

Implementing ICT Based on Metacognition in Vocational Education

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Implementing ICT Based on Metacognition in Vocational Education

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Abstract: This article presents the results of studies conducted by a number of graduate students of technical and vocational education study program who applied innovative learning models and ICT to improve the quality of teaching and learning outcomes in the areas of technical vocational learning. They are one student of Electronics Engineering Education, one of Mechanical Engineering Education, and one of Culinary Art of Home Economics Education. These three studies were under the umbrella of the graduate research grant entitled "Implementation of Metacognition-Based Information and Communication Technology in the Field of Vocational Education Sector". The researchers were a faculty team of the graduate program. One of the objectives of the research grants is to help accelerate the completion of the students' theses. The use of ICT media is very important in the field of vocational learning. ICT Media that has been developed based-on metacognition helped to improve the quality of teaching and learning outcomes. There are three research questions: 1) Does the development of blended learning-based instructional plan enhance the students' skills in cooking the continental cuisine? 2) Does the development of interactive books improve the learning outcomes of the microprocessor subject at vocational schools in Surabaya? and 3) Is there any significant effect of CAI-based CNC Basics learning on the students' interactive thinking skills on the subject of operating CNC machine basics in the vocational high schools. The studies were experimental research using tests, observation, and questionnaires as the data collection techniques. The data analysis techniques used were percentages and inferential statistics using t-test. The results showed that ICT media based-on metacognition developed was able to improve students' learning outcomes and metacognition skills. The metacognitive skills include: critical thinking skills, self-directed skills, and repeat themselves and learn in more depth. The implication of this study was that the use of ICT media based on metacognition was essential in improving the process and learning outcomes.

Keywords: *ICT Media, Metacognition, Vocational Learning*

1. Introduction

These last few years, the Government of Indonesia gave more attention to vocational education. It can be seen that the Government of Indonesia has been programming the ratio between vocational high school and senior high school at 70:30. The number of vocational high schools increased greater than the number of high school in order to prepare the need for middle-level manpower.

Meanwhile, the learning composition of the vocational high school is more emphasis on practice rather than theory with the ratio 60:40. Therefore, the suitable learning for vocational high school is active learning, in which students demanded an active role (student-centered). With active learning, students will increase their understanding about the material better, both theory and practice, through learning by doing. Active learning can help students to develop knowledge in a flexible, ability of problem solving in effectively, self-directed learning, collaboration capabilities and an effective intrinsic motivation [1]. Active learning also emphasizes learning through solving the problem through activity [2, 3].

It is important to provide teachers to have the competence to manage teaching and learning more meaningful. Learning skills and innovation are more recognized as skills that distinguish students who are ready for environments of life and work that become increasingly complex in the 21st century with students who are not ready. Focus on creativity, critical thinking, problem solving, learning strategies, communication and collaboration are essential in preparing students for the future.

The problems of this research include: 1) Does the instructional plan development based on blended learning can improve learning outcomes? 2) Does the development of interactive books improve the learning outcomes? and 3) Is there any effect of the implementation of learning based on CAI towards increasing the level of interactive thinking of students?

There are several forms of learning with ICT, such as: teachers and students use local television programs and video to strengthen the understanding of a material being studied; teachers and students use digital cameras to prepare the content and learning materials; administrators use computer-based learning management systems to deliver e-learning and set learning with students. Teachers can also use the internet on a project-based learning and to web-quests. In addition, the use of online communication tools such as skype, blogs and forum network can be used by students, teachers, schools, experts and community.

Some researchers have been utilizing of ICT in learning. Nurlaela [4, 5] developed ICT in the form of multimedia by using CAI for the socialization of knowledge of foodstuffs in elementary school students, and research findings indicate an important result. Buditjahjanto and Hajime Miyauchi [6] have used ICT in the form of a computer game to learn the decision on the amount of emissions that must be produced by a power plant. Ekohariadi [7] has conducted research on computer-based learning by measuring the ability of students to learn computer programming.

Some studies have used and developed ICT in education media learning. Yvonne Rogers and Mike Scaife [8] in their research used interactive multimedia for learning. Their multimedia learning and edutainment shaped in CD-ROM with various learning topics that have a level of difficulty. Their research was to develop how to support learning activities through interactive design effectively. The use of ICT for learning in the form of Computer Assisted Instruction (CAI) has also been developed in the form of computer-assisted learning. As it is known that the nature of the use of ICT is mobile. Therefore, this CAI package also has the advantage that the learning can be used anywhere. Sultan, et.al [9] also used the advantages of CAI in packages so that it can be used in learning via PDA.

The use of ICT in education can be used widely. Several private and public schools in large cities have developed school websites. This website is a media campaign and communication between the school with the students, teachers, parents and the wider community. However, the use of ICT for teaching and learning is still inadequate, although some schools have been commonly used it, especially international schools or franchise branch of a foreign school system [10].

The use of ICT media based on metacognitive is more influencing the quality of teaching and learning outcomes. The use of metacognition in the field of ICT has been carried out by Quamrul [11] by using a web-based to measure the capacity of students to self-assess their understanding, the regulation of student learning (level of trust), the class dynamics (reaction), and method of instructor. The purpose of the study was to evaluate how students regulate their own learning and improve their ability to self-assess their understanding for more critical. The results show the students become better learners with the self-assessment and can evaluate their own knowledge.

Lawanto [12] evaluated the change in metacognition in students majoring in engineering who were divided into three groups. By using two features, such as metacognitive, cognitive, self-appraisal and self-management was to indicate the level of students' metacognition. The results showed a significant change of metacognition students in studying the project design.

Metacognition has two components: knowledge of cognition and mechanisms of self-control such as control and cognitive monitoring. Knowledge of cognition consists of information and understanding that possessed a learner about the process of thinking itself, in addition to knowledge of various learning strategies to be used in specific learning situations. The second component of metacognition is monitoring the cognitive, namely the ability of learners to choose, use, and monitor the study strategies that suitable. Based on this, then some of the main indicators of metacognition are: 1) learners understand their learning styles; 2) learners being able to select specific learning strategies for specific situations; 3) learners use specific learning strategies to certain situations; 4) learners monitor learning strategies used; 5) learners are able to measure the achievement of learning; and 6) learners are able to apply self-directed learning.

This research is to develop learning media based on ICT that consists of three sub-research, namely: 1) Development of instructional plan based on blended learning in standard of competence processing continental cuisine to improve learning outcomes; 2) Development of interactive e-book media with the subjects of microprocessor technique at SMK Negeri Surabaya; and 3) The effect of implementation CNC learning based on CAI toward the Enhanced of the level of interactive thinking of students on Material Basic Operating of CNC machines in SMK.

2. Research methods

This research consists of three sub-researches, and each sub-research will be presented the method briefly. The first sub-research is Development of Instructional Plan Based on Blended Learning using method 4D Models that adopted from [13]. The method consists of four stages, namely Define, Design, Develop, and Disseminate. This research did not do in the disseminate stage. Because the development results only applied limited to school where the research was do, namely SMKN 1 Dlanggu. The subjects were students of vocational high school with expertise Program Culinary, XI class in academic year 2013/2014 at SMK Dlanggu. The Standard of Competence was continental cuisine. Ten students were involved in this pilot test. Tests were carried out 3 times. Collecting data used the technique of questionnaires, observation and tests. The research design at this stage used the one-group pretest-posttest design [14]. Data analyze technique used descriptive qualitative.

In the second sub-research was the Development of Interactive E-Book Media, the development model also used 4D models. The subjects were students of X-TAV1 and X-TAV2 class at SMK Negeri Surabaya. This research was conducted in SMK Negeri Surabaya and held on even semester 2013/2014. Collecting data used the technique of questionnaires, observation and tests. The design of trials used an intact group comparison, such as by comparing the control group with the experimental class. In the experimental class, students were given an ebook teaching media, while in the control class did not use 29 book media but using power point media. To measure the differences of learning outcomes between control class and experimental class was based on the posttest. Data analyze technique used descriptive qualitative analysis to analyze the feasibility of the media and post-test items, as well as to analyze the students' response to the use of interactive e-book media. To determine differences of learning outcomes of students between control class and experiments class was analyzed using t-test.

In the third sub-research was The Effect of Implementation CNC Learning Based on CAI toward the Improvement of Level Interactive Thinking of Students. This research used analysis descriptive method with quantitative approach. The population was all students of class XII SMK Antarctica 1 Sidoarjo with TPM expertise program. The sample was determined by random cluster sampling consisted of 59 students. Collecting data used observation and test technique. Data analyze technique used simple regression.

3. Results and Discussion

Results of research and discussion respectively described as follows:

3.1 Development of Instructional Plan based on Blended Learning

Online learning model used in this study was a weblog. A weblog is a website that will contain an individual's personal record on the internet and web-based application that allows anyone to create and develop a dynamic website without having to understand programming languages and provides a free weblog without costs. The use of weblogs in education facilities is to improve information sharing. It makes easy to publish information and allows teachers to monitor. Teachers can upload learning materials, assignments and evaluations in the media weblogs. Meanwhile, students can download it as a reference lesson while providing convenience to students to deepen students' knowledge through link a variety of websites that supporting material.

Weblog that developed by the researcher was at the address: <http://belajarkontinental.com/jb>. The learning was held three meetings with two different basic competencies. The first basic

competence was "Basic Principles of Continental" and the second basic competence was "Processing Hot and Cold Appetizer".

Results validation of instructional plan included lesson plans, worksheets, Weblog and Assessment Sheet. Those were categorized as very feasible to implement. Feasibility percentage of lesson plan based on blended learning while on the trial test showed improvement from the first meeting to the third meeting, respectively reached 82.23%; 90% and 93.33%. For student activities, at the first meeting, the role of teacher in teaching was still dominate in learning. In the second and third meetings, the role of students were more dominating and teacher simply reminded and guided the students' presentations and students' practice. In the pilot testing, the highest grade of student activity was doing an assignment (LKS) (37.8%). Student responses indicated a positive response (96.3%). Mastery of student learning outcomes included mastery of cognitive, psychomotor and affect [16] showed completion both individually and classically.

Based on the results of data analysis, it can be concluded that the development of instructional plan based on blended learning in the competency standard of processing the continental culinary is feasible to be applied and can help to complete the student learning outcomes. Relevant to the opinion of Shinde [15], that the implementation of blended learning in school education in India can [16] prove student learning outcomes. The positive response of students to the blended learning indicated that students were happy with the learning. In line with the opinion of Harriman [16] that blended learning has the advantage, such as: the students not only learned more during an online session. Students not only learned one direction sequentially, but also this learning can improve interaction and satisfaction of students. With blended learning students have the opportunity to learn the material desired.

In the blended learning methods, students of vocational high school in Culinary Program were challenged to implement collaborative learning between class teaching and online learning using a weblog, so that students' skills in using media of information and communication and the internet can be improved. In addition, it also can improve their learning outcomes. In this way the advantages of collaborative between class teaching and weblog can be maximized. It enriches the findings of Sawmiller [17] that stated classroom blogging can improve the process of critical thinking, collaboration, and can be applied to the study of science with various learning models. This research in blended learning showed that learning weblog can stimulate the activity of students in the assignment (LKS). It is in line with the opinion of Quinn et.al [18] that stated the implementation of blended learning, students showed behavioral changes more effective learning. Based on that, blended learning also improves students' metacognition, because there is an opportunity for the students to set up their own learning strategies and deliver them to learn the material they want.

3.2 Development of Interactive e-Book Media

In this research, validation learning media carried out by five experts consisting of 4 Lecturer State University of Surabaya and 1 teacher SMK Negeri Surabaya. Media validators were composed of content experts, instructional media experts and linguists. This validation purpose was to make feasible for media learning that to use for this research. Data obtained from validation results showed an average score of 79.2%. It means that learning media in the category of feasible to use. The results of the validation items obtained an average score of 76.5%. It means these items categorized as feasible to use. While for test result of learning outcome obtained with the average value of 82.15 for the experimental class and 77.15 for control class. Student learning outcomes of the two groups were then analyzed using t-test. From the results obtained t_{count} of 3.824 while the value obtained t_{table} 1.612. By comparing the values between t_{count} and t_{table} , then it is known that the $t_{count} > t_{table}$, therefore can be concluded that the results of student learning using interactive e-book media is better than the results of student learning using power point media. The results of students' response to interactive e-book media obtained an average score of 85.42% and categorized as very well then the interactive e-book media feasible to use in the learning process. Research results showed that the student learning outcomes who used interactive e-book media is better than the

student learning outcomes using power point media that is supported by previous studies. Binas [19] found that the delivery of information by using the e-book is very effective. E-book supports to provide feedback to students about their qualities and skills.

The learning model used to implement the media e-book was a model of problem-based learning (PBL). PBL has common characters which provides to the students on the subject of authentic and meaningful that will provide convenience to the students to carry out the investigation and inquiry [20]. This model also has some special characters, such as the submission of questions or problems, focus on the linkages between science disciplines, authentic investigation, produce products / works, shows these products and cooperation. Authentic problems are problems that exist in our life everyday and to be beneficial directly if we can how to solve the problems. Authentic problems can attract students as a subject to study, as they relate to their daily lives and beneficial for him. Based on this, problem-based learning model and implementation of an e-book media was feasible to develop the ability of students' metacognition. Metacognitive thinking skills are indispensable in problem solving, and therefore, the use of problem-based learning model is appropriate. Ebook that provides opportunities for students to learn independently as well as measure the success rate of learning, it is also very useful in the development of metacognition skills. Referring to the above description, students were encouraged to direct themselves to begin the learning process, and be able to evaluate themselves to assess questions and solving problems. Both of these are characteristic of metacognitive skills [11,12].

3.3 The Effect of Implementation CNC Learning Based on CAI Toward to The Enhanced of Interactive Thinking Level of Students

Problems are often encountered in teaching, especially teaching operate a basic CNC machine is how to present material to students well in order to obtain effective and efficient results or maximum results. Another problem frequently encountered is the lack of attention of productive teachers to the variation of the using of learning methods in an effort to improve the quality of teaching is good. Computer Numerically Control (CNC) is a machine which is controlled by a computer using numerical language (movement commands that use numbers, letters, and symbols). A basic level of CNC machine that exist now is currently divided into two groups, such as CNC machine Two Axis or better known as lathe machine and CNC machine Three Axis or better known as a milling machine.

The research results of application of learning media based on CAI obtained an average score of 3:48, which means learning performed well. The ability of interactive thinking of students achieved an average score of 3:20, which means enough. The learning outcomes of students achieved an average score of 79.7, which means good. Correlations between these two variables, interactive thinking ability of students with learning outcomes determined value Sig. (2-tailed) of 0.027. Compared with a probability level of 0.05, then the level was greater than the significance value ($0.05 \geq 0.027$). This means interactive thinking ability of students has a significant relationship to the learning outcomes.

The media learning CNC simulator were applied by using direct learning model. With reference to information processing theory and the theory of dual coding [21], who believes that in order to transfer and remind information, heading into and out of long-term memory, it is necessary to repeat the exercises. Repeated practice in growing mastery of practical skills can only be done with a hand-on activity. Media CNC simulator applied in this study provide an opportunity for students to be able to repeat themselves and to learn more material being taught, so that the memorizing of information into long-term memory can be performed. Repeating by themselves and studied in greater depth is one of the metacognitive skills, in which one goal is student able to direct themselves to begin the process of learning, as well as reflecting on themselves by reviewing goals and objectives (Quamrul 2010; Lawanto, 2009).

Based on the description in the above results, metacognitive skills have been developed through this research, which include: 1) critical thinking skills, the skill to analyze the arguments and give interpretations based on legitimate perception in the thinking process; 2) self-directed

skills to initiate the learning process, and be able to evaluate them selves to assess questions and solving the problems encountered; 3) repeating themselves and learn in more depth, as well as reflect on themselves by reviewing goals and objectives. However, research result does not explicitly to link the processes and findings on metacognition.

4. Conclusion

The conclusion of this study includes: 1) Instructional plan Based on Blended Learning in Competence Standards of Processing Continental culinary can Improve student learning outcomes; 2) Media interactive ebook can improve learning outcomes with subjects microprocessor techniques in SMK Negeri Surabaya; and 3) There is an effect the implementation of learning CNC based on CAI towards increasing the level interactive thinking of students in the material of basic operate CNC machine in SMK.

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