THE EFFECTIVENESS OF SCIENCE COMIC ON THE MATERIALS OF SOUND AND HEARING BASED ON PROBLEM BASED LEARNING TOWARD JUNIOR HIGH SCHOOL STUDENTS' LEARNING MOTIVATION AND OUTCOME

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Article Info

Abstract

The objective of this research is to measure the effectiveness of science comics for sound and auditory system material based on problem based learning on motivation and learning outcomes of junior high school students. This research is quasi experiment with nonequivalent control group design. The sample was taken by using purposive sampling technique. The sample of this research was VIII E (experimental group) and VIII F (control group) in SMP N 10 Magelang. The writer collected the data by using test (cognitive learning outcomes), questionnaires (learning motivation) and observation (psychomotor learning outcomes). The result of the research indicated that the average of students learning motivation in experimental group in each indicator was higher than the control group. Consider to learning motivation there are significant contradiction between experimental and control group for the result in each indicator. The result of N-gain calculation showed that students cognitive learning of experimental group classified as medium category with the N-gain score of 0.39, while the control group classified as low category the N-gain score 0.25. Based on test result difference in average value of cognitive learning between experimental and control group showed the tcount of the pretest was 1.89 and the tcount of the posttest was 4.49 is higher than the ttable it was 1.67. Based on the result of the research, it can be concluded that the science comics for sound and auditory system material based on Problem Based Learning is effective to create the students learning motivation and improve the learning outcomes.

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INTRODUCTION

Education is a mileston of certain nation which has important roles as the basic and determiner of its development. Law Number 20 Year 2003 regarding National Education System, Article 1 section 1 affirms that education is an awarena and planned effort to actualize learning process and situation, that students will be more active in developing their potentials. This way will make the students to have spiritual power, self-control, personality, cleverness, noble character, and required skills for the society and the whole nation (Permendikbud, 2016). Basic education is an influential thing to initiate learning to the next step.

Basic education for Junior High School requires teachers to implement integrated learning well. Puskur (2008) explains that integrated learning is an approach of learning which actively allow the students to find, dig, and discover concepts holistically and authentically. Students are motivated to discover concepts individually or in group (Parmin et al, 2016). Integrated science, however, has not been fully integrated.

The learning of science has not been implemented in integrated way; since, the teachers mostly came from biology and physics which still taught in separated way. Science learning material was still not variated. Since, it is only based on textbook that it has never been used in learning process. Zain et al. (2013) explains that textbook contains materials which tend to be memorized by students. It is not relevant to students' development which tend to play more. The addition of illustration in the textbook has never given enough influence to improve students' interest of reading.

Students' interest to read in SMP Negeri 10 Magelang was still low. They had been prepared by books prepared by the schools. There was no many students which really reads the book before the learning process. Students had minimum motivation to learn. Students are not encouraged to follow the learning process and being passive in accepting the explanation from the teachers. The tasks of the teachers were done deliberately and not submitted on time. The learning outcome of the students were mostly below the passing grades. In the Final Odd-term test in the academic year of 2016/2017, some students got the score below 75. Even, there is a class which only 10 students who passed the passing grades out of 30 students in the class. According to the interview, students who were under the passing grades were passive and unready to face the learning process. They tend to be passive with boring learning methods.

The most used methods in learning is lectures. According to Harsono et al. (2009), lecture is not effective since it is only limited to students with auditory types, that they become passive in the learning process. There should be a correct method which can make students involve directly in understanding the learning process. The method of learning can be applied at the same time during the application of the media.

Learning media is the medium which can make students play their active roles in the learning process. Yatno et al. (2014) explains that learning media has important role as the carrier of technology and information to be utilized in the learning process, that learning material will be transferred to students more effectively. The most appropriate media to be used is comic. According to Nugraha et al. (2013), comic is the form of art which consist of static picture which is arranged based on certain storyline and provide students' joyful learning experience. It is a popular art, especially among children as the potential way for science education and communication (Tatalovic, 2009). The use of comic will embrace the learning process that makes students able to be involved completely during the learning process.

Based on the theory of Piaget's development, Junior High School students (11-14 years old) is included in formal operational stadium, where it allows them to have the ability of solving problems (Fatimah & Arif, 2014). According to Setyanto et al. (2015) in Rusman (2012), problem-based learning (PBL) is a learning approach which is able to stimulate students high order thinking skills in the real-life world situation. Students' involvement in the learning process can motivate them during the learning process.

Motivation is an important psychological factor in learning process. The level of students' motivation in the learning process influence students' learning development and outcome. According to Tasiwan et al. (2014) in Tella (2007), children have high motivation in learning

which makes them able to have good learning development and result. Comic can motivate students through the combination of method as PBL-based comic.

PBL-based science comic provides students actual problems. It explains difficult materials to students in easy way to understand. The comic which contains the material of hearing and sound provides problems of the broken vocal cords, the incapability of some hearing organs to work, the disturbance of hearing through noises, etc. These problems make students reflect it to their real life and relate it to the learning materials of hearing and sound. In this case, students will try to solve problems in the comic which has interesting design.

The interesting design of comic will attract the students to read. The easy language and the understandable flow of story will make students pleased to learn with it. Therefore, this research aims to explain the effectiveness of science comic in the material of hearing and sounds based on PBL to students' learning motivation and outcome. This article is hoped to be able to improve students' understanding on the use of science comic on the material of hearing and sound based on PBL to their motivation and learning outcome.

METHODS

This research is an experimental research with the design of quasi experimental. This design is specified into nonequivalent control group design (Sugiyono, 2010). The population of this researche were all students of VIII grade of SMP Negeri 10 Magelang in the academic year of 2016/2017. The samples were determined using purposive sampling based on science teachers' consideration that both class has the similar activeness. Thus, the VIII E became the experiment class with the treatment of science

comic while the VIII F became the control class with lecture and electronic guide book. The dependent variables of this research were students' learning motivation and outcome.

Table 1. Nonequivalent Control Group Design

Experiment	O_1	O_2
Control	O_3	O_4

The data of this research were taken suing documentation, test, observation, and questionnaires. The analysis of data in this research used normality test and homogeneity of data in the pretest and posttest. The data of students' learning motivation were obtained in the end of the meeting through questionnaires. Test was used to obtain information regarding students' cognitive improvement. Observation sheet can be used to observe students' psychomotor learning outcome.

RESULTS AND DISCUSSION

The result of this research included the students' learning motivation and learning outcome. The average percentage of students' learning motivation in each indicator between experiment class and control class can be seen in Table 2. Based on Table 2, students' learning motivation of the control class got the overall criteria of good. It is different that the experiment class improved students learning motivation in very good category in all indicators. From the data, it can be concluded that experiment class has better score than control class. From the average difference of students' learning motivation, there is a significant difference to the average score of students in the experiment class and control class. The data of different score test can be seen in Table 3.

Table 2. The Average Percentage of Students' Learning Motivation in Each Indicator

Indicators	Experiment Class		Control Class	
	Achievement (%)	Criteria	Achievement (%)	Criteria
The passion to pursue success	82.3%	Very Good	76.2%	Good
Motivation and needs of learning	81.7%	Very Good	75.3%	Good
Hopes and future aims	81.3%	Very Good	78.3%	Good
Appreciation in learning	81.5%	Very Good	63.7%	Good
Interesting activities in the learning process	85.2%	Very Good	63.7%	Good
Conducive learning environment which allow students to learn well	81.3%	Very Good	79.9%	Good

Tabel 3. The Difference Test to the Averag Motivation Score of Students in the Experiment Class and Control Class in Each Indicator

Indicators	Zcount	Ztable
The passion to pursue success	12.712	1.96
Motivation and needs of learning	12.685	1.96
Hopes and future aims	12.671	1.96
Appreciation in learning	12.795	1.96
Interesting activities in the learning process	12.792	1.96
Conducive learning environment which allow students to learn well	12.649	1.96

The indicator of passion of success can be seen from students' accomplishment of teachers' exercises. In both classes, students ten to finish the task without procrastination. It shows that this indicator was inserted well to the students.

The indicator of motivation and needs of learning is the intrinsic factor which comes from people's internal factor. The learning process of the experiment class and control class involved tasks of homework and students' discussion sheet. The experiment class can finish the tasks well, while the control class had some students submitted the task over time. The completion of the task does not only come from students' motivation to be success, but also their motivation to avoid failure. This motivation can influence students to do the tasks given by teachers. The indicator of students' success and future needs is in line to Feng *et al*. (2013), who states that learning motivation refers to the provision, needs, wants, and motivation of the students to participate in the learning process.

The indicator of students' hope and aims can be seen from the requirement to be success given by the teachers in following science learning. The task given by the teachers can be done well and complete by students of experiment class while the control class did not. This good effort can show the aim of the students to achieve the targeted score. It is the same to Sardiman (2006:85), a function of motivation is to direct action to the direction of the

targeted goals. Motivation can give students' direction and requirement which should be done based on its objective.

The indicator of appreciation in learning is the stimulant to the students to answer questions based on the discussion challenged by the teachers. Students who can answer the questions were given an appreciation. This appreciation was given to students in the experiment class who were able to answer questions, discuss the result with correct answer, and being active to the learning process. The control class only had some students who answered questions. Since, the discussion and students' activeness were low. The statement above is after Wibowo & Suhandi (2013) that one of the ways to motivate students in learning is the provision of stimulus in the form of teacher's challenges. Students' appreciation was given as the statement of "Good!", "Give a Round of Applause!", and "Great". This statement is supported by Uno (2016:34) that learning appreciation can be in the form of verbal statement to good responses, like "Very Good", "Great", and "Amazing" which means as an interaction and personal experience between students and teachers as a social acknowledgment.

The indicator of interesting activities of learning process is highly related to the use of science comic in the experiment class. The

comic was distributed in the beginning of th learning process to students. Students were initially interested to learn using the comic. It is the same to Savitri *et al*. (2016) who states that the use of various media can attract students interest, especially comic. The learning process was started with the orientation of problems in the comic which should be demonstrated by the students. Then, students can understand the content of the comic while listening to teachers' explanation. The content of the comic contains real-life problems to support the research of Tatalovic (2009), that science comic uses the elements and fictions which can be used to explain the real-world phenomena.

Based on the questionnaire of learning motivation, most students feel that science comic is understandable. It is suppoted with the research of Mediawati (2011) as in McCould Scott (1993:64), that comic is a medium which can attract attention of people from different age, because it is understandable. The material of hearing and sound in the comic can be transferred to students easily. It is in line to Yulianti *et.al* (2016) in Waluyanto (2005), that comic is a tool of transferring messages. After the students uses comic, students can learn the science materials from it. The comic provides some problems which are related to problems which should be solved in group. Students were enthusiast to solve the problems. It is similar to Fakhriyah (2014) that learning will build knowledge by building reasoning which is obtained as the result of interaction between individuals.

The problems in the discussion sheet is expected to make students able to solve problems using different solution. The result of discussion is presented in front of the class by some groups. In relation to this, Haji *et al*. (2015) states that students work together as group to discover the solution of problem and to improve their ability to solve problems and making decision. The other group then actively responded the presenting group. Susilo *et al*. (2012) explains that students' active participation can make the learning more active and not bored to grow joy which will impact to students' learning motivation. In context, students will be more motivated, pleased, interested, and able to understand materials using science comic of hearing and sound materials. It is in line with Priatmoko *et al*. (2012), that learning with impression will make students happy that they will remember the moment easily. It also makes the students have strong motivation to learn using science comic. As in

Handika (2012), students had strong motivation which will be useful for them to learn.

The indicator of conducive learning environment included group discussion, practicum, and learning activities. Students in the experiment class can do learning process more smoothly and conducively than in control class. Effective learning is the creation of conducive learning which condition really supports the learning process. Students can be more focus on learning with conducive situation. It is in line with Sudarisman (2013) in Uno (2010) that conducive learning situation will support the interaction in learning which will result better outcome. Based on the percentage of questionnaire to students' learning motivation, the students in experiment class were in very good category while the students in control class was only good.

The high percentage of each indicator motivate experiment class to show that science comic can help them improve their learning motivation. It is because comic can make students more spirited to learn, easy to understand materials, enjoy to use comic, motivated to learn, being active in learning, and interested to read the comic until its end. Discussion of the comic can make students actively involve in solving problems. The steps of PBL learning which begins with initiating the orientation of problems, group organization, group investigation, delivery of analysis and result, and evaluation of the learning process which used science comic. Students will be invited to analyze and solve problems in the comic with their group and present the solution which can be confirmed by teachers.

Students' learning motivation plays important role to their learning outcome. Their cognitive result was measured by pretest and posttest. In the beginning, both class got pretest to know their initial status. The class ended with posttest in multiple choice questions. The posttest consisted of 25 items. The score of the pretest to both class can be seen in Table 4. Meanwhile, the posttest score to experiment and control class can be seen in Table 5.

Table 4. Pretest Score

Class	Highest Score	Lowest Score	Mean
Control	80	60	67.8
Experiment	80	60	70.9

Table 5. Posttest Score

Class	Highest Score	Lowest Score	Mean
Control	88	68	75.8
Experiment	92	72	82.2

Pretest was done before the treatment given to both classes to indicate the initial understanding of the students. Table 4 shows that the average score of control class was lower than experiment class in 67.8 and 70.9 repsectively. Somehow, the highest and lowest score of both class were same (80 and 60). Was conducted after the treatment to control and experiment class. Table 5 shows that the average score of control class had lower score than the experiment class in 75.8 and 82.2.

The normality test of the pretest shows that the x^2_{count} of the experiment class was 6.57 while the x^2_{table} was 11.07. Since $x^2_{count} < x^2_{table}$, it can be concluded that the score of pretest in experiment class had normal distribution. Meanwhile, x^2_{count} of the control class was 9.18 while the x^2_{table} was 11.07. Since $x^2_{count} < x^2_{table}$, it can be concluded that the score of pretest in control class also had normal distribution.

The two variance homogeneity tests was done to measure the homogeneity or the variance of samples taken from the same population. The result of analysis to pretest shows that the F_{count} was 1.06 while the F_{table} was 2.07. Since, $F_{count} < F_{table}$, it can be concluded that the variance of pretest to both classes were same. For the posttest, the F_{count} was 1.41 while the F_{table} was 2.07. Since, $F_{count} < F_{table}$, it can be concluded that the variance of posttest to both classes were same.

The result of the normality test in the data of pretest and posttest in experiment and control class showed that the test had normal distribution as well as being homogenous. The next analysis of measurement was parametrical statistics. The measuremen of t-test statistics to both parties can be used to know students' cognitive learning outcome between experiment and control class. The test of item discrimination to pretest-posttest of the students in experiment and control class can be seen in Table 6. The result shows that the average pretest score of control class students' cognitive result was different to the pretest of experiment class. It also happens to the posttest, which shows different average scores between both classes with less significant difference to the experiment class in the pretest and posttest. Significant differences to students' cognitive pretest and posttest result shows that students in both classes experienced an increase to the average cognitive result.

Table 6. The result of t-test of Pretest-Posttest in relation to Students' Cognitive Outcome

Treatment	Class	$\bar{x}$	S	dk	α	t count	t table
Pretest	Cont	67.9	39.7	59	5%	1.89	1.67
	Exp	70.9	37.6				
Posttest	Cont	75.9	23.2	59	5%	4.69	1.67
	Exp	82.2	32.7				

The increase of students' learning outcome used N-gain test. Based on the N-gain test, students' learning outcome of the control class was categorized as low with the N-gain score of 0.25, while the experiment class was 0.39. It shows that both classes got an improvement of cognitive learning outcome aftere the treatment of comic science for experiment class and guide book to control class.

The psychomotor learning outcome can be seen in the practicum by observer. The practicum was done based on the steps of PBL in the experiment and control class. It is in line with Prihatiningtyas *et.al* (2013) who states that psychomotor skills are very important to be taught because from this skills, students will understand the material better.
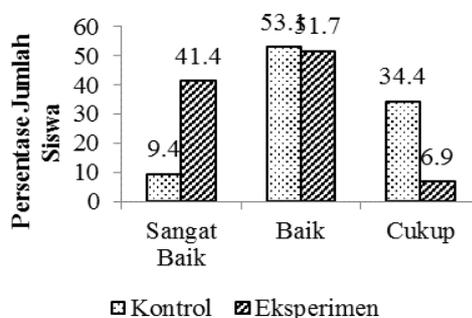

Figure 1. Students' psychomotor learning result

From figure 1, students' learning outcome of the experiment class was higher than the control class. It is because the experiment class already fulfilled five categories in good category. Meanwhile, the control class only got 3 aspects in good category and 2 aspects in fair category. It can be inferred that students' psychomotor learning outcome in the experiment class was higher than the control class.

The difference above is supported by difference test of Mann-Whitney which can be seen in Table 7.

Table 7. Mann-Whittney test results with different level of students' developed psychomotor

Class	U count	σu	Dk	α	Z count	Z table
Cont	1346	69.2	59	5%	12.74	1.96
Exp	1417.8					

Students' cognitive result were analyzed through their classical learning achievement which becomes the final term of the average homework score, students' worksheet, discussion sheet, and posttest. The average task score of experiment and control class were 889 and 81.5 respectively. The average score of students' worksheet score in the experiment class was 89.5 and 87,5 for the control class. The average score of the posttest to the experiment class and control class were 82.2 and 75.8. The average score shows that experiment class dominated the control class.

The percentage of students' classical elarnig outcome based on Figure 2 shows that students' learning achievement of the experiment class was higher than control class. The learning process will be deemed success with the minimum 85% students passed the score of ≥75 that both of the class were considered success in comprehending the materials of hearing and sound.
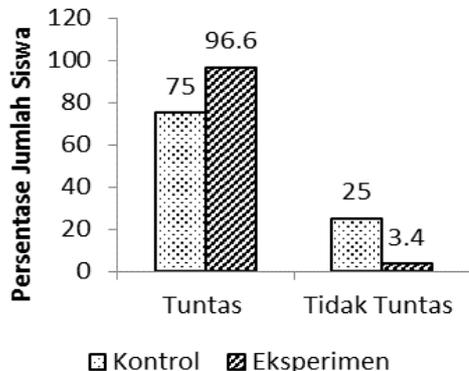
Figure 2. Students' Classical Achievement

Students' classical achievement is strongly related to their motivation. The motivation of students in the experiment class was higher than the control class. The experiment class was in very good category, while the control class obtained the good category. Both of the classes are considered have good learning motivation. It is in accordance with Tasiwan *et al*. (2014) in Tella (2007) that students have high motivation in learning and have good level of learning development.

CONCLUSION

Based on the result and discussion, it can be concluded that PBL-based science comic is helpful to improve the learning motivation of VIII grade students of SMP Negeri 10 Magelang. It is seen from the average percentage of experiment class students' learning motivation which is considered very good, while improvement of students' learning outcome was only in medium category. This result was significantly different to control class.

Based on the observation and research, the suggestion to the provision of PBL-based science comic should be made in more interesting way by putting more comedy to the storyline. The use of language between dialogue should be more concise, simple, and communicative in delivering explanation of materials. Further research is need to be done with the same treatment to other materials.

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