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The development of science comic book to improve student's understanding in elementary school

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Abstract

This study aims to: (1) understand the steps of science comic book development for 5th grade elementary school students, (2) understand the feasibility of science comic book from learning aspect, materials aspect, and instructional media aspect, (3) understand the effectiveness of science comic book to improve the student's understanding in elementary school. This is a research and development by using ADDIE model (Analysis, Design, Development, Implement, and Evaluate). Product validation tests are carried out by material experts, learning experts, media experts, teacher response, and students response. Product implementation is conducted on the 5th-grade students of Muhammadiyah Ngijon 1 elementary school. Data collection is used questionnaire and test. The results showed that the assessment from media experts is 81.25 (high feasibility); from the science, material expert is 85.00 (high feasibility); from learning experts is 93.18 (high feasibility). Teachers and students in the small group obtained a value of 97.50 (high feasibility) and in large group trials obtained a value of 94.58 (high feasibility). The effectiveness of science comic book is tested by Wilcoxon Signed Test and the result of Z_{value} at -3.903 on the asimp significance of 0.000 on two-tailed test. The test result show that the significance value is smaller than alpha (0.05); then it can be concluded that "Ho is rejected and Ha is accepted". It means that there are differences in students' understanding of pre-test and post-test in science learning, so it can be concluded that science comic is effective to improve the understanding of the elementary school students. This shows that the science comic book is fit for use in science teaching.

***Keywords**: comic book, science learning, student's understanding, elementary school*

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INTRODUCTION

Education in a broader perception has begun since human beings were on the earth (Hartono & Haryanto, 2018). Education cannot be separated from every human life because through education human can be beneficial and independent. The growth of a nation depends on the good quality of human resources generated from education quality (Bhakti & Maryani, 2016). Education is dynamic pressure that impacts on the physical, psychological, or intellectual ability, interest, will, and life of the individual in encounters and interactions with others and in connection to God. Constitution number 20 of 2003, which relates to the national education system, has fundamental demands because it must ensure equal distribution of educational opportunities, quality improvement, also relevance and efficiency of education management to address challenges, corresponding with the changing demands of local, national, and global life. One effort to meet these demands is to make educational reform in a planned, directed and sustainable way.

The most appropriate and effective teaching-learning approach as a renewal in Natural sciences education is an approach that includes the conformity between the situation and the children's learning to the real-life situations in the environment. Natural sciences education in elementary schools is faced with problems such

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as facilities, books, media, and funds (Hwang, Yang, & Wang, 2013). Natural sciences is a part of human life so that Natural sciences learning is the interaction between students and their living environment (Maslichah, 2006).

Natural sciences learning require the selection of appropriate approaches, strategies, and media. The selection of the right learning approach, with the situation and conditions faced will affect the impact on the mastery level or learning achievement of the students encountered (National Research Council, 2011). In this case, the role of teachers is the most important. Through the guidance of professional teachers, the students will become intelligent and educated figures, so that students are expected to become a superior generation who are ready to complete in the increasingly fierce competition and challenges (Maryani, 2010). In addition, teachers should also be able to choose appropriate learning strategies suitable to the conditions of students. Teachers also have to make innovation in learning with various media learning.

Related to this case, the selection of media should be in accordance with the students' needs, interests, conditions, individual differences, and should pay attention to students learning styles. Individually, humans are varied, so in understanding concepts will be achieved through different stages of learning. There are three kinds of student learning modalities (Fitkov-Norris & Yeghiazarian, 2015) so that teachers can apply appropriate strategy techniques both in learning and self-development of students, namely visual, auditorial, and kinesthetic modalities. visual modality is the students' learning power lies in the eye sense, include reading text, graphics, or seeing an event. Auditory modality lies in the sense of hearing, including listening and heed to explanations, then kinesthetic modality located at the sense of touch such as pointing, touching, or doing. Understanding that point, the teachers should be able to design media, methods, contextual learning materials relevant to the potential tendency, or students learning modalities.

One of the reform efforts in Natural sciences learning can be done by the selection of media used in the learning process. The learning process is a process of communication and takes place in a system, so the media occupies an important position as one component of the learning system (Schaal, Bogner, & Girwidz, 2010). The media is a tool of communication channels. Media literally means an intermediary, which is intermediary between the message source and message recipient (Liu, 2010). The use of media in learning can enhance students' learning process, which is expected to enhance the learning outcomes that want to be achieved.

Based on observations in Muhamadiyah Ngijon 1 Elementary School, Yogyakarta, Indonesia on 26 December 2016, in the learning process of Natural sciences, showed that the interest of students to the lesson was less than optimal. The evidence was that when the learning took place, students tended to busy themselves and did not pay attention to the teachers' explanation, other than that the students more often asked about things they had not understood but students did not want to read the learning material first. Yet what students asked was already listed in the students' worksheet or books. So it affected students learning outcomes. The results of interviews with the teacher of 5B class showed that some students were less interested in reading the Natural sciences learning material given by the teacher. So the students' grade was less because students did not understand the learning material.

Lack of students learning outcome in 5th grade of Muhammadiyah Ngijon 1 Elementary School in natural science subject is because of the usage of media which is less varied that is still in the form of books and worksheets. Teachers have not packed the natural science material attractively, so students feel that natural science lesson is difficult and boring. Natural sciences learning in the classroom are still focused on the mastery of the learning material (natural science as a product), while the natural science as a process and attitude is not prioritized. So the teacher hopes there is a medium that can be used by the teacher in order to the students will be more interested and feel fun to read and understand the natural sciences learning material given by the teacher. One of the alternative media used in natural sciences learning in 5th grade of Muhammadiyah Ngijon 1 Elementary School, so that students prefer to read and understand the learning material, is the print media in the form of comic. The results of research conducted by (Puspitorini, Prodjosantoso, Subali, & Jumadi, 2014; Suparmi, 2018), showed that the use of comic in natural science learning make learners feel more motivated in learning. This is supported by the results of students responses, it represents that

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comics make students happy when learning, because comic provide entertainment and not boring in natural science learning.

Comic book is a form of cartoon that expresses the characters, and plays the story in a sequence that is closely related to the image, and designed to provide entertainment to the readers. Comic book is created with coherent and orderly storyline, and make it easier to remember so that students are interested to read it. Comic book is a form of media that can be used independently by students and can be used by teachers as an alternative to support classroom learning.The comic media suitable for learning in reading the story and it is proven to improve learning outcomes (Ahmat & Sukartiningsih, 2013). There are an improvement of motivation to learn and character of students after using science comic media (Widyawati & Prodjosantoso, 2015).

The selection of comic as a learning media is because there is a tendency of many students who like reading entertainment media such as comic, compared with reading lessons material or doing tasks. The use of comic book in the learning process is said to be suitable for learning if the comic can create the interests of learners, make the learning process more effective, can increase interest in learning, and generate interest in appreciation (Hosler & Boomer, 2011). Thus students' understanding and learning outcomes increased.

This comic is developed to be useful for students in the classroom study as well as self-study, especially on the learning material of green plants of 5th-grade elementary school. *Science* comic contains natural science learning, especially green plants learning material. The selection of green plants material is based on students' difficulties in understanding the concept in green plants matter. In this comic tells the green plants in the process of life. Thus the learning material of green plants will be more easily understood by the students when developed in the form of comic.

The effectiveness of comic media can be proved by tested to the students, and then did the statistical test from the students' test result. It aims to determine the improvement of students' learning outcomes after the use of comic in the learning process of natural sciences. The purpose of comic development is not just to help teachers to teach, but to make it easier for students to learn. So that comic media can be utilized as much as possible to assist in improveing the progress and quality of learners. This comic is expected to be one of the references in teaching and learning process in elementary schools.

METHOD

This research used ADDIE model which are Analysis, Design, Develop, Implement, and Evaluate (Branch, 2009).

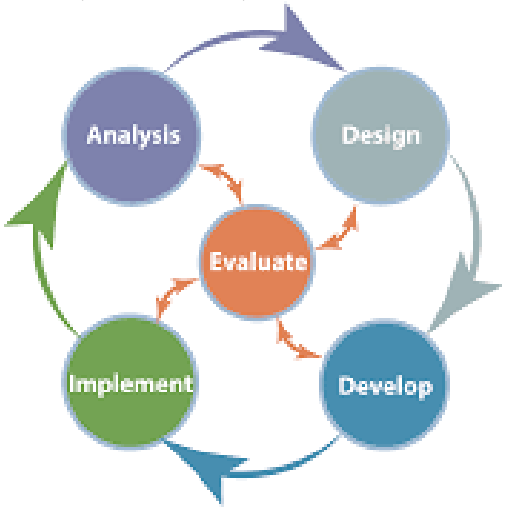

Figure 1. ADDIE Model

This research procedure includes several stages such as: (1) Analysis was an analysis activity of the work situation and environment thus could be found what products needed to be developed. (2) Design was a product design activity in accordance with what was needed. (3) Development was activity of manufacture and testing of product (4) Implementation was activity of using the product. (5) Evaluation was an activity to assess whether every step of the activities and products in accordance with the specifications or not.

Product validation test was done as follows:

Learning Material Validation Test

The material validation test was conducted by a competent lecturer or learning material expert on learning materials related to the Natural Science of 5th-grade elementary school

Media Validation Test

Performed by media expert, learning material expert, and learning expert. This activity was given sheets of assessments, comments, suggestions to know the feasibility of the comic.

Learning Validation Test

Performed by expert in the learning process. This activity was in the form of given

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assessment, comments, suggestions, to comic product through questionnaire given by researchers.

Small group trial

At the trial of Comic product and the questionnaire was given to small group in 5thgrade elementary school by taking 5 students.

Large group trials

At this stage, the trial of comic product was tested to a large group with a total of 20 students of 5th grade in Muhammadiyah Ngijon 1 Elementary School. Students assessed comic products using questionnaires. Then the results of the assessment of large group trials will be analyzed and revised, thus it will produce a good product and feasible to use. In this study the instruments used by researchers are observation, interviews, questionnaires, and documentation. Data analysis techniques are descriptive qualitative and descriptive quantitative analysis.

RESULT AND DISCUSSION

The feasibility test of comic book aims to assess whether the developed comic book has been feasible for use or not. This is carried out by assessing the comic books to experts of material, media, and learning as well as the validation sheet. The results of comic validation are qualitative and quantitative data which was obtained from questionnaires. Qualitative data was written and oral input on the quality of comic books. Quantitative data was the assessments of expert on comic feasibility. The results of the study of Natural Science comic learning media by expert lecturers, teachers, and students through product trial in small group and large group are as follows:

Qualitative Data Analysis of *Science* Comic

Analysis of Media Expert

The assessment of comic was conducted by Ragil Kurniawan, M.Pd who is one of the lecturers of Elementary School Teacher Education who are competent in the field of educational technology. The following is the result of media evaluation on comic quality on November 17, 2017, the total score of 52 so as to get value of 93,75 and get the rating with the category of "high feasibility".

Suggestions from media experts focused on display aspects of the reading panel. The panel in comic draft is still not systematic, and making the students have difficulties to find when search the certain section. The guide instructions for using comics are not available yet and researcher are invited to add the learning guide instructions on comics using. This guide is needed because the media is an educational comics, which have different characteristics from entertainment comics in general.

Analysis of Learning Material Expert

The assessment of comic was conducted by Panji Hidayat, M.Pd, on November 20, 2017, one of the lecturers of Elementary School Teacher Education who are competent in the field. The total score of 34,thus get the value of 85 and get the assessment with the category "high feasibility". Material expert give suggestion that the material in comics is not accordance with the learning outcome of 5th-grade elementary school, then the researchers must look back the scope of the material. In the comic book, researcher explains about plant pigments and only mention about chlorophyll. Whereas, plant pigments is not only consist of chlorophyll, but also consist other parts and have not mentioned in the comics. Then the researcher must add the material according to the theory. Moreover, material expert also suggest that the benefits of the parts must be reviewed in depth on comic stories due to this is the abstract concept of this material.

Analysis of Learning Expert

The assessment of comic was conducted by Ms. Amaliyah Ulfah, M.Pd on November 20, 2017, one of lecturer in Elementary School Teacher Department of Ahmad Dahlan University. The media assessment on comic quality presents the score of 93.1 and obtained the assessment with the category "High Feasibility". Learning experts provide suggestion on the conformity between evaluation questions and indicators on learning outcomes. The operational verb words used in learning indicators are not in accordance with the question indicators. The evaluation system must be focused to measure higher order thinking by using operational verbs at the C4-C6 cognitive level.

Small Group Product Trial

Small group product trial was conducted at Muhammadiyah Ngijon 1 Elementary School with a total of 5 students, teachers and students giving score, recommendation, and suggestions. Here are the comments and suggestions:

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1) "*Good, funny, and easy to understand, also comic book light to carry, interesting story because we can understand about green plants from the pictures in the comic*". Based on this comment and suggestion, the comics is interesting and easy to understand.
2) "*The comic book is very good, the color is very bright, and educating the children to be diligent in reading, and I really like to read comic book* " based on the comment, it means comic is very well liked and motivating students to love reading.
3) "*The comic book is good, I like the comic, and the story educating children to diligently read and love the environment, I quickly understand the story*". Based on this comment means comic is good and motivating students to love the environment.

Large Group Product Trial

Large group product trial was conducted at Muhammadiyah Ngijon 1 Elementary School with 20 students. Teachers and students giving score and comments. Here are the comments and suggestions:

a) "*The comic book is good, easy to understand*" based on the comment it is known that students can understand easily, they are also interested.
b) "*I really like the comic book, the learning material is easy to understand, preferably the story characters is added more*" based on the comment it is known that students are interested and want more comic stories.
c) "*The comic book is easy to understand, but why there is real plant image in the comic?*" based on the comment, the students are interested and want all cartoon images in the comic.
d) "*The comic book is very interesting and easy to understood*" Based on the comment, it is known that students like the comic.
e) "*The comic story is interesting, the characters are funny, the contents are easy to understand, just EXCITING ah!!!!"* based on the comment it is known that the comic is interesting.
f) "*I love reading this comic because it is about natural sciences lesson and I can understand about this lesson easier*". Based on this comment, it can be seen that the comic is interesting and fun to learn.
g) "*The picture in the comic is funny, especially "Ulil", it is perfect for children*" based on the comment, the story characters in the comic is interesting.

The teachers said that the comic book is fit to use in science learning. The teacher suggest to develop this book more for the other subjects. For a long-term, this comic book can be sold to the public so that it can be used more broadly.

Quantitative Data Analysis of Comic Media

Quantitative data analysis was performed to manage data obtained from the assessment of media expert, learning material expert, learning expert, teacher assessment, and students questionnaire. The results of *the* comic quantitative data analysis from media expert, learning material expert, learning expert, teacher assessment, small group trial and large group trial can be seen in Table 3.

Table 3. Results of Product Trial Assessment

Num	Expert	Score	Score Conversion	Category
1.	Media Expert	52	93,75	High feasibility
2.	Subject Matter Expert	34	85	High feasibility
3.	Learning Expert	41	93,1	High feasibility
4.	Small group test			
	Student	500	100	High feasibility
	Teacher	38	95	High feasibility
5.	Large group test			
	Student	1412,5	94,1	High feasibility
	Teacher	38	95	High feasibility
Sum			655,95	
Average			93,7	
Category			High feasibility	

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Test of Effectiveness of Comic Book in Students Understanding

The effectiveness of the comic book can be determined by statistical tests using Wilcoxon signed ranks. Here are the results of the effectiveness of comic book:

Tabel 4. The Results of the Negative Rank Differences

		N	Mean Rank	Sum of Rank
Pretest-posttest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	20[b]	10.50	210.00
	Ties	0[c]		
	Total	20		

a. Postest < Pretest
b. Postest > Pretest
c. Postest = Pretest

Tabel 5. The Results of the Wilcoxon Signed

	Postest-pretest
Z	-3.930[a]
Asymp. Sig. (2-tailed)	.000

a. Based on negative ranks
b. Wilcoxon signed ranks test

Based on the conducted test, negative rank differences on the test results using Wilcoxon signed showed the value of 0 all for number of subjects (N), Mean Rank, and Sum of ranks. Value of 0 indicates that there is no decrease from the pre-test value to the post test value.

Positive rank differences on result of the test by Wilcoxon signed ranks, showed that 20 students who were given pre-test and post-test on learning material of green plants experience improvement in learning outcome from pre-test to post-test. Mean rank or the average of the increase is 10,50; while the number of positive rank or sum of ranks is 210,00. It means the average increase in the value from pre-test to post-test occurs in 20 students. There is no impairment from pre-test to post-test.

The ties value is 0, so it can be said that there is no same value between pre-test and post-test. This means that the 20 students have an increase in value. There is no similar value between the pre-test and post-test. From these results it can be seen that use of media of science comic shows a progress with a positive trend.

Then performed statistical test by Wilcoxon signed test, it was obtained the test results with the value of Z of -3.903 at asymp significance of 0.000 on the two-tailed test. Because the significance value is less than 0,05; then it can be concluded that "Ho is rejected and Ha is accepted". It means there are differences in learning outcomes using science comic for pre-test and post-test, so it can be concluded that *science* comics is effective to be used in learning. Because it gives influence to the understanding of Natural sciences concept so as to improve learning outcomes in 5th-grade elementary students.

Science comic books are effectively to be used in learning due to several conditions. First, the results of analysis on small and large group trials showed that students are very enthusiastic in reading the comic books, because not only has good storyline, but the appearance of comic book is also colorful and make the students love to read. Reading interest is a form of literacy and high motivation of students.

Motivation grows from high curiosity to try and find a concept. Then, try to find and investigate to find the concept. Comic books that given to students using an interesting storyline and loved by students of elementary school. The characters "Lulu" and “Cici” that have good character can influence the students and imitate the good character. The theme of green plants is delivered contextually so it is easy to understand. Contextual learning can increase the science process skills and student learning motivation (Noor & Wilujeng, 2015).

Second, comic books use visualizations in accordance with real concept of green plants. The abstract concept of this material is made in concrete in order can change the misconceptions of the material into more precise and valid information. This is in line with the study of (Tekle-Haimanot et al., 2016) that comic books can reduce misconceptions within the children.

Comic book can improve the students’ analytical thinking ability and scientific attitude (Lestari & Projosantoso, 2016). This factor is significantly facilitating the students to understand the learning material.

Third, the students’ activeness in learning is shown by the number of students which discuss interesting things they found in the comic book. The students’ discussion theme was focused on the material is being taught. It indirectly occurs to students because students do not realize that they are actually learning but through playing. Means, the comic book is very suitable with the students’ characteristics of

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elementary school that they still prefer to play. The students can learn while playing, and the students' learning interest can increase significantly. In line with the results of study (Lin, Lin, Lee, & Yore, 2015) states that comic books have great potential to develop the interest and pleasure of readers, especially in learning science.

CONCLUSION

The results showed that the comic assessment from media experts, science learning material expert, learning expert for elementary school are high feasibility. Assessment from the small group of students, the classroom teacher, and the large group of students are high feasibility. From the Wilcoxon signed rank analysis, there are differences in students' understanding between pre-test and post-test in natural sciences learning, so it can be concluded that natural sciences comic is effective to improve the understanding of elementary school students. This shows that the science comic book is fit for use in science teaching.

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