

DEVELOPING CHARACTER BASED INTERACTIVE LEARNING MEDIA TO FACILITATE STUDENTS' SELF-LEARNING OF MATHEMATICS CAPITA SELECTA

(A research on mathematical critical and creative thinking skills of
Mathematics department students of teachers training and education
faculty of Siliwangi University)

Nani Ratnaningsih^a, Hetty Patmawati

Study of Mathematics Education Program FKIP Siliwangi University, Jln. Siliwangi
24 Tasikmalaya, West Java Indonesia e-mail: niratzk@gmail.com

Program Mathematics Education FKIP Siliwangi University, Jln. Siliwangi 24
Tasikmalaya, West Java Indonesia e-mail:
hettypatmawati@unsil.ac.id

Abstract:

This research aims to design and develop a character based learning Interactive Media to Facilitate Students' self-learning of Mathematics Lecture Capita Selecta in developing Mathematical Critical and Creative Thinking skills of students. This research employs developmental research for one year from two years as planned. Research methods and its study in the first year is started by theoretical studies conducted mainly in literature and rational considerations, and empirical studies when the trials of character-based interactive media is designed to explore critical and creative thinking skills of students. Result of this study can be drawn that the designed teaching materials are already able to direct students to discover concepts related to materials of Algebra, Quadratic Equations and Functions, and Systems of Linear Equations, and the given problems can explore critical and creative thinking skills of students. Teaching materials designed to be interactive media is ready to use to facilitate self-learning of the students. The further research is implementing capita selecta Mathematics as lecture using character-based interactive learning media to students who attend the lecture in order to determine the influence of media in developing interactive learning critical and creative thinking skills of the students.

Keywords:

Character-Based Interactive Media Learning, Critical Thinking Skills, Creative Thinking Skills

1. INTRODUCTION

In an effort to improve the quality of education in Indonesia, in particular the quality of mathematics education should be a new breakthrough, both in curriculum development, human resources, learning innovations, as well as in the fulfillment of the educational facilities. Related to human resource development, the learning process plays an important role in enhancing the ability to think critically and creatively mathematical students. This is consistent with the purpose of the Faculty of Education (Guidance and Counseling) Tasikmalaya Siliwangi University to prepare teachers field of study in middle and high school, according to the necessities of both quantity and quality. While one of the missions of Mathematics Education courses FKIP Siliwangi University si to conduct a quality of education in preparing the qualified educators of mathematics. Based on

this, the students in the study program Mathematics Education as a candidates of mathematics teacher need to prepare themselves optimally to be able to fulfill the mission of Mathematics Education courses. To carry out this mission, one of the subjects being provision student teachers in middle and high school subjects are Capita Selecta of Mathematics. The Capita Selecta of Math discusses some selected topics in mathematics in middle and high school in depth include the way to present it in appropriate method as wells as the aplicabel of mathematics curriculum. Scopes of the course include: topics and middle school mathematics that are essential and frequent misconception, or a topics are felt difficult by students.

To facilitate students' self-learning, the use of instructional media is one of the alternatives in the development process of learning to become better. Munadi, Y (2008)

argued that the position of instructional media is to serve the learning needs of the students. Through the use of instructional media, students could understand the topic seem abstract and not easily visualized with better selflearning. In addition, students are expected as a mathematics teacher candidates are motivated and able to play an active role in the classroom. Kusumah, Y (2008) also emphasized that one of the solutions that are considered appropriate to realize the self-study is the application of information technology as a medium of learning mathematics, which provide opportunities for students to learn independently via programmed instructional materials interactively. Interactive multimedia applications in mathematics learning is one form of innovation (product technology) in education. This will have an impact on the recipient or user of these innovations, namely education *stakeholders* including students. Acceptance of an innovation become very complex due regard to the diversity of perceptions, backgrounds, and interests of users of innovation itself.

The results of previous research has an impact quite well that the media interactive teaching materials to provide convenience to the students to learn independently. Currently each class in FKIP already available means to support learning based on information and communication technology (*Information and Communication Technology / ICT*). In the current circumstances, learning should no longer be a tedious thing, as a few decades ago. Thanks to the development of information technology so rapidly, teaching materials can be presented with sounds and images are dynamic, not boring, and solid information. Therefore, the development of ICT-based learning is expected to improve the quality of the learning process in the classroom. UNESCO 2002 states that the use of ICT in teaching has three objectives: 1) to build a "*knowledge-based society habits*" such as problem solving skills (*problem solving*), communication skills, ability to find / manage information, transform that information into new knowledge and inform others, 2) to develop the ability to use ICT or "*ICT literacy*", and 3) to improve the effectiveness and efficiency of the learning process.

One computer-based learning media that are popular today is the interactive media. The use of interactive media in the learning of mathematics in the classroom is expected to attract interest and motivate students to improve their achievement. Kusumah (Rosmana, Anto, 2008: 2) argued, "In general, the student / students have the curiosity high to try something new, including the technology in this decade is loved by teenagers and school children." Learning math by using media interactive is one form of realization of the curriculum in Mathematics Education courses and also the development of the courses of Mathematics Instructional Media. Students are expected to participate actively and self-learning course on Capita Selecta Math so as to develop critical and creative thinking skills".

Interactive multimedia applications in mathematics can present high-level concepts and skills in mathematics, which is connected between one element and the other element that is difficult to be taught and learned through books alone. Excess interactive media applications of mathematics in explaining a concept can require students to explore and analyze, to try and explore the concepts and principles contained in the material which it faces, so relatively quickly build student understanding of the structure. This was caused because the integration of components such as sound, text, animation, pictures / graphics, and video functions to optimize the role of the senses in receiving the information into the system memory. Regular learning that have been done without the help of interactive media was not giving students the opportunity to explore and develop their creativity. Therefore, the development of character-based interactive learning media predicted to facilitate students to independently develop high-level thinking skills. Based on this, the authors are interested in carrying out research with the title "Media Development Character-Based Interactive Learning to Facilitate Self-Study Students on courses Capita Selecta Math".

This study aims to identify the elusive teaching materials, the characteristics of critical thinking skills and creative mathematical, and the initial condition of the student. In addition, designing interactive

teaching materials that includes the ability to think critically and creatively mathematically to facilitate self-learning students in courses Capita Selecta of Math. Outcomes of this study was *the software* media interactive learning in courses Capita Selecta of Math.

2. RELEVANT SOME STUDIES

Relevant studies with learning media have been carried out by a research team consisting of Sri Wardani, Ipah Mudzalipah, and Edi Hidayat. The study, entitled "Development of Media-Based Learning Interactive Multimedia to Facilitate Self-Study Students on courses Capita Selecta Mathematics (Research on Capability Understanding and Troubleshooting Mathematics Student Mathematics Education Study Program FKIP Siliwangi University Tasikmalaya) concluded that the design and development of media-based learning multimedia interactive to facilitate student self-learning and provides opportunities to develop the ability of understanding and problem solving mathematical, media-based learning interactive multimedia sufficient quality making it feasible to use student of mathematics learning courses capita selekta mathematics, and media-based learning interactive multimedia positive effect on the ability of understanding and solving mathematical problems students of mathematics education. Other research is Kusuma (2008, 2009) stated that (1) a computer-based interactive learning can be presented in an interesting, efficient, and effective interaction patterns tutorials, simulations or games; (2) Development of learning model based *eLearning* enhance the ability of high-level mathematical thinking; and (3) increase the ability of reasoning, communication, connection, problem solving, critical thinking, and creative thinking mathematically through computer media learning better than students in the regular classroom learning; (4) the implementation of the use of computer media can significantly increase positive attitude and interest of students in learning mathematics.

3. THEORETICAL REVIEW

3.1. Media Interactive Learning

Media in the learning process tend to be interpreted as graphics tools, photographic, or electronic to capture, process, and reconstruct

the visual or verbal information (Arsyad, 2007). With the presence of media in learning, students can learn the material independently and provides an opportunity to discover mathematical concepts and develop their creativity. Media classified into five groups: (1) human-based media (teachers, instructors, tutors, role playing, group activities, *field-trip*); (2) print-based media (books, guides, exercise books (*workbooks*), work tool, and loose sheets); (3) visual-based media (books, job aids, charts, graphs, maps, pictures, transparencies, *slides*); (4) based audio-visual media (video, film, slide-tape programs, television); and (5) computer-based media (computer aided teaching, *interactive video*, *hypertext*). In mathematics, interactive media is helping students in understanding the various materials that seem abstract independently. Sutopo (2003) in Samsudin, A. (2008), suggested a media presentation could use some kind of text, charts, audio, video, animation, simulation, or photos. If the various components of the (text, charts, audio, video, animation, simulation, or images) can be combined interactively, it can produce an effective learning.

In this study used media in the form of presentations random (*non-linear*), which is one form of interactive video (*interactive video*). This learning media according Seels and Glasgow (Arsyad, 2007) classified the type of microprocessor-based media on the choice of cutting-edge technology media. Media cutting-edge technology itself is divided into (1) a media-based telecommunications, such as *teleconferencing*, distance learning, and (2) a media-based microprocessor, such *computerassisted instruction*, computer games, the system tutor intelligent, interactive, *hypermedia*, and *compact (video) disc*. Preparation of the learning process through interactive media begins to prepare the material that will be taught following practice questions that includes the ability to think critically and creatively in the form of interactive animated video. In the learning process, students interact with computers and learn math concepts independently. Lecturers act as a resource and motivator. Another thing that needs to be done because learning through interactive media does not mean fully learning with just a computer, but it should remain the guidance of the lecturers so that the effectiveness of the use

of interactive media is maintained. While interactive media can serve as instructors and facilitate self-learning students about the procedure to be performed.

3.2. Building Character through Interactive Media

According Sulasdi (2013) Indonesian nation's toughest problems are many communities that have been so long stuck in a culture accustomed to one not accustomed to right, which in turn mindset, and destructive patterns of its actions. So that the Indonesian people have a mindset, a sense, and follow the pattern of a civilized, required education that can serve to build Indonesian human character praiseworthy, noble, so that the Indonesian people have a high civilization. This will be achieved through advances in science and technology-based character education that is able to build a competitive nation's competitiveness. Obligation to form the character of graduates are not only borne by the lecturer of a particular or specific courses but each lecturer has an obligation not only to form a midwife competence in academic and technical mastery but concerning personality attitude and internalize the values of characters. The role of the lecturer is important because the lecturers are the main actors in the learning. Character should be imparted to the students through the learning delivered each lecturer.

Characters are defined by the Higher Education and important development in higher education is an integration of values if the thought, though the heart, though the flavor / intention, sports and academic culture that is the character of an honest, intelligent, strong and caring. Honest character described upright, not lying, not cheating, genuine, and sincere. Honesty student at the time resolve the issues contained in teaching materials can be implemented in a self-learning through interactive media. To solve the problems and find Konsep-concept based on truth which further relies on honesty in its completion. Do not follow the stream copy of the answer key or only cheating have friends. In this case the interactive media so constructed can build honest character within students.

Smart is the perfect character development his reason for thinking and sharp mind. This character is shown by the ability of

critical thinking, creative, innovative, curious, science and technology-oriented and reflective. Designed interactive media can build critical thinking skills and creative students. Characterized by a resilient character wherever they are always difficult to beat. Mastering the situation is not controlled situation, reliable, strong in character, steadfast and longsuffering. Always trying to find an alternative solution models. Formidable character is also demonstrated by the attitude that never blame others. Every issue that arises is not a burden but a process. Interactive media designed to give a student the opportunity to settle the problems easily mapun tough, and able to make these tough characters animating patterns of thinking and acts of everyday life. Character matter very broad scope. Care among others to campus, community environment. Designed interactive media can be obedient to the rule-mover aturan requested and can be used to build a true culture, concerned about his friends who are not able to resolve the problems that occur, and help each other in solving problems.

3.3. Critical and Creative Thinking Mathematically

Think includes two main aspects, namely critical and creative. Both think the use reasoning to develop various ideas. According to Fisher (1995) thought occurs in every human mental activity that serves to formulate or solve problems, make decisions, or gain understanding. Judging from the dimensions, Marzano *et al.* (1989) found that thinking includes five dimensions of metacognition, critical and creative thinking, thinking, thinking ability of the core, and the relationship between thinking with certain knowledge. In line with these opinions, Fisher (1995) suggested, to think critically and creatively involve aspects of the mind, and both are used in reasoning and build ideas. Additionally thought to be involved in any mental activity that helps formulate or solve a problem, make a decision or to build understanding, and then through thinking can interpret something.

Ennis (1981) defined critical thinking is a thought process with the aim of making sensible decisions about what they believe or do. Further Ennis (1981) suggested there are six basic elements of critical thinking that

is *Focus* (focus), *Reasons* (reason), *Inference* (concluded), *Situation* (situation), *clarity* (clarity), and *Overview* (holistic view). According to Baron and Sternberg (1987) there were five keys in critical thinking that is practical, reflective, reasonable, beliefs, and actions. The five keys to be merged into a definition of critical thinking, so that is the critical thinking is a reflective thinking focused on deciding what is believed or done. In addition, the notion of critical thinking was something that is reasonable, reflective thinking that is focused on the decision of what is believed to be, done, or done (Marzano *et al.*, 1989).

Creativity in mathematical definition proposed by Erynk, Silver, and Sriraman. According Erynk (1991) that mathematically creative is the ability to solve problems and to develop ideas in structures with properties of deductive logic. The resulting concepts to integrate into the things that are important in mathematics. Meanwhile, Silver (1997) argued that not as a creative domain privileged few individuals, but rather as an orientation or disposition toward mathematical activity that can be developed extensively in public schools. Further Silver suggests mathematical activities such as problem solving and posing problems interwoven with creativity which includes fluency, flexibility, and novelty. Sriraman (2004) defined creativity as a process that results are not unusual, in the solution of the problem given and that regardless of the level of complexity. Sriraman also suggested that creativity can be applied in the classroom to provide opportunities for the student or students solve problems that are not complex and structured routine. So that the problems were not only raises motivation and perseverance but also has a very wide degree of reflection.

From the description, the intended creative mathematical is the ability find and resolve problems with components mathematical fluency, flexibility, novelty / originality and elaboration. Fluency is the ability to express similar ideas to solve a mathematical problem. Flexibility is the ability to produce a wide variety of ideas to solve problems outside the usual categories. Originality is the ability to provide responses that are unique and unusual. While the

elaboration is the ability to explain, develop, enrich or outlining a more detailed answers or ideas given.

4. RESEARCH METHOD

The population in this study were all students of Mathematics Education Program FKIP Siliwangi University who follows the lecture *Capita Selecta* of Math. The sampling technique using cluster random sampling. The method used in this research is *the development of research*. Procedures in developing interactive learning media include: analysis of the needs of students in the upper division courses, designed the teaching material in writing, ask the expert judgment of teaching materials, revised based on input of experts, designing interactive learning media, ask the expert judgment of interactive media, revised, limited testing, analysis of the trial results, revisions, and obtained media interactive learning mathematical ready empirically tested and implemented in the learning of mathematics.

5. RESEARCH FINDINGS and DISCUSSION

The results of the analysis of the initial conditions of students in mathematics education courses are students who had a grade point average (GPA) of 3.04 on average. Age students who will be the population is between 19-20 years. At this age, students have to know the device and using a computer or the Internet because of the results of faculty trustee information was not a single person who does not have a social networking account. Learning process using interactive media-based characters can be granted in accordance with the characteristics of the students. Media mathematics interactive form of teaching materials courses *Capita Selecta* of Math covering materials: operations algebraic form, determining factors tribes algebra, completing the operation fractional algebraic form and function, declared eligible tested empirically to students outside the sample in the learning process Course *Capita Selecta* and received a positive response from the mahasis wa. They were motivated and excited to learn math through this interactive learning media. This is according to research conducted Yusuffia Nur Rahmawati entitled *Mathematics Interactive Learning Software Based Characters with Adobe Flash CS3 on Topic Theorem*

Phythagoras. Research conducted Tri Agung titled Using CD media Interactive Computer-Based Learning to Enhance Understanding of Mathematics Concepts. In addition to research conducted Sudirman, Hermawati entitled Development of Interactive Multimedia Mathematics Subjects at the high school level Class X in Bandarlampung. Research conducted by Rionardho entitled Development of Interactive Multimedia Learning Material Using the Topic Geometry in class X SMA PGRI 3 Batujajar. The study concluded that the use of interactive media can facilitate independent learning, motivate and develop learning outcomes and establish the desired character. Other research is Kusuma (2008, 2009) Stated that (1) a computer-based interactive learning can be presented in an interesting, efficient, and effective interaction patterns tutorials, simulations or games; (2) Development of learning model based *eLearning* enhance the ability of high-level mathematical thinking; and (3) increase the ability of reasoning, communication, connection, problem solving, critical thinking, and creative thinking mathematically through computer media learning better than students in the regular classroom learning; (4) the implementation of the use of computer media can significantly increase positive attitude and interest of students in learning mathematics. Based on the results of Experts considered that a matter of critical and creative thinking skills mathematically feasible to use as an instrument to measure the ability after going through several revisions.

6. CONCLUSION

Software media interactive learning mathematics were tested empirically feasible to students outside of the sample, which will be implemented in the learning process Course Capita Selecta of Math. Media was fit to be

used based on the analysis of experts and limited testing. Similarly, the instrument's ability to think critically and creatively expressed mathematically feasible to proceed empirically test based on the consideration of experts and limited testing.

7. ACKNOWLEDGMENTS

This research is a competitive grant from the Higher Education, on this occasion we would like to thank all parties involved in the research process. Especially to LPPM Siliwangi University and Higher Education which has facilitated us to propose this competitive grant proposals. Moreover, thanks also to the leadership of the University and the Head of FKIP Siliwangi University and their staffs.

8. REFERENCES

- Arsyad, A. (2013). *Media Pembelajaran*. Edisi Revisi. Jakarta: PT. Raja Grafindo Persada.
- Evans, J.R. (1991). *Creative Thinking in the Decision and Management Sciences*. USA: South-Western Publishing Co.
- Fisher, R. (1995). *Teaching Children to Think*. Cheltenham, United Kingdom: Stanley Thornes Ltd.
- Kusumah, Y.S., et al. (2008). *Pengembangan Model Computer-Based E-learning untuk Meningkatkan High-Order Mathematical Thinking Siswa SMA*. Laporan Tahap I Penelitian Hibah Bersaing Nasional tahun 2008-2009.
- Marzano, R. J. et al. (1989). *Dimension of Thinking: A Framework for Curriculum and Instruction*. Alexandria US: Association for Supervision and curriculum Development.
- Munadi, Y. (2008). *Media Pembelajaran*. Sebuah Pendekatan Baru. Jakarta: Gaung Persada Press.
- Samsudin, A. (2008). *Peran Multimedia Interaktif (MMI) dalam Pembelajaran Fisika*. [Online]. Tersedia: <http://pendidikansains.blogspot.Com/2008/01/peran-multimedia-interaktif-mmidalam.html>. [12 Desember 2008].
- Wibowo, A (2013). *Pendidikan Karakter di Perguruan Tinggi*. Yogyakarta: Pustaka Pelajar.