Dinamika Pendidikan 12 (2) (2017) 196-206

Dinamika Pendidikan

http://journal.unnes.ac.id/nju/index.php/dp

Development of E-Book Multimedia Model to Increase Critical Thinking of Senior High School Students

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DOI: 10.15294/dp.v12i2.13567

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History Article

Received 22 August 2017
Approved 9 November 2017
Published 31 December 2017

Keywords

critical thinking ability; Multi media e-book,;Research and development; quasi experiment

Abstract

This study aims to develop the interactive e-book multimedia model to improve the students' critical thinking ability (KBK). Critical thinking is very important to develop because it provides a high level of reasoning thinking that provides permanent experience to students through conscious and controlled decision making in a rational, reflective, responsible manner with the optimization of potential. Flash-based e-book media is capable of interactively loading videos, pictures, practice questions and learning with directed directions from the teacher. The research method developed is research and development. The output products are learning plan, KBK evaluation question, flash-based interactive e-book multimedia, and quasi experiment to see media effectiveness to KBK. The results showed that e-book multimedia is able to significantly increase the KBK of high school students in economic learning.

How to Cite

Suparno.(2017). Development of E-Book Multimedia Model to Increase Critical Thinking of Senior High School Students. *Dinamika Pendidikan*, 12(2), 196-206.

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p-ISSN 1907-3720
e-ISSN 2502-5074

INTRODUCTION

Critical thinking ability (KBK) is very important to develop because it creates reasoning in conscious and controlled in decision making in rational, reflective, and responsible ways with all its potential. Education as an effort to prepare the learners in the future demands initiative and mindset that provide experience. According to Utami and Nina (2013), learning itself is an activity of seeking facts with various methods and individual experiences through practice with a concrete approach.

Through critical thinking, the students will ask, connect ideas, think logically, know the structure of a science whether it is good or bad, also right or wrong, and know the result of thinking. Students who think critically and know the benefits of a lesson will seriously learn and be able to provide ideas and solutions in facing everyday problems.

Dewey (Johnson E. B, 2010: 187) said that 'Schools should teach the students the right ways of thinking'. Sizer (Johnson E. B, 2010: 181) viewed school as a place to practice thinking and solving problems, as it is said that 'School means learning to use the mind well, thinking creatively about important issues, and inculcating the habit of thinking'.

Technological progress requires a teacher as an educator to always innovate in creating the learning media that is able to support the students' understanding in learning the subject matter both theory and practice (Saeroji: 2014). Learning process that is only teaching concepts and memorization and only teaching and pursuing the material delivery is stated by Tinning and Macdonald (Mahendra et al: 2008: 39) as follows *'... Teachers in school are not developing a reflective thinking, thus their teaching task is solely run as something routine, without any attempts to facilitate learning with various teaching and strategies and method",* which means that teachers in schools do not develop reflective thinking, so the teaching task is only a routine, without trying to facilitate learning with different types of methods and teaching strategies.

Thinking skills are grouped into basic thinking skills and high level thinking skills. According to Costa (1985), qualification, classification, variable relationship, transformation, and causal relationship are included in the basic thinking skills. While the complex thinking skills include problem solving, decision making, critical thinking and creative thinking.

Critical thinking according to Joane Kurfiss (Inch, et al., 2006) is an assessment which purpose is to examine a situation, phenomenon, question, or problem to derive a hypothesis or conclusion that integrates all available information so that it can be confidently justified.

Critical thinking is a rational decision-making on what is believed and conducted. According to Michael Scriven and Richard Paul (Ebiendele Ebosele Peter, 2012: 1): *Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication, as guide to belief and action.* It appears from this definition that critical thinking involves cognitive aspects such as application, analysis, synthesis, and evaluation.

Faccione (1998) referred to the experts' consensus in the American Philosopical Association in 1990 introducing five steps in the thinking process: interpretation, analysis, evaluation, concluding expertise, argument and reflection. The ability to think critically is based on a consensus attended by 46 experts from the Leading Universities conducted by the American Philosophical Association (Facione, P. A. ,1998: 2).

The ability to think critically in this research is a high-level thinking ability which purpose is to examine a situation, phenomenon, question, or problem to get a hypothesis or conclusion as a rational decision-making process for what is believed and conducted in a real way through aspects of interpretation, analysis, evaluation, conclusion, and explanation.

It is in line with a research by Lloyd and Nan (2010): *Critical thinking is also an important goal of education within the schooling sector. It is embedded in the Melbourne Declaration(Educational Goals for Young Australians) (MCEETYA, 2008) which describes successful learners as those who are "able to think deeply and logically,and obtain and evaluate evidence in a disciplined way as the result of studying fundamental disciplines" (p.8);and, elsewhere, as those who "are able to make sense of their world and think about how things have become the way they are" (p.8). This would indicate that, for the pre-service teachers who participated in this study, it is important to be engaged in critical thinking (i) for their own academic development and to demonstrate this capacity as a part of achieving the requisite Graduate Attributes; and, (ii) to understand its role in their future professional practice as teachers.*

Based on the definition, it explains that critical thinking describes the success in learning to think deeply and logically on the facts of the problem to get the logical problem solving.

"Critical thinking" as a part of the process of evaluating the evidence collected in problem solving or the results produced by thinking creatively (Crowl et al., 1997; Lewis & Smith, 1993).

It is in line with the views of Crowl and Lewis (1993) in King et.al who revealed that critical thinking is the most important part of the process of assessing the facts collected to solve the problems by creative thinking.

Media comes from the Latin word "medium" that means "between", a term that denotes everything that carries information between source and receiver (Muhammad Jauhar, 2011: 95). Learning media includes everything that can bring messages and information conveyed by a teacher as the communication to the students in delivering learning materials in order to improve the knowledge, motivation, thinking and understanding of learners to the learning materials delivered.

Meanwhile, according to Sugandi (2004) in Prihatanti (2013), learning media can be used to stimulate the mind, feelings, attention, and ability or skills of the learners so that it may encourage the learning process. Utilization of media really has a big share in learning activities. It is in line with what was proposed by Marintan and Widiyanto (2017) in general, that the benefits of media in the learning process is to facilitate the interaction between teachers and students so that learning activities will be more effective and efficient.

E-book is an abbreviation of a term in English electronic book. E-book as a multimedia of learning is very interesting because it provides ideas, information and learning materials according to the students' level of thinking. As part of the information contained in the flash based e-book, it includes; Video, sound, music, text, animation, movies, graphics, images and data.

A research by Bobbi De Porter (Niken Ariani and Dany Haryanto, 2010: 6), the creator of Quantum learning, revealed that humans may absorb a matter of 70% of what is worn, 50% of what is heard and seen (audio visual), and 30 % of what is seen, 20% of what is informed, and 10% of what is read. The learning media is expected to increase the awareness of audio visual-based-learning.

Multimedia can be a combination of text, graphics, animation, sound and images. However, the combination of two or more types of media is emphasized on the control of the computer as an overall driver in a program / software. Thus the meaning of multimedia refers to a wide variety of combinations of graphics, text, sound, video, and animation. This merger is an entity that displays information, messages or subject content (Arsyad, 2002: 169).

The use of paper in the activities of human life can be reduced by utilizing the learning media effectively. More than 300,000,000 tons of paper is consumed by the entire population of the world. This is proportional to 800,000 tons per day or 10,000,000,000 sheets of 80 gram A4 size paper (Sam Martin: 2011). It is a waste of resources in the long period that becomes a threat to the society and the nature. We can design a thick book with hundreds of pages in one e-book that is easy to carry with flash disc and can send it via internet online in seconds. Other problems that

arise include students carrying very large and heavy books to school, the cost of books is increasingly expensive, and every semester there will be the new books.

E-book as a learning multimedia may include film / video of learning, text, images, questions, pdf files, voice recording of instructional direction of teachers, and given nuance or music in mp3. It will be interesting for the students to learn because it can be presented with high quality and interactive dimensions. On the other hand, there are still weaknesses to develop further with the personal writing of students, workmanship online and so forth.

The android computer operating system is growing rapidly. The development of mobile phones and note book with jellybean, KitKat until now lollypop enables the development of e-book as a learning media, even Google play store provides its own application for the operational of e-book. Communication technology that can be a learning media is currently located close to the grip of students at home. A study on the use of the internet from mobile phones and note book or computer found that 98% of children and adolescents claim to know about the internet and 79.5% of whom are the internet users. The study also revealed that 69% of the respondents use computers to access the internet. More than half of respondents (52%) use mobile phones to access the internet (Reza Wahyudi, 2014)

Senior High School is as the organizer of formal education implements the curriculum 2013. The materials of *demand, supply and equilibrium* contains graphs, econometrics and analysis of economic case are still considered difficult for the students, so e-book is developed to improve the critical thinking skills.

The problems in this research are: 1) how the development of media learning is to develop the students' KBK on the economic lesson on the subjects of *demand, supply and equilibrium*, 2) how the development of multimedia e-book model is to develop the students' KBK, 3) whether there are differences in students critical thinking skills before and after treatment, 4) whether there are differences in the students' critical thinking skills between before and after treatment, 5) whether there is an increase in students' critical thinking skills. While the purpose of this research is to develop flash-based e-book multimedia model and to know its influence on economic learning in Senior High School on the subjects of *demand, supply and equilibrium* in developing KBK.

METHODS

This is a Research and Development (R & D) research. According to Borg & Gall (2003: 772), research development is a research oriented to developing and validating the products used in education. The development is multimedia learning media of e-book based on interactive flash for senior high school learning subjects of demand, supply, and equilibrium.

The series of steps to carry out in the development model used in this research is a 4-D model (four D model) developed by S. Thiagarajan (1994). The reason for using this Thiagarajan development model is because the steps of the model are able to provide detailed directions so as to produce a clear product.

Define stage covers the need analysis, the student analysis, the learning objective analysis, the Core Competence and Basic Competency analysis, and the determination of instructional objectives, design, material preparation, media selection, media format selection, initial design. The initial design stage includes the following steps: 1) Determining the material, 2) Collecting materials according to the determined material, 3) Determining the design of the display menu, 4) Preparation of material to be included in the initial view, 5) Making video tutorials, 6) Packing media on CD, developing learning tools that have been revised based on input from validator. This stage includes several steps: 1) validation, 2) revision, 3) product trial (limited), and 4) revision, and disseminate (spread). However, in this research there is a modification and only up 3-D stage because the product of development is not until disseminated.

Learning media is validated by three

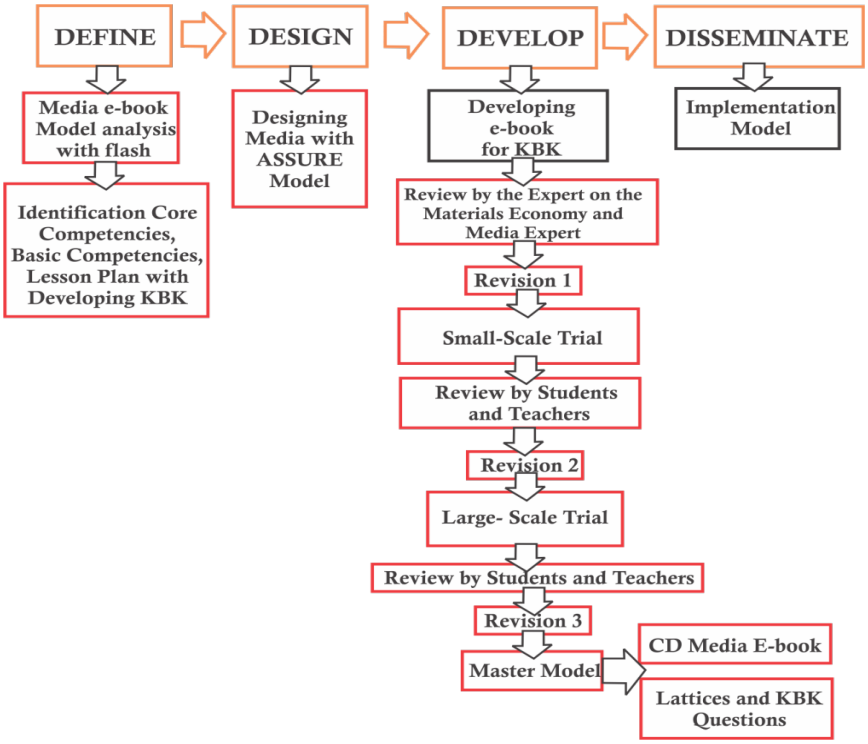

Figure 1. Multimedia Model Development Flow of e-book to increase KBK of high school students on subjects of demand, supply and equilibrium

Economic Teachers and discussed in the MGMP and three lecturers of media experts with educational technology background and the validation is by 20 high school students to determine the feasibility in learning. Questionnaire of flash-based e-book media developed with Likert scale is conducted by the criteria of qualification assessment adapted from Akbar and Sriwiyana (2010) as follows:

Table 1. Criteria of Percentage Analysis Validation

Criteria	Level of Validity
75.01% – 100.00%	Very Valid (can be used without revision)
50.01% – 75.00%	Valid Enough (can be used without little revision)
25.01% – 50.00%	Not Valid (cannot be used)
00.00% – 25.00%	Very Unvalid (prohibited to be used)

Source: Processed Data (2017)

Development of KBK instrument covering 25 questions of multiple choice tests refers to KBK indicator, in which there are 20 valid questions and 5 drop problems. Furthermore, a reliability test of 0.361 is obtained, which means the questions in the test have high reliability.

Testing the difficulty level of 20 items of the KBK test, there are 19 items with medium category and one item with difficult category. Based on the differentiation test, one item is in a very good classification, four items are in a good classification, and 15 items are in a medium classification.

The learning device product that has been developed and validated is then passing through the quasi experimental test. According to Creswell (1994: 132), Nonequivalent (Pretest and Posttest), Control Group Design is the most popular approach in quasi experiment. Economic learning is conducted at SMA AVICENNA Jakagarsa, Jl. M Kahfi II No. 66 Jagakarsa, Jakarta Selatan. The school year of 2016 consists of 2 Classes: ten IPS (social) 1 (20 students) and ten IPS 2 (20 stu-

dents).

Table 2. Signs of Critical Thinking Instrument

Components	Indicators
Interpretation	1. Expressing the meaning and significance of an event, situation, data, rule belief and discovery.
	2. Distinguishing events based on an experience
Analysis	3. Identifying and correlating trends of actual conclusion of relationship of a statement
	4. Creating a curve based on data of information
Evaluation	5. Assessing credibility, logical strength and correlation of a statement
	6. Identifying a solution
Inferrence	7. Identifying and assessing element / evidence of logical conclusion
	8. Selecting relevant information to create a conclusion
Explanation	9. Drawing conclusion of thinking within a framework of evidence, concepts, methods, criteria factually
	10. Proving a contextual thinking
	11. Presenting a thinking in a strong argument

Source: Processed Data (2017)

RESULTS AND DISCUSSION

Based on the research that has been conducted, the following results are obtained:

Development of learning device to develop KBK.

Learning device is developed from the syllabus in accordance with the Core Competence and the Basic Competence on the subjects of demand, supply and equilibrium, and then the Lesson Plan and learning design are developed that can be implemented with e-book media referring to the ability to study a situation, phenomenon, question, or economic problems as a rational decision-making process through the aspects of interpretation, analysis, evaluation, conclusion, and explanation.

Development of multimedia model of flash-based e-book learning.

Development to produce a revised learning device based on validator input includes (a) validation, (b) revision, (c) product trial (limited), and (d) revision. The learning media is validated by three teachers as the material expert of Economics subject in MGMP and three lecturers with Educational Technology as the media expert and a limited test to 20 high school students. Based on the results of media development and the assessment conducted by the Material Experts, it obtains the average score of 4.5 with a valid category to proceed to the next research. Afterwards the validation test is conducted by three media experts with the following results in the Table 4. Here is a tabulation of evaluation data by the material experts:

Table 3. Assesment of Material Experts on *E-book* media

Assesed Factors/Aspects	Average of Score Assessment of Material Expert
Conformity of Indicator Formulation with Basic Competency	4.7
Conformity of Learning Objectives with Indicators	4.7
Conformity of Material with Learning Objectives	4.3
Logical Sequence / Systematics of Material	4.7
Clarity of Economic Material	4.7
Conformity of Material with Subject	5.0
Conformity of Material with Purpose of Expenditure (Achievement of Student's CBC)	4.3
Completeness of Material with Learning Competencies	4.0
Clarity Media Gallery with Material	4.7
Video Conformity used with Learning Materials	4.3
Completeness of Material with Learning Competencies	4.7
Grammar used in Economic Material	4.3
Conformity of Material with Characteristics of High School Students	4.3
Total Average	4.5

Source: Processed Data (2017)

Table 4. Assesment of E-book media by Senior High School Students

Assesed Aspects	Assesment Average of Students
This flash e-book media can be easily operated	4.4
I think this e-book media is less interesting	4.5
Media e-book is able to well display the learning outside the room	4.5
I am able to explore the thoughts and experiences of learning independently	4.3
This media is very useful to me in learning	4.5
It is an interactive media in learning independently	4.4
I am able to independently analyze the learning problems that the teacher gives by e-book	4.7
This e-book media is new so I cannot understand it	4.4
This e-book media is able to deliver the learning material clearly	4.6
I can run e-book media on my pc or android	4.6
Average	4.65

Source: Processed Data (2017)

Table 5. Media Expert Assesment

Assesed Aspects	Average of Score Assessment of Material Expert
Media display attracts students' attention	5.0
Preparation of media is easily operationalized by students	5.0
Fonts used are easy to read and clear	4.7
Suitability of fonts on the media is clearly read	4.7
Color selection on message emphasis is clearly read	4.7
Simplicity of layout to make it easy to understand	4.3
Text and image composition	4.7
Color composition of the layout	4.7
Selection of background settings	4.7
Selection of layouts does not generate selective attention	4.7
Selection of learning companion sound animation	4.3
Placement of material supporting video	4.3
Selection of animated images supporting material	4.0
Ease of navigation buttons in operation	5.0
Interactive navigation button supports material	4.7
Message design is relevant to the content	4.3
Media can be run on PC or Android	4.7
Media suitability with high school learning	4.7
Ability of media to provide real-world learning experiences outside classroom	4.7
Suitability of media compilation to present real thing in student learning	4.7
Total Average	4.6

Source: Processed Data (2017)

The validation of the media expert obtains an average score of 4.6 so that the media is valid to the joint learning test of the Senior High School students with input of providing back sound when the students do the test and also an material introduction by the teachers. The learning media test on a small group scale with 20 Senior High School students obtains the following scores(Table 5).

The evaluation of e-book media by Senior High School students obtains an average score of 4.56. Thus the media is ready to be tested in the classroom learning.

The differences in KBK students before the treatment with e-book media with a written pre test in the form of multiple choices of 20 questions on two classes (experimental class and control class) obtain a descriptive data in Table 4.

Table 6. Score Description of Pre test at Experiment and Control Classes

		Pre test of Experiment Class	Pre test of Control Class
N	Valid	20.0	20.0
	Missing	.0	.0
Mean		48.0	51.5
Median		52.5	50.0
Mode		55.0	45.0
Std. Deviation		12.8	12.6
Variance		164.2	158.2
Range		50.0	45.0
Minimum		20.0	30.0
Maximum		70.0	75.0
Sum		960.0	1030.0

Source: Processed Data (2017)

The average score of the pre-test of the experimental class of KBK is 48, while of the control class is 51.5. After providing the learning at the experimental class using flash-based e-book media and at the control class using powerpoint, the students should do the final test (post test). The average score of KBK of the experimental class on post test is 75.3 while the average score of KBK at the control class is 60.5 with the data description as follows:

Table 7. Score Description of Post test at Experimental and Control Classes

		Post test of Experimental Class	Post test of Control Class
N	Valid	20.0	20.0
	Missing	.0	.0
Mean		75.3	60.5
Median		75.0	60.0
Mode		75.0	40.0
Std. Deviation		11.1	15.1
Variance		122.3	228.7
Range		40.0	45.0
Minimum		55.0	40.0
Maximum		95.0	85.0
Sum		1505.0	1210.0

Source: Processed Data (2017)

The student's KBK improvement in the experimental class and control class can be seen in the following table:

Table 8. Score Improvement of KBK of Students Pre test and Post test at Experimental and Control Classes

Measure	Pre test at Experimental Class	Post test at Experimental Class	Post test at Control Class	Pre test at Control Class
Mean	48.0	75.3	60.5	51.5
Minimum	20.0	55.0	40.0	30.0
Maximum	70.0	95.0	85.0	75.0
Std. Deviation	12.8	11.1	15.1	12.6
Variance	164.2	122.3	228.7	158.2
Gain	5		2	
N Gain	10		4	

*N-Gain Statistic Output
Source: Processed Data (2017)

It can be analyzed that each class has an increase in KBK, but the improvement of the experimental class using the e-book media is higher. E-book multimedia is able to accommodate various media that is packaged interactively. For learning, it can be packed by the following ones : 1. Providing introduction to learning with materials that can be easily learned by the students and can be analyzed; 2. Incorporating easy-to-read drawings, examples and illustrations and emphasizing important material that should be learnt by the students; 3. Providing supporting data in the form of animations, numbers or videos that can be learnt by the students as a learning application; 4. Providing KBK evaluation questions; 5. Incorporating animation / sound / learning media supporting so the learning will be comfortable and not boring for the students.

CONCLUSION

This research aims to develop e-book media model to improve the student's KBK by conclusion as follows : 1) flash-based e-book media can be developed for the economic learning in SMA on the subjects of demand, supply, and equilibrium by developing KI, KD from syllabus and made as part of RPP; 2) development of flash-based e-book media for the economic learning in Senior High School on the subjects of demand, supply and equilibrium can be used to increase the students' KBK by building a media by adjusting to KBK analysis that is expected to emerge; 3) learning by flash based e-book is able to significantly increase the student's KBK in High School Economics learning. It shows that multimedia e-book is the right media chosen by teacher in learning to improve the students' KBK on the subjects of demand, supply and equilibrium.

Students' KBK in Senior High School Economic Learning can be improved by the flash based e-book multimedia. Therefore, it requires further development for other topics in Senior High School Economic Learning so that the school is expected to provide the e-learning space facilities and the good internet access and the researchers can do a research on flash-based e-book multimedia to improve other learning competencies.

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