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Developing Inquiry-Based Lectora Multimedia in Order to Increase the Logical Ability and the Creative Thinking

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Abstract

The study aimed at: (1) developing inquiry-based lectora multimedia which is eligible to increase the logical ability and the creative thinking of the fifth-grade students; and (2) measuring the effectiveness of the inquiry-based lectora multimedia development in increasing the logical ability and the creative thinking of the fifth-grade students. The study was a research and development (R & D) effort. The developmental design of the study was adopted from the procedures proposed by Borg & Gall. In the preliminary field testing, the researcher involved three fifth-grade students from SD Jetis, Bantul. Then, in the main field testing the researcher involved eight fifth-grade students who were not involved in the preliminary field testing. Finally, in the operational field testing the researcher involved 33 students from Grade VA. The product of this study will be an inquiry-based lectora multimedia. Based on the research and development that had been conducted, 117 material experts and 87 learning experts declared that the inquiry-based lectora multimedia development is feasible with "Highly Valid" assessment category. The inquiry-based lectora multimedia development is effective to increase the logical ability and the creative thinking of the fifth-grade students. From the operational field testing, the researcher found that $p = 0.003 < 0.050$ and this finding implies that there is an increase in the logical ability and the creative thinking of the fifth-grade students who had been taught using the inquiry-based lectora multimedia in comparison to the students who were not taught using the inquiry-based lectora multimedia.

Keywords: lectora, multimedia, inquiry, logical thinking, creative thinking

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Introduction

Education is the absolute right for all Indonesian citizens and it is the obligation of the government to afford the education toward all of the citizens. This obligation is in accordance with the objective of the Indonesian state that has been declared in the Opening of 1945 Constitution that states the enlightenment toward the life of the nation. In order to conduct this obligation, the government has been designing laws, regulations, and numerous policies. One of the government policies in conducting this obligation is launching the 9-year compulsory learning period. This statement implies that at least Indonesian people have to afford the educational degree that is equal to the junior high school degree.

Through the feasible education, it is expected that the community will be able to increase their life quality. In order to be able to improve their life quality, the community should have sufficient skills. Paying attention to the existing phenomena, it is apparent that the people who have been able to improve their life quality are the ones who have the skills to see the existing opportunities and the products that have not been designed before. One of the role model for this type of people is Bill gates, one of the richest men in the world. Bill Gates designed Microsoft, computer software that has been used by almost all the people in the world. Another role model is Mark Zuckerberg who has designed Facebook; he invented this social media at his very early age. Both of them are able to create their products because they devote

and maximize their logical ability. They will not be able to design their product if they do not increase their logical ability.

Departing from this situation, teachers should be able to create a learning process that might bring the students to the logical ability and the creative thinking. Logical thinking is a thinking process that benefits logic, rationale, and sense. In the learning process, students are encouraged to define and to transform complex information, to compare the information and the existing information, and to develop the information within their memory into new information or skills that are in accordance to the environment, the location, and the time where they live.

If a student has been trained in raising questions, then he or she will be more skilful in thinking and delivering his or her mind and opinions. Through the reinforcement of his reasoning, the student will be more able to formulate and to raise questions. The student who has good logical ability will be more effective and more intelligent in attending the learning process within the school. Logical ability and creative thinking are very important in the overall learning system nowadays. Through the logical ability and creative thinking, students will not only be the knowledge users but also the knowledge producer; students will be able to produce new knowledge, new thoughts, or new works. Students will not only accept knowledge or opinions from other people but also deliver their own opinions. In the interaction with new information, students will be able to process the information immediately and to generate new knowledge.

Students in elementary school age might perform logical ability on concrete matters. At the age of six, seven, and eight years old, children might hypothesize or perform deductive thinking and their thinking is not limited only to the concrete matters. The logical ability can be increased by means of classification. This can be found in the statement by Copeland who argues that classification is the basic process that children can use to develop logical and mathematical reasoning abilities (Micklo, 1995, p. 24).

Creative thinking is a skill of performing thinking pattern that has been based on the in-depth understanding toward the concepts that an individual has mastered previously and the thinking pattern then will influence the individual's mind to make a change. A usual matter for a teacher might not be usual for a student. Therefore, teachers should be able to develop a learning method or a learning strategy that will develop their students' creative thinking.

Basically, every individual has the potential of being creative; however, not all individuals are able to develop this potential. Therefore, as early as possible the students should be facilitated in developing their creativity. One of the ways for developing students' creativity is attending learning process. This is in accordance to the statement by Torrance who suggests that creative potential exists among all people and can be improved through learning (Wang, 2012).

Teachers as the Avant Garde of education in Indonesia bear a heavy task in manifesting all of these matters. The presence of information technology such as Internet provides enormous influence toward the educational system in Indonesia nowadays. Knowledge can be attained easily through numerous websites, social media, and multiple information accesses that have been available at little cost. In other words, it can be said that knowledge is not centred on the teachers anymore because it can be attained directly by means of technology. The impact is that the learning patterns and activities that have been implemented in the classroom will be marginalized because there are numerous learning sources and knowledge sources around the students.

The impact of information globalization has been highly influenced students in most of their life aspects. Students are very familiar with multiple gadgets. Many students bring their smartphones to the schools. They are also able to operate both the personal computer and the notebook either in their house or in their school. The students are more interested to attend the learning process through the computer that is connected to the Internet rather than the learning process through the conventional way. The students are even able to access a lot of information in a single click.

Multimedia is always related to computer use. As a consequence, teachers are demanded to be able to use computer in order to create their own multimedia. Multimedia is the presentation materials using both words and pictures (Mayer, 2009, p. 2). The existing words in multimedia can be displayed in both oral and written manners whereas pictures in multimedia can be displayed using statistical graphics,

illustrations, photographs, maps, animations, and even videos.

The use of multimedia nowadays is heavily necessary due to the technological advancement. Elementary school students have been very familiar to technology, especially computer. Multimedia is very useful for accommodating the different students' needs. This is in accordance to the multimedia characteristics (Daryanto, 2010, p. 53). First, multimedia has more than one convergent media; for example, the elements of audio and visual can be combined. Second, multimedia is interactive in the sense that multimedia has the capacity to accommodate the user's response. Third, multimedia is independent in the sense that multimedia provides easiness and content completeness in such away that the user is able to operate the multimedia without the guidance of other people.

The use of multimedia in learning process provides several benefits. According to Newby, Lehman, Russel, & Stepich (2000, p. 108), there are 10 benefits that multimedia-based learning process have. The first benefit is multimedia-based learning process has better learning and retention. Multimedia-based learning process provides several learning models and involves the users actively. The learning process can be better and be more interesting so that the expected retention can be higher. The second benefit is multimedia-based learning process has different learning style and preferences. The different manner of delivering learning messages will be more preferred if the multi-media combines several models that provide learning opportunities for students. The third benefit is multimedia-based learning process has effectiveness across learning domain. The teaching effectiveness through the use of multimedia-based learning process should be displayed in shorter time with more optimal learning process and the teaching process should be able to be conducted in any time and at any place. The fourth benefit is multimedia-based learning process has realism. The interactive multimedia provides high level of reality. Fifth, the multimedia-based learning process offers motivation. Students consistently display po-sitive attitudes toward the learning multimedia. The sixth benefit is multimedia-based learning process has interactivity. The key element in computer is interaction with the user. Computer is able to display information, to attain students' response, and to respond to evaluation. The seventh benefit is multimedia-based learning process has individualization. Computer's capacity enables individual learning. Computer provides feedback and monitors students' achievement. The eighth benefit is multimedia-based learning process has consistency. Individualization generates different learning manners for each student. However, it is equally important to define special themes that might be handled in a similar way by the students. The ninth benefit is multimedia-based learning process has learner control. Computer is able to provide controls to the user both on the learning speed and the learning sequence. The students who think fast will complete their learning materials immediately. On the other hand, the students who think slowly will complete their learning materials slowly. The slow-thinking students might even need more time in completing their learning materials. The tenth benefit is multimedia-based learning process has motion. Moving pictures can describe procedures effectively since these moving pictures are important in the learning process. Video will also be more effective in assisting the procedural learning process.

The multimedia that will be implemented in the study is the lectora software. Lectora is a form of learning multimedia that benefits the Internet in the form of program operation. Lectora is similar to the Microsoft PowerPoint that displays learning materials in the form of presentation slides. Lectora as a form of interactive multimedia in the learning process appears from the needs to share overall information and knowledge through the active participation from the students (Widiastuti & Wangid, 2015, p. 235).

The results of observation in SD Jetis show that teachers most of the time implement lecture as their method in conducting the classroom learning and they have not benefitted other learning method. In terms of learning sources, the teachers just use the teacher book and the student book and they have not used the other learning sources. The scientific approaches that the teachers implement are not in the appropriate sequence; instead, they skip one of the steps in these scientific approaches. Looking at the classroom learning, it is apparent that most of the teachers use lecture as their method in conducting the classroom learning. The students listen actively and they take notes on the lecture of their method. As a result, the students lack of academic situations that offers

the space of freedom, the sense joy and security in expressing opinions, and questions and active roles in attending to the learning activities. This situation has caused the students unable to draw the association between what they have learned and how their knowledge will be useful or be beneficial for their life. The students' capacity to raise questions and to express their opinions is still low and they become untrained to raise questions.

Teachers demand learning methods or strategies that are able to bring the students to the objectives of implementing the 2013 Curriculum namely being able to performing logical ability and creative thinking. One of the learning methods or strategies that are able to achieve these students is the inquiry learning. According to Sanjaya (2006, p.196), inquiry learning is a sequence of learning activities that emphasize the critical and analytic thinking process in discovering the answers to a problem independently. Inquiry learning is built under the assumption that since having been born to the world human beings possess the encouragement to discover their own knowledge. The curiosity toward their surrounding environment is their nature that has been implanted into their sense of sight, audibility, and others. Human beings' curiosity increases until their adulthood and the development of their curiosity lies on their brain and mind. The knowledge that human beings possess will be meaningful whenever their knowledge is based on their curiosity.

According to Fang, Lamme, & Pringle (2010, p. 2), inquiry learning is:

> A multifaceted activity that involves observation; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyse, and interpret data; proposing answer, explanations, and predictions; and communicating the results.

The above statement implies that inquiry learning is a process that contains observation and this observation will encourage students to raise questions, to find other books and information sources in order to reconsider their existing knowledge, to review the results of preliminary studies that display that the related topics have ever been studied, to analyse and interpret data, to prepare temporary answers, to explain and predict, and to finally communicate the results.

Inquiry is a learning process that centres on the students and in such learning process the students actively research their knowledge. The active research of the knowledge is manifested on the participatory learning process through systematic, critical, logical, and analytic investigation activities. These activities cause the students' learning process to be meaningful because the students discover independently their knowledge. This is in accordance with the learning paradigm that puts the students as the learning subjects and the teachers as the directors who should be capable of creating learning condition that enables the students to find the concepts using multiple learning sources.

The objective of the study then is to increase the logical ability and the creative thinking of Fifth Grade Students in SD Jetis. Due to the students' high enthusiasm toward the technological advance and the lack of laboratory operation, inquiry-based multimedia will be developed in order to improve the logical ability and the creative thinking of Fifth Grade Students in SD Jetis.

Method

The study implemented the research and development model proposed by Borg and Gall (1983, p.775). However, in the study the researchers would implement 9 of 10 stages because the study was a limited research conducted toward the teachers in SD Jetis; therefore, the final step of research and development in this study was dissemination. The complete stages of research and development in the study were as follows: (1) preliminary study and information collection; (2) planning; (3) draft of product development; (4) limited experiment; (5) revision on the results of limited experiment; (6) field experiment; (7) refinement on the product resulted from the field experiment; (8) operational field experiment; and (9) refinement on the final product.

The product experiment consisted of three stages namely limited experiment, field experiment, and operational field experiment. Prior to the experiments, the inquiry-based lectora multimedia was validated by the material experts and the media experts. The subjects in the product experiment in the study were the fifth-grade students of SD Jetis.

The subjects were three students who had been selected from Grade VC for the limited experiment using the one to one evaluation sampling technique (Dick & Carey, 2009, p.262) and eight students who had been selected for the field experiment. Then, 33 students from Grade VA were selected as the experimental classroom and 32 students from Grade VB were selected as the control classroom.

The data gathering instruments that had been used in the study were interview guideline, observation guideline, product assessment scale, teacher response scale, and student response scale.

The feasibility of the product that had been resulted was analysed using the reference proposed by Widoyoko (2013, p. 238). The assessment would be considered meeting the criteria if the assessment category that had been achieved was at least "Good."

Table 1. The Conversion of Product Quality Assessment for the Lectora multimedia

Score Interval	Score	Category
X >Xi + 1.80 Sbi	A	Very Good
Xi + 0.60 x Sbi < X ≤ Xi + 1.80 Sbi	B	Good
Xi – 0.60 x Sbi < X ≤ Xi + 0.60 x Sbi	C	Moderate
Xi – 1.80 Sbi < X ≤ Xi – 0.60 x Sbi	D	Low
X ≤ Xi – 1.80 x Sbi	E	Very Low

Results and Discussions

Preliminary Study

Based on the results of the interview with the Grade V teachers in SD Jetis, the researchers found information that the teachers had not developed lectora multimedia; instead, the teachers only used the media that had been available within the school. The subjects, in this case the teachers, had attended the socialization and the training program of 2013 Curriculum as their preparation prior to implementing the new curriculum. In conducting the learning process in the classroom, the teachers always strived to use learning media. SD Jetis had quite complete learning facilities that might support the teaching-learning process. The subjects were still accustomed to the old method (lecture) in the teaching process; as a result, sometimes the steps in the scientific approach were skipped or even were not performed. The subjects understood that there were several learning approaches other than the scientific one that might be implemented. The subjects had actually been provided with a training program of designing learning media using the lectora software but still sometimes they also benefitted the laboratory within the learning process.

In the observation during the learning process, the students were situated to work both in person and in group. When the students worked in group, the number of the member for each group had been decided by the teachers. The objective was to avoid the appearance of most prominent student within the group. There were several methods that the teachers implemented and these methods were lecture, group discussion, and independent assignment. During the learning process, the teachers used the teacher book and the student book as the learning sources. The learning media that the teachers used were the pictures of digestion instruments within human body.

The results of the observation showed that SD Jetis had already had facilities in which the development of lectora learning multimedia might be developed because the elementary school had an ICT laboratory and a computer laboratory that had been sufficient for a classroom. During the learning activities, the teacher explained the learning materials by pointing to the pictures. The teacher dominated the learning activities within the classroom and the students only listened to the teacher's explanation. During the observation there were only 4 students who raised questions to the teacher. When the teacher asked the students' opinion in group, the students answered altogether; on the other hand, when the teacher asked the students' opinion in person they remained silent. The answers that the students provided in the exercises were almost similar and in accordance with what they read from the student book.

From the results of the preliminary study, the researchers might conclude that the teachers demanded learning media that might improve the fifth-grade students' logical ability and creative thinking. The study then was focused to development learning multimedia that was adjusted to 2013 Curriculum. The multimedia that had been developed was also adjusted to the characteristic of the fifth-grade students in SD Jetis Bantul.

Table 2. Media Expert Judgment on the Inquiry-Based Lectora Multimedia

No.	Sub-Variable	Assessment Results	Score	Category
1.	Getting Started	9.00	B	Good
2.	Moving Around	13.00	A	Very Good
3.	Searching and Results	9.00	A	Very Good
4.	Content	82.00	A	Very Good
5.	Curriculum Support and Practical Matters	18.00	A	Very Good
6.	Bonus Questions	20.00	A	Very Good
7.	Inquiry Presentation Format	26.00	A	Very Good
	Total Score	177.00	A	Very Good

Table 3. Material Expert Judgment on the Inquiry-Based Lectora Multimedia

No.	Sub-Variable	Assessment Results	Score	Category
1.	The materials are in accordance to the learning objectives.	26.00	A	Very Good
2.	The materials are in accordance to the students' characteristics.	8.00	B	Good
3.	The materials are up to date.	8.00	B	Good
4.	The materials are quite in depth	17.00	A	Very Good
5.	The materials are appropriate to all genders, races, and religions.	12.00	B	Good
6.	The materials provide other sources for reference	16.00	B	Good
	Total Score	87.00	B	Good

Data from the Results of Expert Validation

Based on the revisions provided by the experts and the teachers and also based on the findings in the operational testing, the researchers generated the final product. The final product review toward the inquiry-based lectora multimedia was the results of confirmation between the theoretical review and the findings from the previous studies.

The study developed inquiry-based lectora multimedia with the sub-theme Living Manners of Human Beings, Animals, and Plants for the fifth-grade students. Based on the Table 2, the score of the product was 177.00 and belonged to the "Very Good" category.

According to the material experts, the inquiry-based lectora multimedia earned 87 and belonged to the "Good" category. From the assessment, the researchers might conclude that the inquiry-based lectora multimedia had been feasible for implemented in the study. Then, based on the assessment provided both by the media experts and the material experts it was found that the inquiry-based lectora multimedia had been considered having clear concept and good directions and the materials within this lectora multimedia had been in accordance with the basic competencies and the core competencies. In terms of multimedia design, the inquiry-based lectora multimedia had been in accordance to the standards of multimedia technical presentation for learning process; the standards were having clear background, directions, pictures, music, texts, reading materials, and audio that supported the learning process so that the students were happy and interested in attending the learning process.

Data Analysis on the Results of Limited Testing

Logical Ability and Creative Thinking

The assessment of the students' logical ability and creative thinking was based on the pre-test and the post-test that had been conducted before and after the implementation of inquiry-based lectora multimedia that had been developed. Prior to attending the learning process that made use of the inquiry-based lectora multimedia, the students' average score of logical ability was 12.67 whereas the students' average score of creative thinking was 7.00. After attending the learning process that made use of the inquiry-based lectora multimedia, the students' average score of logical ability was 17.33 while the students' average score of creative thinking was 11.67.

Data Analysis on the Results of Field Testing

Logical Ability

The following diagrams described the improvement on the students' logical ability during the field testing.

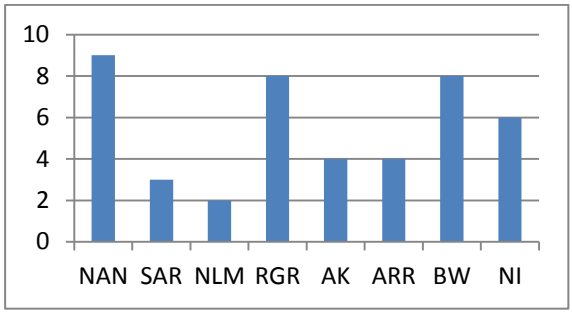

Figure 1. The Students' Logical Ability before Treatment.

Figure 1 displayed the students' score of logical ability prior to using the inquiry-based lectora multimedia, namely 10.25.

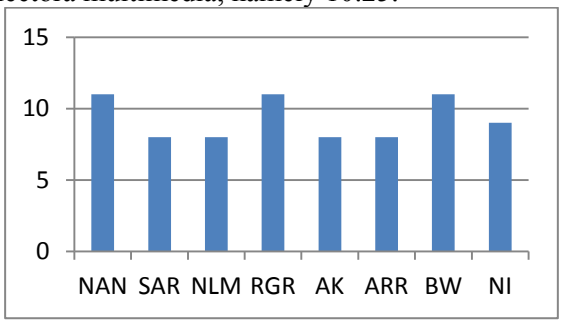

Figure 2.The Students' Logical Ability after Treatment

Figure 1 and 2 displayed the improvement on the students' logical ability from 8 students who had been selected as the subjects for the field testing. The students' score of logical ability after attending the learning process that made use of the inquiry-based lectora multimedia was higher in comparison that before attending the learning process, namely 12.875 to 10.250.

The data also showed improvement on the students' logical ability and creative thinking after attending the learning process that made use of inquiry-based lectora multimedia; their score after attending the learning process was higher than before attending the learning process, namely 9.875 to 7.250.

Data Analysis on the Results of Operational Field Testing

Logical Ability

The logical ability test aimed at measuring the students' logical ability that appeared after the students attended the learning process that made use of the inquiry-based lectora multimedia. The experimental group in this study was Grade VA with 33 students who had been provided with the inquiry-based lectora multimedia as their treatment. During the learning process, the students were provided with the learning materials through the treatment. The teacher explained how to operate the inquiry-based lectora multimedia and along with the students started the learning process 1 until the learning process 6. Table 4 displayed the data from the results of the students' logical ability in the experimental group after the treatment.

In Table 4, from 33 students whose logical ability had been measured during the operational field testing 2 students had score that belonged to the "Moderate" category, 18 students had score that belonged to the "Good" category, and 13 students had score that belonged to the "Very Good" category. Classically, the average score of the students' logical ability was 17.45 with "Good" category. Within the operational field testing, the logical ability that the researchers desired had completely appeared in the learning process within the experimental classroom.

In the operational field testing, the control group served as comparison. The control group was assigned in order to identify the differences that appeared between the group that had not been treated and the group that had been treated.

In Table 5, from 32 students whose logical ability had been measured during the operational field testing 8 students had score that belonged to the "Very Low" category, 4 students had score that belonged to the "Low" category, 13 students had score that belonged to the "Moderate" category, 4 students had score that belonged to the "Good" category, and 3 students had score that belonged to the "Very Good" category. Classically, the average score of the students' logical ability was 13.625 with "Moderate" category.

From the results that had been displayed in Table 4 and Table 5, the researchers might conclude that there had been differences on the logical ability between the students who had been treated with the lectora multimedia and the students who had not been treated with the lectora multimedia. The students who had been treated with the lectora multimedia earned better achievement in comparison to the students who had not been treated with the lectora multimedia.

Table 4. The Data from the Results of Students' Logical Ability Test in the Experimental Group

No.	Score Interval	Category	Number of Students in the Operational Field Testing
1.	$x > 18.00$	Very Good	13
2.	$15.00 < x \leq 18.00$	Good	18
3.	$12.00 < x \leq 15.00$	Moderate	2
4.	$9.00 < x \leq 12.00$	Low	0
5.	$x \leq 9.00$	Very Low	0
	Total		33

Table 5. The Data from the Results of Creative Thinking in the Experimental Group

No.	Score Interval	Category	Number of Students in the Operational Field Testing
1.	$x > 20.00$	Very Good	3
2.	$16.20 < x \leq 19.60$	Good	4
3.	$12.80 < x \leq 16.20$	Moderate	13
4.	$9.40 < x \leq 12.80$	Low	4
5.	$x \leq 9.40$	Very Low	8
	Total		33

Table 6. The Data from the Experimental Group's Creative Thinking Test Results

No.	Score Interval	Category	Number of Students in the Operational Field Testing
1.	$x > 10.00$	Very Good	20
2.	$8.40 < x \leq 10.00$	Good	10
3.	$6.60 < x \leq 8.40$	Moderate	3
4.	$4.80 < x \leq 6.60$	Low	0
5.	$x \leq 4.80$	Very Low	0
	Total		33

Table 7. The Data from the Control Group's Creative Thinking Test Results

No.	Score Interval	Category	Number of Students in the Operational Field Testing
1.	$x > 13.00$	Very Good	4
2.	$10.80 < x \leq 13.40$	Good	4
3.	$8.20 < x \leq 10.80$	Moderate	10
4.	$5.60 < x \leq 8.20$	Low	10
5.	$x \leq 5.60$	Very Low	4
	Total		33

Creative Thinking

The creative thinking test aimed at measuring the students' creative thinking that appeared after the students attended the learning process using the inquiry-based lectora multimedia. Table 6 displayed the data from the experimental group's creative thinking test results.

In Table 6, from 33 students whose creative thinking had been measured during the operational field testing 3 students had score that belonged to the "Moderate" category, 10 students had score that belonged to the "Good" category, and 20 students had score that belonged to the "Very Good" category. Classically, the average score of the students' creative thinking was 10.97 with "Very Good" category. Within the operational field testing, the creative thinking that the researchers desired had completely appeared within the learning process of the experimental group.

During the operational field testing, the control group served as a comparison. The control group was assigned in order to identify the differences that appeared between the group that had been provided with the treatment and the group that had not been provided with the treatment.

In Table 7, from 32 students whose creative thinking had been measured 4 students had score that belonged to the "Low" category, 10 students had score that belonged to the "Moderate" category, 4 students had score that belonged to the "Good" category, and 4 students had score that belonged to the "Very Good" category. Classically, the average score of the students' creative thinking was 8.47 with "Moderate" category.

From the results that had been displayed in Table 6 and 7, the researchers might conclude that there had been differences between the students who were provided with the inquiry-based lectora multimedia and the students who were not provided with the inquiry-based lectora multimedia. The students who were provided with the inquiry-based lectora multimedia had better results than the students who were not provided with the inquiry-based lectora multimedia.

Teacher Response Questionnaire

Teacher response questionnaire was distributed in order to identify the teacher's response toward the use of inquiry-based lectora multimedia within the learning process. The followings were the results of the teacher response questionnaire toward the learning process that made use of inquiry-based lectora multimedia and these results had been converted to five-scale points.

Table 8. The Assessment on the Results of the Teacher Response Questionnaire within the Field Operational Testing

No	Sub-Variables	Score	Category
1.	Learning Materials	27.00	Very Good
2.	Learning Strategies	24.00	Very Good
3.	Technical Quality	32.00	Very Good
	Average	27.67	Very Good

Based on the results that had been displayed in Table 8, it was apparent that the teacher response toward the use of inquiry-based lectora multimedia within the learning process had been good. The good use was apparent in the score that the teacher attained namely 27.67, with "Very Good" category. The detailed results then were 27.00 on the sub-variable "Learning Materials" with "Very Good" category, 24.00 on the sub-variable "Learning Strategy" with "Very Good" category, and 32.00 on the sub-variable "Technical Quality" with "Very Good" category.

Student Response Questionnaire

The student response questionnaire was related to the use of inquiry-based lectora multimedia within the learning process. In terms of media and learning materials, the students' response toward the inquiry-based lectora multimedia was good because 82.09% students provided good assessment toward the inquiry-based lectora multimedia. The students' comments also showed positive response. It was apparent that the students had been happy and had easily understood the materials that were delivered during the learning process that made use of the inquiry-based lectora multimedia.

The learning process in the school should be able to develop the students' reasoning skills, in this case the logical ability and the creative thinking. The reasoning skills should be provided to the students since their early age for the sake of the students' development. This statement is in accordance with the statement by Weber (2011) who suggest, "Children need to learn to give 'good reasons' for their own beliefs and likewise distinguish between good and bad reasoning in other, correct their opinion if necessary, and modify their judgment in making accordingly."

Start conducting the learning process from the actual context/object in the students' surrounding environment will ease students in understanding a concept. Such process will ease students in understanding a concept and can be a bridge within the students' mind in understanding concrete abstracts to more abstract concepts. It is here that students' reasoning skills are trained so that students are able associate the knowledge that they have learned to the new knowledge so that their cognitive structure will be more improved. Thereby, the new knowledge will be shaped in their reasoning process by putting together the knowledge that they have learned. Such sequence is named as meaningful learning, which has been proposed by Ausubel (Widyastuti & Pujiastuti, 2014, p. 183).

Logics will appear in the reasoning process if an individual has found two different objects or matters that have relationships leading to conclusion. In order to generate the appropriate knowledge, there should be an appropriate reasoning process as well namely the logical ability.

Koray & Köksal (2009, p. 3) defined that logical thinking comprises both thinking about thought and reversal association between what is possible and what is real. Logical ability is the highest reasoning process proposed by Piaget in accordance to the cognitive development. The development of reasoning capability belongs to the operational concrete stage and the operational concrete stage that starts from age of 7-8 years old. This is in accordance to the statement by Gredler in Koray & Köksal (2009, p. 3) which suggests that development of logical thinking is explained in concrete and formal

operational periods beginning from 7-8 ages to older age.

Students use mental operation in order to solve actual problems. Students are able to use their mental capacity in order to solve concrete problems and they are also able to perform logical ability although their logical ability is limited to the current situations (Izzati et al., 2008, p. 104). During the operational concrete stage, students are able to perform most of the tasks in the higher level compared to the previous stage. Their understanding toward the concept of space, causality, categorization, conversion, and summation is better. Their decisions regarding the cause and effect will improve. The categorizing capacity will help students to think logically. According to Piaget, students in the operational concrete stage think inductively by starting to observe specific symptoms or matters in a group of community, animal, objects, or events prior to drawing conclusions (Izzati et al., 2008, p. 105).

In order to identify the students' creative thinking, the researchers applied the aspects that had been contained within the creative thinking. De Bono in Barak & Doppelt (2000) defined 4 levels of achievement in terms of creative thinking skill development namely: awareness of thinking, observation of thinking, thinking strategy, and reflection on thinking. These levels would be elaborated as follows.

1. Level 1: Awareness of thinking
   This level consists of several points as follows:
   a. General awareness of thinking as a skill
   b. Willingness to think about something
   c. Willingness to investigate a particular subject
   d. Willingness to listen to others
2. Level 2: Observation of thinking
   This level consists of several points as follows:
   a. Observation of the implication of action and choice
   b. Consideration of peers' point of view
   c. Comparison of alternatives
3. Level 3: Thinking strategy
   This level consists of several points as follows:
   a. Intentional use of a number of thinking tools
   b. Organization of thinking as a sequence of steps
   c. Reinforcing the sense of purpose in thinking
4. Level 4: Reflection on thinking
   This level consists of several points as follows:
   a. Structure use of tools
   b. Clear awareness of reflective thinking
   c. Assessment of thinking by the thinker himself
   d. Planning thinking tasks and methods to perform them

Level 1 is the lowest level of creative thinking because this level mainly expresses the students' awareness toward the needs to accomplish their assignment. Then, Level 2 displays the higher level of creative thinking because in this level the students should show how they observe the implication of their choices such as the use of special components or programming algorithms. Level 3 is another higher level of creative thinking because in this level the student should select a strategy and coordinate the strategy to multiple explanations within their tasks. They should decide how the desired level of detail and how to present the logical conditions or sequences from a system of action. Last but not the least, Level 4 is the highest level of creative thinking because in this level the students should test the characteristics of the final product by comparing these characteristics to the objectives, should explain their conclusions toward the success or the difficulty during the developmental process, and should provide suggestions for improving the planning and the construction process.

Creative thinking is a process and, therefore, in the learning process teachers should follow the appropriate steps. Cramond (2015, p. 3) elaborates the creative thinking process into 4 steps namely preparation, incubation, illumination, and verification. Preparation is the stage of gathering data or information that will be necessary for solving the problems. In this stage, divergent thinking or creative thinking is highly demanded. Then, incubation is the stage of hatching the problem-solving process in the pre-conscious realm. This stage lasts within undefined time. Next, illumination is the stage of displaying inspirations or ideas for solving problems. In this stage, spontaneous ideas appear. Last but not the least, verification, or also known as evaluation, is the stage of testing the new ideas or creations in the reality.

Based on the opinion by Anwar, Aness, Khizar, Naseer, & Muhammad (2012, p. 44), the creative thinking might be measured through four aspects that are the cognitive characteristics within creativity. These cognitive characteristics are as follows: (a) fluency (generating issues); (b) flexibility (shifting perspectives easily); (c) originality (consisting of something new); and (d) elaboration (building on existing ideas).

In order to achieve the learning objective, namely to improve the logical ability and the creative thinking, inquiry-based lectora multimedia should be developed. A good multimedia should follow the principles of multimedia creation namely multimedia principle, spatial contiguity principle, temporal contiguity principle, coherences principle, individual differences principle, modality principle, and redundancy principle (Mayer, 2009, p. 184). In addition, a good multimedia should follow the requirements of good multimedia and materials. The criteria that should be met by a learning multimedia in order to be categorized being feasible have been proposed by Hackbarth (1996, p. 231). The first is getting started. The instruction installment should be easily operated and this process should be conducted without software intervention or interference. The second is moving around. The displayed menu should be access easily and immediately. The third is searching and results. There are the menus that facilitate the students to search learning materials. The fourth is content. The displayed materials should be valid, directed, and appropriate for students. The fifth is curriculum support and practical matters. The designed programs should complete the components other than curriculum and should provide direct contribution toward the objective achievement. The sixth or the last is bonus questions. There should be bonus practice such as quizzes and games that will improve the students' capacity in applying the knowledge that they have attained.

On the other hand, the contents/materials should meet the quality that covers six aspects. The six aspects are as follows: (1) the materials should be in accordance to the learning objectives; (2) the materials should be in accordance to the students' characteristics; (3) the materials should be up to date; (4) the materials should be in-depth; (5) the materials should be in accordance to all genders, races, and religions; and (6) the materials should provide other sources of reference.

The inquiry-based lectora multimedia that has been developed itself has already met the feasibility of a good multimedia both in terms of technical aspects and in terms of materials aspects. Within the designing process, not all of the principles have been applied. The materials that had been omitted were the modality principle and the redundancy principle.

Hammza, Daw, & Faryadi (2013, p. 37) suggested that multimedia support the transferring of knowledge sufficiently and offer the good environments for student to avoid feeling bored in the classroom. The inquiry-based lectora multimedia that had been developed contains the elements that a multimedia contains namely text, picture, animation, and video. The use of these elements can draw the students' interest in order to perform further learning process regarding the materials that have been taught. The existing elements within the multimedia might also accommodate the students' learning styles, namely visual, auditory, and audiovisual, so that the students' understanding toward the learning process might improve.

The form of inquiry presentation in the lectora multimedia was also able to direct the improvement of the students' logical ability and creative thinking. The reason was that the students should follow the inquiry steps that had been presented from the problem identification that had been entitled *Tahukah Kamu* (Do You Know) in the lectora multimedia. In the problem identification stage, the students should understand the problems that were discussed. The second stage was the proposal of temporary hypothesis, which had been entitled *Apa Pendapatmu* (What is Your Opinion) in the lectora multimedia. In the second stage, the students should provide their temporary answers or opinions over the problems that had been presented. From this point, the students' logical ability and creative thinking started to develop. The third stage was data gathering activity that had been entitled *Ayo Cari Tahu* (Let's Find Out). In this stage, the students gathered the data regarding the problems through reading texts, pictures, and videos that had been presented. From this stage, the students assumed whether their answers or opinions that had been provided in the first stage were appropriate or not. The fourth stage was the hypothesis testing. In this stage, the students applied the knowledge that they had attained during the data gathering activity in order to respond to the questions that had been given. The fifth or the last stage was

the conclusion drawing. After completing the previous four stages, the students were expected to draw the conclusions that had been the results of reasoning process that had been performed from the first stage to the fourth stage. In each stage that the students had passed, their logical ability and creative thinking developed and improved.

Based on the results of operational testing that had been performed in Grade VA as the experimental group, the inquiry-based lectora multimedia was considered being able to improve the students' logical ability and creative thinking. This improvement has been in accordance to the statement by Reinhardt (Snyder & Jo Vaughan, 1996, p. 179), who also identified how multimedia could improve the learning quality. Reinhardt explained in more details that: (1) multimedia can boos curiosity, creativity, and teamwork amongst participants; (2) multimedia can change the role of teacher from the traditional role of omniscient ruler to that of a tour guide; (3) using multimedia can reinstall the apprenticeship model of learning; (4) multimedia can increase access to information; (5) multimedia can provide a richer environment to penetrate "media overload"; and (6) multimedia can break down the wall of the classroom.

Similarly, Martin, Sexton, & Franklin (2005, p. 185) stated that:

> Inquiry is the process that students should use to learn science; they should be able to ask question, use their question to plan and conduct a scientific investigation, use appropriate science tools and scientific techniques, evaluate evidence and use it logically to construct several alternative explanations, and communicate (argue) their conclusions scientifically.

Based on the above statement, the inquiry-based lectora multimedia was considered appropriate in improving the students' logical ability and creative thinking. The results from the operation of inquiry-based lectora multimedia were the improvement of the students' logical ability and creative thinking. In average, the students' logical ability and creative thinking improved in terms of comparison between the pre-experiment scores and the post-experiment scores. The experimental group experienced higher improvement in comparison to the control classroom. Based on the results of t-test, it was statistically apparent that there had been differences in the logical ability and the creative thinking between the experimental group and the control group.

From multiple studies that had been conducted, especially with regards to the improvement of logical ability and creative thinking, there had not been any studies that combined both reasoning skills. Similarly, there had not been any studies that investigated the use of inquiry-based lectora multimedia for improving the logical ability and the creative thinking.

The results of the study showed that the use of inquiry-based lectora multimedia has been able to improve the logical ability and the creative thinking of Grade V students in SD Jetis, Bantul.

Conclusions

The inquiry-based lectora multimedia that has been developed in order to improve the students' logical ability and creative thinking is considered feasible for implementation according to the material experts and the learning experts with "Very Good" category.

The inquiry-based lectora multimedia proves to be effective in improving the logical ability and the creative thinking of Grade V students in SD Jetis, Bantul. The statement is based on the results of operational field testing that shows sig. value < 0.05; such a sig. value implies that there have been significant differences between the students who attend the learning process using the inquiry-based lectora multimedia and the students who do not attend the learning process using the inquiry-based lectora multimedia.

The feasibility and the effectiveness of the inquiry-based lectora multimedia that has been developed for improving the students' logical ability and creative thinking of Grade V students in SD Jetis, Bantul have already been proven. Therefore, the researchers would like to provide several suggestions as follows: (1) the teachers might use the inquiry-based lectora multimedia as their guideline of learning implementation that might improve the students' logical ability and creative thinking; and (2) the teachers might use the inquiry-based lectora multimedia by adjusting the multimedia to the students' characteristics and the schools' surrounding environments.

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