatives. According to Dudeliany (2014) Student worksheet is a printed material in the form of sheets of paper contains materials, a summary, and instructions to
implementation of learning tasks that must be done by students referring to basic competence to be achieved. While multiple repetition is a way used to express a concept in various ways and forms (Mahardika, 2012). Explained a physics concept by using different representations would facilitate students to understand a concept of physics taught so that purpose of learning can be achieved.

The results of research relevant to this research is experimental type research conducted by Ningrum, et al., (2015) showed that learning by using quantum teaching model can improve the ability to multiple representation student in class X student in SMA Plus Darul Hikmah Jember. Research as experiment was also conducted by Nisak, et al., (2012) found that learning by using quantum teaching model gives influence to student learning outcomes and can improve multiple representation ability of students in Junior High School.

Based on the above description, quantum teaching model needs to be applied to solve the problems in class XI Science 1 on SMAN 1 Pakusari. Therefore, the researcher conducted a classroom action research with the title of research "Increased of VVPR through Quantum Teaching Model with Student Worksheet based on Multiple Representation". this study aims to describe the increased of verbal representation and visual physics representation of students after the implementation of quantum teaching model with student worksheet based on multiple representation on learning physics graders XI Science 1 in SMAN 1 Pakusari.

METHODS

METHODS

The type of research used in this research is Classroom Action Research. The research design used is Hopkins cycle, that is classroom action research consisting of four stages including planning, action, observation, and reflection. The subjects of the study were students of class XI Science 1 SMAN 1 Pakusari academic year 2016/2017.

This classroom action research consists of one pre-cycle and 3 cycle activities. Methods of data collection in this study are the method of observation, interviews, documentation, and tests. The data obtained are verbal representation and visual representation of students obtained from the post-test pre-cycle, cycle I, cycle II, and cycle III. The purpose of this research is to solve the problems in class XI Science 1 SMA Negeri 1 Pakusari namely the low ability of verbal representation and visual physics representation of student.

Data analysis technique used is descriptive analysis technique. The increase in representational capability of each cycle can be seen using the normalized gain formula,

\[ \text{SpOST} = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \]

expressed in the following equation.

Where:

- \( N_{gain} \) : the criteria for improved multiple representation ability
- \( S_{post} \) : a score post-test at n cycle
- \( S_{pre} \) : a score post-test at pre-cycle
- \( S_{max} \) : maximum score

The criteria for the improvement of multiple representation of physics students can be seen in table 1.1.
RESULTS AND DISCUSSION

Physical learning by integrating multiple representations can help students understand one concept with different representations. This can help students in solving questions have been physics. As an examples of the concept of Kepler’s I law can be made in the form of verbal and visual representations. One example of the problem used in this study can be seen in Figure 1.1.

In the pre-cycle activity the learning model used is a direct learning model using lecture, question and answer method, and group discussion. The result of data analysis on pre cycles activity got the average score of verbal representation ability of student equal to 45.68 and the ability of visual representation student equal to 22.57. This shows that the ability of verbal and visual physics representation student XI Science 1 students not pass the minimum mastery criteria that is equal to > 76 set by SMAN 1 Pakusari.

Analysis data on cycle I, that is learning implemented by applying quantum teaching model accompanied by student worksheet based on multiple representation indicate an increase of multiple representation ability of student physics. According to the data analysis, the average score of verbal representation ability of student equal to 58.18 and visual representation ability equal to 26.67. The average score of verbal and visual physics representation ability of students has increased from pre cycle to cycle I. Increased of verbal representation ability student is shown by the N-gain value of 0.23, including in the low category and for the ability of visual representation obtained the N-gain 0.05 including low category.

Learning activities in cycle II is implemented by applying the same learning model that is a quantum teaching model with student worksheet based on multiple representation. Based on the result of data analysis on cycle II, the average score of verbal representation ability is 65.15 and visual representation ability equal to 64.24. The average value of verbal verbal and visual physics representation ability of students has
increased from pre cycle to cycle II. Increased capacity of verbal representation ability student is shown by the N-gain value 0.36 including the medium category and for the ability of visual representation obtained the N-gain value is 0.53, including the medium category.

Learning in cycle II show an increase of verbal and visual physics representation ability of student but not yet fulfill the minimum mastery criteria which determined by school so that learning is continued to cycle III by applying the same model that is quantum teaching model with student worksheet based on multiple representation. Based on the analysis of data cycle III, the average value of verbal representation ability is 90.30 and the ability of visual representation student of 86.36. Increased capacity of verbal and visual representation student are shown by N-gain value that is for verbal representation of 0.82 including in high category and for visual representation obtained the N-gain value of 0.82 including high category.

Based on data analysis, learning to use the quantum teaching model with student worksheet based on multiple representation shows an increase of verbal and visual representation ability. The increasing graphic of verbal and visual representation capability can be seen in Figure 1.2.

![Figure 1.2 Increased ability of verbal and visual representation ability (Source: author)](source)

Learning with use the quantum teaching model with student worksheet based on multiple representation can help students understand the material given. On learning teachers combines various methods learning such as a method of talk, group discussions, question and answer, assignments, and experiments in accordance with the syntax of the quantum teaching model. In addition, student worksheet based on multiple representation can facilitate students in learning to understand the material with different representations. According to Cheng and Gilbert (in Adadan and Guzel, 2013) in studying science conceptually, students need to understand the various representations of the concept of science, can translate different representations, and show the capacity to construct representations with specific goals.

The results of interviews that has been done with several students stated that learning with quantum teaching model invites students to be more eager to accept learning and students easily understand the material being taught.

The ability of verbal representation and visual representation student physics are the result of student learning obtained after the pre cycle, cycle I, cycle II, and cycle III. Based on the results of data analysis shows an increase in the ability of verbal and visual physics representation student. This shows that the application of quantum teaching model can increase the ability of multiple representation of student physics (Ningrum, 2015, Nisak 2012). So that the application of quantum teaching model can improve student learning

CONCLUSION

Based on the results of the research and discussion that has been described then it can be concluded that: (1) There has been increasing the ability of verbal representation of students after the application of quantum teaching model with student worksheet based on multiple representation class XI Science 1 in SMAN 1 Pakusari from pre cycle to cycle III with N-gain value 0.82 including in high category. (2) There has been increasing the ability of visual representation of students after the application of quantum teaching model with student worksheet based on multiple representation class XI Science 1 in SMAN 1 Pakusari from pre cycle to cycle III with N-gain value 0.82 including in high category.

As for advice in this research that is learning by applying quantum teaching model with student worksheet based on multiple representation can be used as base for further research in development of model or method of learning which suitable applied in physics learning.

REFERENCES


