Developing Pre-service Teachers' Critical Thinking Through Multimedia Learning

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Abstract. This study discusses how pre-service teachers can develop critical thinking skills in making multimedia-based learning media. This is caused by the paradigm of higher education competence which currently requires the integration of critical thinking skills, from various perspectives and cultures in the learning process. Students as pre-service teachers are expected to be able to communicate the learning that will be delivered through critical analysis and problem solving from various perspectives. This research is an ethnographic case study that focuses on the process of making multimedia learning in the field of art by utilizing Microsoft PowerPoint. The instruments used are observation sheets and interviews through focus group discussions. This study involved 20 students as pre-service teachers of cultural arts in multimedia learning courses. The results of the study show that art education students class of 2020 who have attended multimedia learning courses are able to interpret, analyze, evaluate, conclude, explain what they think, make judgments, and generate ideas or innovations for problem solving. The students can use their critical thinking skills and dispositions in making interesting and communicative teaching media when their critical thinking skills are integrated into the teaching of multimedia learning courses. In future research, it is expected to cover a larger and more representative sample to avoid bias and evaluate critical thinking skills properly.

Keywords: Critical thinking · Pre-service teachers · Multimedia learning

1 Introduction

Critical thinking is one of the elements of 21st century learning and has become a challenge in higher education. This is in accordance with the regulation of the Ministry of Education and Culture Number 20 of 2003 [1], which states, "National education functions to develop capabilities and shape the character and civilization of a dignified nation in the context of educating the nation's life, aiming to develop the potential of students to become good human beings. Have faith and fear of God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. To produce graduates who are highly competitive and ready to face the challenges of the times, higher education must prioritize critical thinking. Students with critical thinking skills can build an innovation in response to the industrial revolution 4.0; in order of to make them being used to solve problems systematically and

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making decisions independently; thus, they never stop learning throughout their lives. As a result, critical thinking skills are very important for student achievement.

Critical thinking is the ability to analyze, evaluate, and interpret data in scientific discovery activities; hence, reasoning ability is necessary for students to succeed in the workplace [2]. Problem solving also requires critical thinking to be able to approach challenges from various angles [3]. Students must be able to interpret, analyze, evaluate, conclude, explain what they think, make judgments, and generate ideas or innovations for problem solving to develop critical thinking. Therefore, it is very important to measure students' critical thinking skills during problem solving exercises. However, the facts show that the critical thinking ability of Indonesian students is still relatively low. In 2009, Indonesia was ranked 60th out of 65 countries in the Program for International Student Assessment (PISA), ranked 64th out of 65 countries in 2012, ranked 69th out of 75 countries in 2015, and ranked 72nd out of 77 countries in 2019 (OECD, 2019; 2016; 2014; 2010). This shows that Indonesian students have not been taught to think critically, resulting in low levels of critical thinking among Indonesian students. As a result, students have weak performance in giving opinions, reasoning, and solving problems.

1.1 Approach in Developing Critical Thinking Patterns

Passing exams for some Indonesians is often considered as the main goal, although critical thinking, problem solving, and creative thinking skills are considered secondary. This situation shows that students have a low level of thinking ability. This shows that the education system relies heavily on memorization. It does not emphasize critical thinking which helps learners to think rationally about issues, to reflect on ideas and to make smart choices from different choices [4].

Despite the fact that the pricess of tthinking is natural for everyone, not everyone can do that well enough, so the critical thinking process needs to be honed in every job, because critical thinking skills cannot be generated automatically [5]. It is not an instant knowledge to be taught but can be enriched with proper guidance and practice. Most academics and classroom teachers agree that fostering students' thinking skills, particularly through integrated critical thinking (CT) learning, is one of the most pressing learning goals for modern education [6]. Thus, higher education teachers must design appropriate methods and techniques in learning and teaching [7]. Lecturers are expected to integrate CT skills into student pedagogy because CT skills are an important element of academic literacy for teacher students in universities.

Innovation in the learning process is one strategy to foster critical thinking skills. To continue the learning process in the midst of a pandemic, information technology has become the main media for online learning applications. Rapid advances in information technology, multimedia technology, and network technology have offered important technical opportunities that have made constructivist learning over the Internet more feasible and simpler to implement. Information technology has facilitated online learning to support the development of students' critical thinking skills through the Learning Management System (LMS). LMS is a web-based learning space that connects lecturers and students to post modules, share video links, power point presentations, assignments, online quizzes, create discussion groups, announce grades, and conduct meetings [8].

1.2 The Use of Multimedia in the Production of Teaching Materials

Multimedia interactive learning is a new thing for students of the Visual Arts education study program. So far, students have used Information and Communication Technology in the form of Microsoft PowerPoint software only as a medium for presenting subject matter, so it is not possible for students to explore deeper knowledge of teaching materials that have been presented in the form of presentation media. This is not in line with the character of the scientific approach initiated by the government in an effort to improve the quality of learning in the classroom. According to the regulation of Ministry of Education and Culture Number. 81A of 2013; concerning the Implementation of the 2013 Curriculum, the scientific approach (scientific epproach) in learning has components of the learning process, including: 1) observing; 2) asking; 3) trying/gathering information; 4) reasoning/association, and; 5) forming a network or performing. When drawn to the realization of the implementation of the new curriculum which was initiated regarding the independence of learning in schools, then the implementation of multimedia learning is very much needed.

The utilization of Information and Communication Technology is not only required for teachers but also for the development of students' abilities. The learning process carried out by students can be improved by utilizing technology, therefore students will understand the material presented by the teacher, besides that students will add insight into the use of technology. Utilizing technology allows students to explore the knowledge they already have and can construct their own experiences [10]. The use of technology in learning is able to establish student interaction with learning media in an effort to build their own knowledge. Utilization of Information and Communication Technology in the form of the use of interactive multimedia learning through computers (Computer Assisted Instruction).

Multimedia learning is an application that is used in the learning process to deliver material and stimulate students to want to learn. Multimedia is a combination of text, art, sound, images, animation, and video that is delivered by computer or digitally manipulated and can be delivered and/or controlled interactively. This definition of multimedia can be described as follows: (Fig. 1).

Text or symbols are a common system used for communication and information by everyone from the past until now. Clarity of meaning and density of words in the text becomes very important, therefore the text becomes a vital element in the MMI

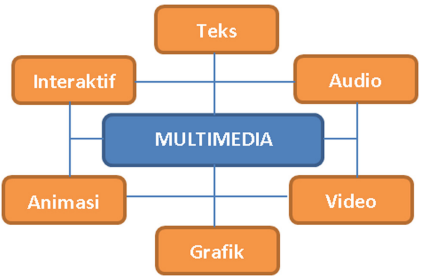

Fig. 1. Multimedia scheme

navigation system menu. In computer systems, text is known as a font because text characters in computers can be engineered in various sizes and shapes that are very attractive, even text can be made to move in various movements.

Animation is an attempt to bring a static presentation to life. Animation is a visual change over time that gives great power to MMI projects and on the Web. Image is a static image file (still image) that contains an image or photo of an object. There are several advantages of image media in MMI. In computer systems, audio can be converted from analog form to digital audio. Digital audio is a representation of the original sound. Similar to audio, in a computer system, video can be converted from analog video to digital video. Digital video is a representation of the original movement, while interactive refers to the multimedia capabilities itself.

2 Methods

The design of this research is a case study with an ethnographic approach to multimedia learning courses, where the researcher simultaneously acts as a teacher in the classroom. In the implementation process, the researcher involved himself in making observations during the making of teaching media and interviews in the form of reflection at four meetings with students of the 2020 Class of Visual Arts Education. The ethnographic approach focuses more on the process of designing ideas, realization and reflection in the manufacture of learning media; the concept of critical thinking and the disposition of each behavior through the process of interpreting, analyzing, evaluating, concluding, explaining what they think, making judgments, and generating ideas or innovations for problem solving.

This study involved art education students class of 2020 ($N = 20$) who attended multimedia learning lectures. This course aims to offer students' knowledge about technology that can be used in creating fine art learning media, and to build their critical thinking skills as pre-service art teachers who have knowledge in technology. This course is conducted for 3 credits per-meeting and the implementation of observations is carried out for 4 meetings on the use of hyperlinks and other supporting tools in Micrsoft Power Point software.

Several research methodologies have been carried out as follows; (1) The researcher acts as a lecturer providing material on the use of technology in the manufacture of learning media, especially on Ms.Power Point; (2) The lecturer divides students into 4 groups and provides opportunities for students to choose core competencies, make indicators, and make learning media based on the indicators. Students can communicate their thoughts based on their knowledge and competence through problem solving activities; (3) After students complete the draft of the learning media, students can upload it on google classroom to get feedback from the lecturer. Lecturers can provide input on their students' work and they must revise it based on the lecturer's input; (4) Group discussions were held to present their work through a zoom meeting; (5) Peer-teaching and video-recording are used to conduct a peer-teaching lesson in their own group and record it. Each student in the group may choose to teach part of the lesson (for example, a teaching practice assignment ranging from 10–20 min) to put his ideas into practice. While one is teaching, the other group members will act as students. After students finish

teaching, they need to engage in critical discussion with and provide feedback to their group members. Peer evaluation questionnaires are provided by lecturers to help them evaluate each other's practices and provide constructive comments; (6) Reflective writing is reviewing their micro-teaching videos and their peers' feedback; students need to systematically reflect on their teaching effectiveness.

Class observations were carried out to convey students' critical thinking skills and dispositions. Furthermore, individual interviews and personal reflection were used to obtain data. All authors conducted semi-structured interviews with each student to investigate their learning and reflective experiences through reflective assignments and their identity formation during the semester. Students were specifically asked to describe their interactions and collaborations with their groupmates during task execution (eg, collaborative learning media and lesson planning), as well as their involvement in reflective tasks and perceptions of the effectiveness of reflection in their teaching and learning process. Through reflective tasks, students are also encouraged to reflect on the formation of their identity in relation to their interactions with the instructor and groupmates, such as joint discussions about the creation of learning media and lesson plans in the performance of their groupmates in peer-teaching, as well as the role they play in the process.

All interviews were conducted in the Bahasa, in a structured and unstructured manner covering how the process of planning ideas and expectations was desired as well as reflection on the work process. The data collected were analyzed quantitatively and qualitatively. Quantitative data were obtained from questionnaires, particularly information about students' critical thinking skills and dispositions. Qualitative data obtained from class observations and interviews with students. In addition, the information collected was analyzed thematically based on a 6-step thematic content analysis. The thematic analysis stage has a clear and useful framework for analysing teaching activities.

3 Results and Discussion

The results of the study show that the critical thinking skills of art education students' class of 2020 who take learning multimedia courses are as follows (Fig. 2).

From the chart above, it can be concluded that the level of critical thinking skills of the 2020 Visual Arts Education students who take the multimedia learning course during the creation of the work is between adequate and good. Of the various components, skills

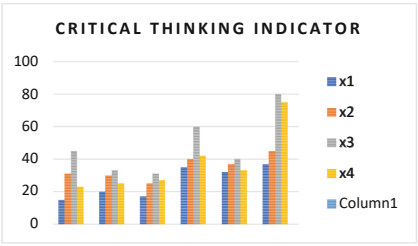

Fig. 2. Critical thinking indicator.

in making media and integrating concepts rank the highest at 80% and 60%, respectively. This shows that student creativity is very adequate in the process of making powerpoint-based learning media by utilizing hyperlinks. Students are weak in analyzing data and needs with a minimum score of 15%. In addition, students' communication skills are also at a low point of 20%.

Instructional strategies for media creation should emphasize social constructivist principles such as collaborative learning, scaffolded learning, and case studies to cultivate students' critical thinking skills; implementing several tasks in learning that are integrated into assignments to improve arguments, evaluations, synthesis, and conclusions about certain problems. Emphasis on understanding argument structure and development of reflective and metacognitive skills, such as monitoring and reflection [11], develops critical perspectives for assessing the strengths and weaknesses of other perspectives as they occur to be perceived by students.

The provision of case study-based questions is emphasized throughout the stages of creating media designed to improve students' critical thinking skills [12]. In this study, art education students' class 2020 who took the multimedia learning course succeeded in applying Socratic questioning tactics (awareness of assumptions) and activities such as deductive logic scenarios (deduction) and personal reflection (interpretation), which have an effect on supporting critical thinking skills. In other cases, direct instruction is offered in critical thinking skills [11], especially for deductive and inductive logic (analyzing), which requires reasoning skills that students must acquire.

In addition, the use of projects can help students strengthen their critical thinking skills. Students can leverage their problem solving skills by innovating on the projects they create. Students can use their knowledge and experience to create superior products. It should be mentioned that giving pre-service teachers greater opportunities can increase their creativity. Overall, the discussion's emphasis on learning allows lecturers to hone critical thinking skills through critical dialogue and provides feedback and opportunities for reflection, enabling students and lecturers to build shared meaning (Fig. 3).

The second diagram shows the students' critical thinking disposition. Perseverance and self-confidence have a significant impact on the development of critical thinking in art education students class of 2020 who attend multimedia learning courses by 80% and 70%, respectively. The majority of students assessed that their ability to create works and self-confidence could increase creativity with an average score of good or very good. In addition, by giving presentations in groups, students can develop their communication

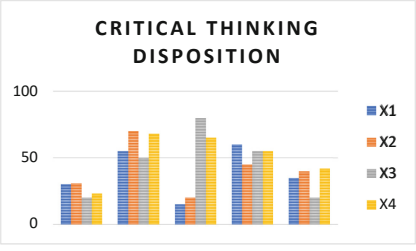

Fig. 3. Critical thinking disposition.

skills and increase their capacity to think critically. However, the ability to collaborate is still at an average rating of 42%, students are less cooperative when making joint work, need to be redeveloped for an open attitude and willing to accept opinions for evaluation and reflection.

The results show that the influence of lecturers' views on learning is beneficial for pre-service teachers. Students can feel that when lecturers provide a better and more suitable atmosphere for students to engage in reflective thinking and critical thinking assessment activities, they can encourage students to adopt critical thinking attitudes towards learning [11]. Cooperative learning, problem-based learning, and project-based learning were successfully implemented during learning, indicating the success of social constructivist-based teaching methodologies to cultivate critical thinking dispositions [13].

3.1 School Expectations of Pre-service Teachers

Lectures that are attended by students majoring in art education require them to practice teaching in schools according to the applicable curriculum, which is for 3–6 months at school called Introduction to the School Field (PLP). In these activities, students are required to be able to adapt to school and teaching and learning activities. The school considers PLP students to have mastered the material according to the field and adequate pedagogical competence, this view is the result of discussions with one of the civil servant teachers who are responsible for the school.

A teacher is required to have quality when presenting teaching materials to students. The quality of a teacher can be measured by morality, wisdom, patience and mastery of learning materials when adapting to students. Many factors occur in schools, including the condition of human resources, limited infrastructure and other supporting factors. In dealing with these problems, pre-service teachers must be able to overcome them constructively, and not destructively. Teachers have an important role in educating the nation's children and advancing education. To answer the development of world globalization that demands quality by giving birth to quality and competitive human resources (HR) [14].

The preparation of pre-service teachers who have academic and professional independence is expected to be able to develop the disciplines studied and at the same time have the competence to design, manage, implement, and develop conducive learning activities for students. The qualifications that must be possessed by teachers are (1) up to date, in accordance with the rapid development of science, technology, and Visual Arts; (2) can understand the basic principles and generalizations as the principle of choosing information that is developing, (3) pre-service teachers are expected to be skilled in using rational, logical, coherent thinking competencies, and be able to distinguish between facts and feelings, (4) always develop essential morality in the framework of evaluating and using knowledge, (5) being able to face challenges and encouraging pre-service teachers to always learn, (6) enabling pre-service teachers to be creative in solving problems that arise in their duties (7) being able to communicate ideas with various media, orally and in writing, (8) conduct educative interactions and be able to understand others, and (9) understand concepts, principles, approaches, and learning strategies/methods [15].

professional competence [15], meaning that a teacher must have adequate knowledge of the material to be taught and also master the methodological aspects; social competence means that teachers are expected to have the ability to communicate socially, both at school and in the community with various elements of their lives and personal competence means that a teacher is expected to have a solid personality attitude and can be imitated by students. In the context of teacher professionalism, competence can be interpreted as a qualitative description of (rational) behavior in order to achieve certain goals in accordance with certain conditions. [16] "A professional is a person who has special knowledge and skills, can weigh alternatives and choose from among a number of productive actions that are most appropriate in certain situations".

These competencies refer to rational appearances and actions as the fulfillment of certain specifications in carrying out educational tasks. Thus, a real professional teacher must have the ability to realize his competence in order to achieve educational goals for students. In more detail Brown, et al. [15] suggests that, "A professional teacher must have the following qualities: (a) mastery of the subject to be taught, (b) understanding of the basic principles of children's growth and development, (c) good general knowledge, (d) knowledge of methods and techniques, (e) positive attitude towards work, (f) willingness to adapt to local needs by considering available materials, and (g) dare to fight for better high standards in school. Can be separated from professional and social abilities because these three competencies are inherent in a teacher, but personal abilities are more emphasized on the personality aspect.

3.2 Fun Digital Learning Through Interactive Media

Fun digital learning is an interesting learning pattern for students with the aim of attracting students' attention to the learning process, either by utilizing learning media, teaching materials, teaching strategies and fun delivery methods so that students remember and understand the material being taught. This study uses John Dewey's theoretical perspective on education and its existence, which believes that every student is capable of utilizing art in education as long as there is enjoyment in it [17]. This is supported by social interactions that are able to provide individual sensory stimulation that allows a higher understanding of individual experiences through art education.

Fun learning will occur if the teaching strategies and media taught are in accordance with the students. Pre-service teachers are expected to be able to think critically by analyzing the needs of students related to the learning objectives to be achieved, so that pre-service teachers should be accustomed to thinking critically to face a situation and innovate to deal with these problems.

The teacher is the spearhead of the successful implementation of the curriculum, but a teacher must be supported with learning tools and strategies that must be prepared in advance according to the needs of the school and its students. Fun learning will make an impression and easily stimulate students' affections when they get new material intake. Technology is growing rapidly, there are many applications that can be used to support the implementation of fun learning such as by utilizing social media culture as a learning outcome. So that the connotation of playing social media will be more useful.

3.3 Critical Thinking as a Culture

The Minister of Education and Culture (Mendikbud), Muhajir Effendy said that there were five competencies that were formed in making learning standards in the Industrial Revolution 4.0 Era. The five competencies are, among others; (1) critical thinking skills; (2) creative and innovative abilities; (3) communication skills; (4) cooperate and collaborate; and (5) self-confidence. Muhajir added that self-confidence is a much needed capital for students to be able to get along in the Industrial Revolution 4.0 Era [19].

The first step to foster critical thinking patterns is to use peer-teaching methods in learning, so that students as pre-service teachers can analyze problem-solving and collaborate to communicate their findings. Patterns or critical thinking skills do not merely grow and develop in a person, but need to be honed to sharpen the mindset that is carried out.

The final stage in a teaching is the result of reflection that can be used to improve things that do not meet the target. The application of critical thinking patterns to Visual Arts students is very good, but most students feel less competent when they have to convey their work, even though students are confident that they have high scores, speaking skills must be trained to be more structured. Because an idea will be conveyed better if it is supported by the ability to communicate the idea.

4 Conclusion

This research results in the assumption that lecturers must develop a supportive environment for improving students' critical thinking abilities and dispositions. The interest and expertise of pre-service teachers with the topic of information they convey to students is very important for the development of critical thinking concepts. In learning, lecturers must provide a framework for educating students with the methods and necessary experiences for their personal and professional development as critical thinkers and prosepcetive teacher.

Visual Arts education students show their critical thinking skills and attitudes during learning to produce learning multimedia, while the highest point is in the unification of concepts and media creation, but low in the initial analysis stage, so it needs to be continuously honed. This study also shows that critical thinking skills and dispositions can be taught successfully to students at every stage but need to be improved on the communication skills section.

Future research is expected to focus on the value of academic achievement and the use of tests to evaluate student programs in teaching to determine the efficacy of critical thinking skills, because encouraging critical thinking is a wise investment.

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