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THE IMPLEMENTATION OF METACOGNITION BASED LEARNING MODEL ON INDUSTRY ELECTRONICS FIELD OF FIELD AT VHSS

Purnamawati
Makassar State University

Soenarto
Yogyakarta State University

Abstract:
Implementation of metacognition based learning model on electronics industry field of field at Vocational High Schools (VHSs) aims to test the practicality and effectiveness of the developed model in an expanded scale. The implementation was held on several VHSs in Makassar. Implementation of the learning model made with respect to 4 (four) major components of metacognition. First, *planning,* including the ability to plan learning, to set goals, to determine the sequence of learning, to use learning strategies, and to determine the expectation of learning. Second, *monitoring,* which leads to both moderate activity and the advancement of learning together, such as the ability to make and answer the questions during the process of learning. *Third, evaluation,* including the ability to assess the their progress of learning. *Fourth, revising,* including the ability to modify plans, objectives, strategies, and approaches of learning that has been done before. The results of the implementation of learning models are (1) The learning model satisfied the practically criteria indicated by implemented the learning models and teachers' ability to manage the learning; (2) The learning model satisfied the effective criteria indicated by the students' activitiy, students' response is positive, and the competencies achievement of students learning.

Keyword: *Metacognition Based Learning Model*

Introduction

Learning in electronics industry field contained in Basic Competence Standards focus not only the ability to be mechanical, but also it is to use simple thinking skills, when students are confronted with the problem to create a simple program in the *trainer's* instructions are used in practice. Students are trained to make a simple program with step-by-step plan, find solutions, and solve solutions by algorithm.

The steps are arranged simply requires the student's ability to predict, plan, monitor, and evaluate the stages of problem solving which is the stage of metacognition learning. Other components of metacognition, which is declarative knowledge that students should have underlying knowledge about tools and circuit or experiment, procedural knowledge is how to use the practical tools and materials, as well as conditional or strategic knowledge, that students have to know on what conditions or what strategies done in accordance to achieve an optimal solutions. Thus, learning activities on electronics field needs metacognition on before practice, during practice and after practice.

Learning integrates metacognition is an important thing to implement, because students need to train and cultivate using the ability to think systematically in solving problems. Nowadays, Learning is to be *active learning* and *self-directed learning* where problem solving approach given during the learning will cultivate the habits of students in solving problems by planning ahead step by step until make decision on the final solution, and providing what solutions will be taken.

When students are able to design, monitor, and reflect on their learning process consciously, then the students become more confident and more independent in learning. Haris Mujiman (2009) states that independent learning is an active learning, which is driven by the intention or motivation

to master the competencies in order to solve a problem, and to built with sufficient knowledge or competency. Determination of competence is learning objective, and the accomplishment (good time to learn, a place to learn, how to learn, and learning evaluation) is provided by the students themselves. Independent learning is sensed as efforts of students to perform learning activities based on the intention to master a certain competence.

Essentially, Metacognition is similar to the *"Generic Abilities"* required by the vocational school graduates as well as *vocational* skill. Because there are jobs in the industry today requires not only the *hand-on* job but also *mind-on* job, like computer companies *(software* and *hardware)* and a job requires the analysis and diagnosis skill. Academic and vocational skills are based on suppression in occupation that requires manual skills, within at a certain limits also needs academic skill.

According Soenarto (2003:22) *specific life skill* includes academic and vocational skill which needed person to solve a certain problem or to do the job. Academic skill leads to scientific activities such as identifying a variable, relating various phenomena, designing research and providing ideas, whereas the vocational skill relevant to specific areas such as repairing motorcycle, writing the television-show scripts, repairing electrical instruments, and so forth. And contrary, the fieldwork emphasizes academic skills in a certain extent also requires vocational skills.

Based on some of the problems of learning (teaching practice) in the VHSs, the characteristic of industrial electronics field, and the importance of learning of integrating metacognition, thus the development of learning model on industrial electronics field based on metacognition is critical to student to develope. Metacognition based learning model can be applied in practice learning, where teachers repeatedly encourage and lead students to ask questions, to find solutions of real problems *(authentic)* in their own way, and students display their work with the encouragement of free thought and open inquiry. It is done in order to teachers can develop students' potential in learning, so students can understand and develop their potential. Therefore, empowering metacognition in learning means to train students to develop into independent learners *(self-regulated learner),* to encourage students to become class manager of himself, and to become assessor of thought and monitoring conducted learning (Eggen & Kauchak, 2006).

Metacognition is an essential way to learn effectively in complex situation. Metacognition based learning process is an attempt to introduce new skills and confidence in providing a practical application of learning to improve student learning result (Lovett, 2008). Further, the aspect of metacognition is one dimension of knowledge and interesting skills to study more in depth, both theoretically and empirically through research of development learning models in industrial electronics field VHSs. Some of the things to base considerations include: (1) metacognitive aspect is an aspect of the most complex and highest level in psychomotor and cognitive domains (metacognitive skills), so it needs to do a thorough assessment of its application in the learning, especially in teaching practice (2) metacognitive aspect so has less attention by both teachers and students, and (3) current trend of teaching practices nowadays not only assess learning result, but also to assess the learning process. Furthermore Robinson (2000:2) found that the ability to think, reason, and make decision are crucial for employee who wish do a job well and forward. Someone who can think critically, act logically, and evaluate situation to make decision and solve problem, is valuable asset. Application of higher thinking skills in using technology, instruments, equipment and system information requires high-level skills to create a new level employee more valuable.

Therefore, it is very important to develop metacognitive skills in problem solving, as well as development of higher thinking skills, so resulting quality of learning will increase. Some research indicates there is a relation between the students' metacognitive skills and learning result gained. Billett's researh (1994: 29) suggests that the frequency of various categories of knowledge needed by workers in a wide and consistent variety of types of work. In addition, the nature of the learning experience provided in workplace are reported consistently. Furthermore, it was found that the procedural knowledge, the most frequently used (59%, 62%), followed by propositional knowledge (18%, 8%), and dispositional knowledge (conditional) (23%, 30%) is quite interesting. These results shows the importance of metacognitive knowledge in performing a job in the world

of business and industry. Thus, the learning activities in the field of vocational education are necessary need metacognitive knowledge in carrying out good practices.

McMahon & Luca (2007:676) state that metacognitive skills are so necessary for success in learning. Research results show that students appreciate the developing *on-line* learning. It is most desirable to students, because it can do group collaboration. In process, it follows the steps of planning, monitoring, and evaluating the learning result. Thus, metacognitive skills can improve the success and ability of students in learning.

Oenardi Lawanto (2009:1) in his study found a positive influence between the use of metacognition and performance. Metacognition is fundamental tools that enable students to master cognition, emotion, and motivation of their own. When the electrical engineering students are asked to design a digital voltmeter, they began to ask questions of themselves, the questions that assess the potential of knowledge needed to solve the problem. They also wonder whether they have the proper knowledge to complete the design task, they also wonder they are motivated to engage in these tasks. Thus, metacognition plays an important role in teaching practice.

The results of cognitive research provide an understanding of how people learn and how they solve problems. According to Kerka (1992), the essential skills that are often expressed in thought, i.e.: the ability to think creatively, making decisions, solving problems, visualizing, considering, analyzing, interpretting, and learning how to learn. The characteristics of creative thinkers are perseverance, flexibility, metacognition, transfering knowledge, problem-oriented, open-minded, using quality standards, and independenc. Thomas (1992) states an argument for the role of vocational education, i.e.: (1) the work to rely more on cognitive capacity, (2) a changing work environment requires flexibility and adaptability on changing conditions, and (3) vocational education provides a context of real world for cognitive development.

Based on the description set forth above, then the issues raised, namely: How is the implementation of metacognition-based learning model in the field of industrial electronics field (MPBKEI-BMS) in the VHSs?

THEORETICAL DESCRIPTION

A. Definition of Metacognition

Metacognition is an awareness of one's thinking. Flavell (1979:906) defines metacognition as a regulatory system that includes: (a) knowledge, (b) experience, (c) goals, and (d) strategies. Lee & Baylor (2006:345) describes metacognition as the degree to which students engage in thinking about themselves, the nature of learning tasks, and social context. Metacognition involves knowledge and awareness of one's own cognitive activity (Livingston, 1997). Metacognition also includes self-control one's thinking in the study (Carman, 2005:2). Carman gives limit of metacognitive component involves planning, monitoring, evaluating, managing, and adjusting one's thinking. Therefore, metacognition can be said as thinking about one's own thinking or one's cognition about one's own cognition.

Countinho & Neuman (2008:132) argues that metacognition refers to higher mental processes involve in the learning include planning for learning, using appropriate skills and strategies to solve problems, estimating performance and calibration of the level of learning. Kosine et al. (2008:134) reported that the metacognitive is self-awareness of thinking processes which are the important skills in the development of vocational decision-making.

According to Borich (2007:339) strategies for self-directed learning is metacognition or mental processes that help students to reflect on how their think through internalization, comprehension, and recall the content of learning. Therefore, metacognition is the student's skills in managing and controlling their thinking process. Specific skills that the students have in learning to regulate or control what their learned (Uno, 2008:134).

Metacognitive thinking is an important skill in learning, because students are able to establish intent of information. To accomplish this, students should be able to think of their own thought processes, identify learning strategies that work best for them and consciously regulate how

they learn. Therefore in this study, metacognition is referred to the awareness of one's thinking about the thinking process itself. Thus the awareness of person's thinking is a reflection of a person about what he knows, what he had done, and what he will do in learning.

Then, some psychological researchers describe a different conceptualization of metacognition, such as Flavell, Tobias & Everson, and Desoete. The conceptualization are the components of metacognition with the theoretical framework of metacognition are more general. Other psychological researchers are more concentrate on specific aspects, such as the structure of knowledge, meta-memory and memory processes, learning models, and metacognitive strategies for self-regulation.

Moseley *et al.* (2005:12) metacognition involves two main dimensions, i.e.: (1) involves a person's self-awareness of cognitive function (meta-cognitive knowledge), and (2) application of a person's cognitive resources in learning problem-solving. They are called metacognitive monitoring and regulation. Furthermore, Jordan & Porath (2006:124) explains there are two main aspects of metacognition, i.e.: (1) metacognitive knowledge, including knowledge-based monitoring, ranging from specific knowledge or self-knowledge, and (2) metacognitive activity, monitor the thinking deliberately adjust to a variety of thinking strategies. Pintrich *et al.* (2000) and Serra & Metcalfe (2009:278) distinguish three main aspects of metacognition, i.e. (1) metacognitive knowledge, (2) metacognitive assessment and monitoring, and (3) self-regulation and control.

Lee & Baylor (2006:345) explains that metacognition has four main components: First, planning, it is the ability to learn to plan carefully, to learn to set goals, to determine the sequence of learning, to use learning strategies, and expectations in learning. Second, monitoring, it leads to the moderate activity together with the advancement of learning, such as the ability to make and answer the questions themselves during the learning process. Third, evaluating, it is the ability to assess the progress of learning themselves. Fourth, revising, it is the ability to modify the plans, objectives, strategies, and approaches of learning that has been done before. Bromme *et al.* (2009:9) divides the components into two parts, namely metacognitive knowledge (what is known about cognition) and metacognitive skills (how to use knowledge actively in regulating cognition). Metacognitive knowledge is knowledge about people, tasks, and strategies. And metacognitive skills is metacognition action (planning, monitoring, and evaluatiing).

Based on some opinions about the components of metacognition, the components of metacognition focus in this research are: (1) metacognitive knowledge related to declarative, procedural, and conditional knowledge in the learning on electronic industry field, and (2) metacognitive skills related with the predicting, planning, monitoring, and evaluation skills in learning.

B. Metacognition Based Learning Model

Learning in Industrial electronics field base metacognition is one alternative learning model can be used by teachers to learn in the vocational school. It was developed based on the logic of thinking that learning in the field of industrial electronics students based metacognitive are to develop thinking ability of students through a problem-solving skills in the learning practices that requires interaction process between information processing systems in students' memory structures.

Learning in Industrial electronics field base metacognition uses a basic foundation that every student will build a new form of knowledge by combining new information, then with what is already stored in memory, the results of the previous study. In accordance with constructivism concept, it provides significant opportunities in information available for learning resources, through friends in the group. Interactions between individuals in the groups have been proved meaningfulness in the achievement of metacognitive skills by solving problems, eventhough the practice of learning management cooperation cannot be separated from the constraints and limitations.

The followings are stages of learning using the learning in industrial electronics field base metacognition models presented in Table 1:

Table 1. Phase of learning and activities teacher-student

Phase of Learning	Activities	
	Teacher	Student
Phase I: Introduction / convey the objectives of learning and motivate students.	Motivates students by explaining the importance of topic.	Pay attention to the teacher's explanations.
	Conveys basic competencies, achievement indicators of basic competencies, and learning objectives.	
	Conveys creative thinking, ideas and business.	
Phase II: Demonstrate the applications of knowledge and metacognitive skills in solve problems (tasks).	Recalls the prerequisite topic.	• Observe and record the teacher's explanations. • Ask the unclear topics.
	Recalls the prerequisite topic through giving questions.	
	Explains the importance of metacognitive knowledge and skill in problem-solving. For example, students' prior knowledge (prerequisite topic), predicting and planning before finishing the problem, monitoring during solving problems, and evaluating the end of problem solving.	
	Demonstrates use of knowledge and metacognitive skills through the examples.	
	Analyzes, explores ideas, and brainstrorming (Note: this item based on the teaching topics at the time).	
Phase III: Organize students into groups through guided practice	Explains the formation of the group while giving students chance to ask unclear topics.	• Make a group • Sitting in the form of a circular table • Pay attention to the teacher' explanations, note, and ask the unclear topic.
	Helps the group to perform in an efficient transition.	
	Organizes the position in the circular table.	
	Stimulates students to excel.	
	Creates conducive situation.	
	Provides structured practice step by step.	• Working on individual exercises / groups during the discussions. • Enable the working group
Phase IV: Guide the group in practice.	Given task, and then provide *scaffolding* both individuals and groups.	• Carry out the tasks in *jobsheet* individually / group, discussions with groupmates, and ask to the teacher if all members do not understand.
		• Give the tasks.
		• Reflecting feedback
		• Using the results of the evaluation to improvement.

Phase V: Evaluation and reward.	Evaluates the results of the activities or practices that have been done or each group presents the results of his work.	Doing the tests individually, or present the work and other student groups, attention / response to the presentation of other groups, and pay attention to the teacher's comments.
	Gives *reward* to good achievement of students, both individual / group.	

Implementation of learning using learning in industrial electronics field base metacognition should pay attention to several characteristics, there are :

a. Learning in Industrial electronics field base metacognition used to determine the process and learning result of metacognition based students with problem solving in mastering the competency in field of industrial electronics Vocational.
b. It is right to train and to develop ability of the planning in process of learning, monitoring in process of learning, evaluating of their cognition, and revising. And also improving declarative, procedural, and conditional knowledge in learning.
c. Learning in Industrial electronics field base metacognition was developed to implement *student-centered learning* satisfied the mission in developing a focus on student learning.
d. It is suitable for individual study, group, and giving task as a final project in the classroom and laboratory activities.
e. Assessment rubric satisfies the modified assessment of theory and practice from Ministry of Education format BNSP F096-P2-08/09.
f. It can be implemented to analyze, to diagnose, and to evaluate learning in vocational schools, so we can know the progress and obstacles to learning.
g. This model still needs further elaboration and development.

IMPLEMENTATION METHOD

A. Locus

Implementation of Learning in Industrial electronics field base metacognition is held in several VHSs 1 in Makassar which has field of industrial electronics.

B. Types of data

Required data in this implementation is quantitative and qualitative data. The data provides information or images about the practicality and effectiveness of model Learning in Industrial electronics field base metacognition The obtained data in this implementation includes implemented learning, the ability of teachers in managing learning, students' activities, students' responses in learning, result of students learning competencies.

C. Type of Instrument and Data Analysis Techniques

The instrument used is practical instruments, they are : the observation sheet for implementation of learning in industrial electronics field base metacognition and the observation sheet for the ability of teachers in managing the learning. Effectiveness Learning in Industrial electronics field base metacognition used instruments: (1) observation sheet of students' activities in learning, (2) the questionnaire responses of students towards the learning, and (3) the competence results of student. Data Analysis Techniques is descriptive-qualitative analysis.

IMPLEMENTATION RESULTS AND DISCUSSION

First, the results of implementation showed that learning in industrial electronics field base metacognition satisfied practical criteria in terms of indicators of implementation and teacher ability to manage the learning. But the indicators are interesting to discuss. In term of the vocational school teachers in Makassar had never implement learning in industrial electronics field base metacognition. The learning undertaken by teachers at this time is most using conventional learning approach, dominated by teachers, so students just listen and record what the teacher's explanation.

Students are not given the opportunity to develop their own ability. This learning process is resulting passive students, they are not used to construct their knowledge or to solve their own problems, less to ask when there are unclear topics, and less to express their thoughts or their own opinion on the studied topics. To overcome these factors, the researchers held discussions with teachers about learning in industrial electronics field base metacognition, and then ask teachers to do the re-learning activities using learning in industrial electronics field base metacognition, so that the criteria of practicality of learning in industrial electronics field base metacognition based on indicator of the teachers ability to manage learning include the good-enough category.

Second, the effectiveness of learning in industrial electronics field base metacognition is determined by three indicators, they are: students activities in learning, students' competence result classically, and students responses towards the learning. Implementation results showed that:

1. Students in learning activities, are: (1) conduct practical activities, (2) to hear the teacher's explanations, (3) pay attention to the teacher's explanations, (4) Ask the teacher/friend, (5) Conducting discussion, (6) Giving advice is accompanied sample, and (7) Responding to and member comments. These results indicate that active student activities (activities related to learning) undone by a well, so it was concluded that learning in industrial electronics field base metacognition effectiveness criteria according to indicators of student activity in learning.
2. Students responses in learning found that students response positively, they are (1) students feel good about the learning activities using learning in industrial electronics field base metacognition, jobsheet used, the atmosphere of learning, and how teachers teach with the average percentage of 98.08%, (2) this learning model is a new thing with the average percentage of 80.29%, (3) students show the enormous interest with the average percentage of 100% (4) students understand clearly the guidelines of practical, jobsheet, competency test results of learning, and how teachers teach with the average percentage of 97.69%, and (5) students interest in the appearance (text, illustrations / drawings and layout of drawings) of learning instrument with the average percentage of 97.12%.
3. Based on the results of data analysis competency test learning outcomes, found that 80.40% of students who earn a minimum score of 70. These results indicate that students' competence in the classical met (meet at school krtiteria KKM). In addition, there are: (1) 19.60% of students who obtained low scores (not yet achieved competency learning outcomes), (2) 40.13% of students who obtained scores are, (3) 30.12% of students who earn a good score and (4) 10.15% of students who scored very well.

CONCLUSIONS AND SUGGESTION

Implementation of the learning model on field of industry electronics student based metacognition in the VHSs obtained conclusions and suggestions are as follows.

A. Conclusions

Conclusion of the implementation, as follows:

1. MPBKEI-BMS meets the criteria indicated by learning implementation practical model and the ability of teachers to manage learning including both criteria.
2. MPBKEI-BMS effectively meet the criteria indicated by the student activity, student response, and the achievement of individual students' learning competencies and classical.
3. Students respond positively to learning. Students feel good about the learning activities using MPBKEI-BMS, learning environment, and how teachers teach. Students give an opinion that learning is a new thing. In addition, students showed an interest in learning, be very clear guidelines for practice, jobsheet, competence, learning outcomes, and how teachers teach.

4. Competency in the classical style of student learning outcomes are met (meet at school criteria KKM).

B. Suggestions

Based on the research conclusions, a researcher provides some advice to researchers and practitioners who are interested to apply learning in industrial electronics field base metacognition in the learning, as follows.

1. Recommended that teachers can socialize learning in industrial electronics field base metacognition -palm on the head of vocational schools in order to cultivate critical thinking skills, creative, and innovative.
2. Teacher VHSs electronics industry expertise who wish to apply learning in industrial electronics field base metacognition in other materials, can be done by considering the relationship aspect of metacognition skills and characteristics of the program to be developed.
3. Competency assessment study conducted in the vocational school, should not only see the end result of learning, but must pay attention to the learning process.
4. Education researchers who wish to follow up the implementation of this order: (1) conduct advanced research related to students' metacognitive, (2) the scope of materials/areas of expertise in research is more expanded, and (3) selecting models, approaches and different learning methods

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