



INQUIRY-BASED SCIENCE COMIC PHYSICS SERIES INTEGRATED WITH CHARACTER EDUCATION

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ABSTRACT

This study aimed to test the level of readability and feasibility of science comic, to know character development through a small test in some schools. The research design was Research & Development, trials were using quasi-experimental pre-test-post-test experimental design. The instruments to measure attitudes were: a questionnaire and observation sheet, a test used to measure comprehension of the material. The results showed that learning science by inquiry-based science comic can improve characters and cognitive achievement of primary school students. Results in the form of inquiry-based science comic can be utilized in learning science as a companion teaching materials.

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Keywords: character, inquiry, science comic

INTRODUCTION

The nation character is the basic needed to build a high level of civilization. People who are honest, independent, working as group, follow rules, trustworthy, strong and has a high work ethic, will produce a system of social life and well organized. Therefore Kemendiknas has launched a character-based education on May 2, 2010.

Teaching materials can be used to help both teachers and students in the learning process, so the teachers do not need too much presenting the learning materials in class. In theselection of the teaching materials, we need to pay attention to the illustrations effects that can be used to deliver messages to the users. One of the illustration form that being used frequently in teaching materials, namely comics or cartoons. Comics word comes from the English which is the main manifestation of the literary phenomenon of the image. The word comics generally accepted in Indonesia to mention literary images. According to Mc Cloud (2001), comics

are drawings and other symbols are contiguous or adjacent in certain utterances which aims to deliver information and achieve aesthetic responses from readers. Comic is an art form that uses no moving pictures which are arranged in such forming and build up story. Science is a part of our lives and environment interaction is a central feature in the learning process (Sumaji, 2004). Physics is the science section which is a product and process, so that the learning can not be separated from the inquiry proceedings. Comic science in this study, is a series of illustrated stories that contain knowledge in the form of materials science subjects (physics) are arranged with everyday language and interesting.

Comics liked by the young to the old. Comics in addition to functioning as the entertainment media, can also be used effectively in order to raise interest in reading, develop vocabulary and reading skills and can be used as an effective medium for learning purposes (Hadi, 2008). The utilization of comics on learning in selected schools are to educate, excite learning, funny, and well known by children and adapted from their world.

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One media that can be used by teachers in the learning process of science (physics) is the science comics medium. Comics can also be used to increase interest. The research results by Yulianti & Khanafiyah (2009a) about the experiment of comic science of work and energy can increase the students' interest of Elementary School (SD) Susukan Semarang. Another research on the students of SD Negeri 2 Sukorejo Semarang (Yulianti et al., 2010) applying comic light material science, the result is the science students interest are growing. Therefore, the research on the character integration in science education is aided comic needs to be done.

The objectives of this research are: to test the legibility level and the feasibility of science comic through the medium test, small and class in a number of schools, to find the character development and cognitive learning outcomes after the application of teaching materials accompanying by Comics Science

METHOD

The study is conducting over two years, using a design research and development (Gall et al., 2003). Inquiry based science comic that has been validated testing experts and legibility and the feasibility of small groups consisting of 10 students, the group was composed of 20 students, and the class test on 8 elementary school. The study used a quasi - experimental, pretest-posttest with experimental design.

The subjects in this study are elementary school students from state schools and private elementary school in Semarang which consists of 16 districts. As the samples are from six (6) districts. The sampling is done randomly, we take 3 elementary school from each district consist of state school and a private elementary school. The research instruments consist of a questionnaire, the observation sheet and cognitive ability test.

The data analysis has been done with N gain test-score. The method used in this research is quantitative method in the form of pre-post test.

RESULTS AND DISCUSSIONS

There are five kinds of science comic with the subject matter such as Substance and Changing Form; Earth and the Universe; Thermal Energy and Sound Energy; Simple air; and Water Recycling Process. Science comic which being developed are series of illustrated stories that explain the material science subjects (physics). The students are invited to get to know the characters in the comics, understand the story with the help of an attractive image and some simple experiments. These comics are equipped with several sections such as pictures and illustrations that support the explanation of the material presented.

According to Waluyanto (2005), comic is a tool that has the function to convey the message. Comics as a medium, conveying the message in a clear, coherent, and fun ways. Comic as a media has a potential to become a teaching material. Display image will help in understanding the material. Based on research by Yulianti et al. (2010) science learning by playing while learning approach can improve student learning outcomes. The "Playing While Learning" is a simple trial activities related to the material studied and invites students to do experiment by following the instructions. In the science comic there are also comic reading "Further With Science" for students to learn more about science. This section invites students to open up wider horizons so that its presentation in the form of material enrichment. The final part of this comic is the "Evaluation" which contains questions to test students' understanding of science presented in comics in the form of a game. Rice (2009) suggested that one of the learning process that can arouse the pleasure and interest is the addition of a game. The ana-

Table 1. The Results of Feasibility Analysis of Each Comics

Materials	Display	Language and Text	Content and Evaluation	Character Integrated	Average
Substances and Change	93	93	91	88	91,25 Very Reasonable
Earth and Universe	96	94	89	86	91,25 Very Reasonable
Heat Energy and Sound	98	91	88	85	90,5 Very Reasonable
Simple Air	99	90	87	87	90,75 Very Reasonable
Water Recycling Process	94	92	91	84	90,25 Very Reasonable
Average	96	92	89,2	86	90,8 Very High

lysis results of the feasibility average of comics produced is 90.80%. This shows that the use of Science Comic as a teaching material has a very high rate of viability. The results of the feasibility analysis are presented in Table 1.

The design of Science Comics is compiled using figures which appropriate for elementary school children with the balance and harmonious colors composition and the depiction of the situation with captions that help them to understand the material. This is in accordance with the stages of cognitive development according to Piaget, children of elementary school age who are in the age range 7-11 years are on the stage of concrete operations. Concrete operations stage has the characteristic ability to think logically, begin to look at the object objectively and conceptually, and the thought is no longer about themselves but the outside of themselves too (Trianto, 2007). The Science Comics are a merger between text and image, thus making the message looks more concrete.

Aspects of language and text in science comics are arranged using Bahasa Indonesia in accordance with formal spelling, communicative, adjusted text size, the sentence structure is quite short and easy to understand. Based on the aspects of language, good teaching materials have several criteria: appropriate with the mind development, understandable message and language, the usage of standard terms, and integrity of meaning in both sentences and paragraphs (Ministry of National Education, 2010).

The material aspect of science comics contains valid and up to date illustrations of facts or physics concepts adapted to the curriculum at elementary science lessons. The materials are sufficient to achieve basic competences, as well as balance between content and exercises. This is in accordance with the Ministry of Education (2010) which states that the principles of the content of teaching materials cover the proportionality of relevance principle, adequacy and accuracy. Science comics are constructed upon inquiry-based storyline. Science comics are also

prepared based on guided inquiry. This is consistent with the research by Taulina et al. (2009) that adoption of inquiry approach to learning can improve thinking ability and activities of elementary school students. The application of guided inquiry approach is tailored to the intellectual development of students.

Readability test for the science comics was conducted using jumbled text as the instrument and performed on fourth grade students. The readability score of science comic was 91.4% according to Bormuth criteria which states that teaching materials are easy to understand (Widodo, 2001). The science comic is understandable since it is modified into children's intellectual development level. It used communicative fonts while the size were varied between 15 to 12. The use of the varied font size aimed to attract students to read it. In the early part text size was set at 15 and ended at 12. This is true as stated by Schounnell cited in Kustiono (2010) that when students read, they should be given a larger size at the beginning, and later the teacher can decrease the size down to 12. The development of character and cognitive of students before and after the study are presented in Table 2.

At each treatment, student's character was improved, though not all of the characters became custom. This is consistent with Lickona who states that there are three stages of character development; Moral Knowing, Moral Feeling, and Moral Action. Setyawati et al (2013) believes that the utilization of science module is effective in improving students' character. Character development is presented through dialogue, depictions of figures and indicators adapted to the character as proposed by Ministry of Education. Ulfah (2004) finds that moral attitude or character of elementary school students can be developed using transparency comic as a graphic media.

Character development is delivered through the knowledge of indicators of comic characters favored by the reader. According to Damaiwati (2007), the comic medium is a form of teaching media. A comic is likeable reading

Table 2. Analysis of Students' Character Development

Character	Before	Criteria	After	Criteria	Gain	Criteria
Religious	69,56	Start to develop	84,27	Being a custom	0,31	Average
Creative	62,84	Start to develop	85,50	Being a custom	0,35	Average
Curiosity	67,15	Start to develop	86,54	Being a custom	0,41	Average
Willingness to read	66,43	Start to develop	83,01	Being a custom	0,35	Average
Caring to nature	65,66	Start to develop	84,27	Being a custom	0,32	Average
Discipline	77,39	Start to develop	82,16	Being a custom	0,21	Low

resource for almost all age groups; children, adolescents and adults. Sewell & College (2003) states that the cultivation of character can be integrated into school life so that it becomes culture. Character development can also happen due to inquiry, since the science comic in this study was designed with the inquiry nuance with playing approach. Inquiry can facilitate students to solve problems through scientific investigation, so that students can find their own answers (Mc Dermott et al, 1996). This is also found by Suma (2010), which explains that the inquiry-based learning is effective in increasing mastery of the material and scientific reasoning. Wiyanto study (2004) showed that the application of the inquiry approach successfully increasing interest, developing scientific abilities e.g. explaining, predicting, designing experiments, collecting, analyzing and drawing conclusions, and communicating. Wenning (2005) discovered that the inquiry-based learning gives students experience in working scientifically.

Religious indicator presented in the comic through several dialogues and depictions of figures which recognize God and appreciate all natural phenomena as God's creation. Cognitive aspect of religious character that appears in the comics was emphasized through a dialogue which stated that the earth and the universe were formed because of God's Will. Affective aspect was brought via a dialog contains admiration toward God's creation while reminding others to always be grateful for all God's gifts. The conative aspect was raised in the dialogue between characters who are grateful for everything and use them well. Religious is obedient attitudes and behaviours in carrying out the teachings of his religion (Ministry of National Education, 2010).

Discipline character was taught in the form of dialogue and depictions of figures who behave in an orderly and adhere to the rules. Cognitive aspect of discipline appeared in comics through dialogue and depictions of figure stated that being on time is part of the discipline. Affective aspect was performed via one of the characters that reminded others not to come late again. Conative aspect emerged when one of the characters promised to not be late again. Discipline is an act that shows orderly behaviour and complies with various rules and regulations (Ministry of National Education, 2010).

Creative character popped up when a character stated that use a simple technology facilitate the work of man. Affective aspect implied when the dialogue was able to raise readers' curiosity. Creative is thinking and doing something

to generate new ways or result of something they have (Ministry of National Education, 2010).

Caring toward nature came out when the characters said that the drought was a result of human activity. Affective aspect was shown when the character concerned with the drought. Conative aspect rose in the case of one of the character said that he will participate to lessen drought. Caring for environment is the attitude and action which seeks to prevent damage to the surrounding natural environment, and develop measures to repair the environmental damage that has occurred (Ministry of National Education, 2010).

Students could learn the good attitude through character depiction. This is in accordance with Suyadi (2013), which explains that character education is a conscious and planned effort to determine the truth or goodness, love and do it in daily life.

In addition to character development through comics, the teacher gave an example directly to the students about the character that needed to be developed, e.g. coming on time, greeting others, praying before and after lessons, discipline in doing the task, and inviting students to pick up the garbages around them after the class ended. Direct example were meant that students could mimic them well. This is supported by Zarkasyi cited in Mulyatiningsih (2010) that to providing exemplary is capable of changing students' characters.

Development of the religious character was in the criteria of becoming a custom. This is because the indicators of character such as admiration at God's creation, being grateful to God were characters which had already existed in children. Azwar (2012) believed that the attitude or character is not only determined by the state of the object at hand but also related to the previous attitude experience. Moreover, the religious character was also developed through other subjects such as Islamic education and citizenship education.

The character of caring toward environment, creative and discipline began to develop. These were because the character indicators such as discipline in doing the task, following the school rules, creating a new sentence of a word, or greening school grounds, as well as participating in cleaning school were not the character that was easily done by elementary school children. Elementary age is an age that is more playful and more inclined to break the rules, while not all elementary school children have high creativity to solve problems and littering became the obstacles to cultivate the good characters. This is supported

Table 3. Means of Cognitive Learning Results Assisted with Science Comics

Statement	Before	After
Highest Score	85	95
Lowest Score	30	43
Means	60	74
<g>	0,34	
Statement<g>	Average	

by Azwar (2012) that the culture in which we live and grew up to have a major influence toward the manifestation of our attitude.

The increased religious character, creative, love reading and caring for the environment were in the average criteria since the interaction was limited to the classroom environment. The little time used in the study also led to a modest increase, but at the end of the study the development of characters shifted to “start to become a custom” criteria. This occurred because changing character takes a long and gradual time (Wibowo, 2012). The process of developing character is a long process starting from start until the end of educational units. The development of character education is sustainable, which means starting from the beginning to the end of the education units (Ministry of National Education, 2010).

Improving disciplinary was low, but in the end it showed criteria of ‘becoming a custom’. In addition, character is a developmental educational material. Developmental educational materials means that it requires quite a long process and strengthens the learning activities toward other learning activities, and between learning in the classroom with curricular activities at school and outside of school (Ministry of National Education, 2010).

Cognitive Learning Result

Cognitive learning outcomes are presented in Table 3. Scores were obtained from the tests given before and after the application of science comics.

Table 3 shows that the increase of cognitive learning before and after utilizing the science comic was in the moderate category. This was due to the use of interesting and character integrated teaching materials in the form of comics, causing the students to be more interested in learning. Lubana et al (2013) suggest that the learning device oriented on character education has an effect on the cognitive learning. Novianti & Syaichudin (2010) adds that learning to use the medium of comics can increase students’ understanding.

Bryan (2005) concluded that the character is not only included in the curriculum but can be applied in students’ life anytime. Integration of the characters aimed to promote character education through learning activities. Song et al. (2008) thinks that comics can be used as a powerful learning media to interpret the knowledge and application of science, because the use of comics in science learning will be more stimulating and interesting than sole explanation of science facts. Beside that, cognitive learning outcomes after the use of science comic in learning increase significantly. Wahyuningsih (2011) said that comic as medium of learning can improve learning outcomes completeness, liveliness, interest and positive response from students.

Benninga, et al (2003) suggested that schools which handle their character education program seriously tend to have high academic achievement scores. This is in line with the opinion of Tatman et al. (2009) which states that a school that integrates character education in learning until becoming habit, the students would have high cognitive learning outcomes. This is consistent with the results of research by Yulianti & Khanafiyah (2009^b) on the tryout of force and energy science comic to increase students’ interest at Susukan elementary school Semarang. Yulianti et al. (2010) stated that the application of science comics can foster interest in science toward students of SD N 2 Sukorejo Semarang. Reading is a form of passive play, and through play children have the opportunity to explore, discover, express, create, and learn pleasantly.

CONCLUSION

Based on this research, it can be concluded as follows: the results of the feasibility and readability test of science comic could be used as teaching materials and improve the character and the cognitive learning of elementary school students. Thus inquiry-based science comics that had been generated could be used widely in science teaching as a companion of teaching materials, in ad-

dition to using instructional media that had been used.

Recommendation was addressed to teachers and parents to take advantage of a companion teaching materials in the form of comics in addition to teaching materials that had been used, to improve the character of the students. The use of comics should be repeated at home so that character development could take place quickly.

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