Innovation in learning Basic Competence

by Purnamawati Purnamawati

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INNOVATION IN LEARNING BASIC COMPETENCE OF VOCATIONAL SKILLS IN ELECTRONIC INDUSTRIES BASED PROBLEM SOLVING IN SUPPORTING ASEAN ECONOMIC COMMUNITY (AEC)

Purnamawati, Syahrul
Faculty of Engineering, Universitas Negeri Makassar
tari_purnamawati@yahoo.com

ABSTRACT

This development research aims to produce an innovation in learning the basic competence of vocational skill in industrial electronics field by using problem solving in supporting Asean Economic Community (AEC). The subjects were students and teachers of industrial electronics at SMK Negeri 2 Makassar (A vocational school in Makassar). Data were analyzed through a combination of descriptive and qualitative. The products are books of innovation in learning basic competence of vocational skill in electronics industry through problem solving based and the learning insturments, including: lesson plan, teacher book, student book, student worksheets, and assessment of learning. The results show that (1) the initial testing (validation) for the book of innovation in learning basics competence of vocational skill in electronics industry through problem solving and the learning instruments are valid, (2) theoretically, the book of innovation in learning basics competence of vocational skill in electronics industry through problem solving and the learning instruments can be implemented in a class; empirically, the book of innovation in learning basics competence of vocational skill in electronics industry through problem solving based and the learning instruments meet the criteria of practical and effective. Therefore, it can be used in schools.

Keywords: Innovation in learning, problem solving, skill of electronics industry

INTRODUCTION

Education development of 21st century which is more complex needs creative students who are able to learn independently in different environment. Being able to learn and to innovate is one of the abilities that must be possessed by the students of this century. The higher the degree of complexity of life is, the better ability to learn and to innovate is required. Moreover, the students are required to have critical thinking and problem solving skills, and also good communication among students in order to create academic atmosphere, good communication, and effective collaboration and to have high creativity and innovation.

Attempts to generate innovation and creativity can be resulted in continuous correction of the education system, repair of learning, fulfillment of learning facilities and

laboratories, repair of units production, school management, teacher and students competences and the principal's policies. Bray et. al. (2010) states that there are 4 Cs in learning and innovation skills: (1) Critical Thinking and Problem solving; (2) Communication; (3) Collaboration; and (4) Creativity and Innovation. This theory emphasizes on skills of learning and innovation regardless of critical thinking skills, communication, collaboration, creativity and innovation that can improve the students' ability.

Vocational high school as a vocational institution aims at generating professional graduates that are able to continue to study. Furthermore, as one of the vocational institutions, a vocational high school is hoped that learning objectives can be achieved maximally, basic learning of vocational skills in particular (Dasar Kompetensi Kejuruan 'DKK') and industrial electronic expertise. DKK description has expertise competences to develop basic skills for students. In addition, DKK contains essential skills to generate competences' graduates. However, there are some obstacles that have recently occured at the vocational schools, teaching DKK applied still use direct learning and is full of theoretical nuances. Students in vocational schools are awarded a number of learning problems, but the studentss do not know the steps to solve the problems. As a result, learning created in the classroom causes boredom, unexplored creativity, less ideas, and saturation. Therefore, innovation development is necessary to do in learning.

Innovation in learning can improve motivation and learning outcomes. Learning innovation of DKK based on *problem solving* aims at being autonomous studentss in learning. Students are trained to apply (cognitive) thinking skills in designing steps for solutions by seeing the problems given by the teachers in electronics industry.

Chen (2008:23) identifies three main conditions problem-based learning, ie learning by doing, learning in context, and focusing on the student. The teachers play a role as a facilitator of the problem solving process by helping studentss to describe problems, to develop some ways to solve problems, to search sources of information, and not to provide solutions to the problems (Newton & Newton: 2008:57).

According to Impedovo (2009:37), basically-problem solving skills consist of four major phases: namely, (1) understand the problem; (2) designe a plan; (3) implement the plan, and (4) look back and check. When applying problem solving strategies in learning at least there should be some factors to consider; (1) specific knowledge domain, (2) algorithm, (3) heuristic, (4) the decision mechanism, and (5) reflection. These are all the stages of problem solving used in learning to embed students' thinking skills. Soden

(2013) explains that thinking skill development that will improve learning and problem-solving performance in the workplace is an important goal for vocational education and training. Furthermore, Ahghar (2012) explains that problem-solving in educational skills is effective in students' self-regulation learning and it always has good stability.

Recent researches in respect to problem-solving method have changed professional standards, demands on the new workplaces, learning theories, educators/ trainers to revise curriculum integrated in learning environment. It has also encouraged leaners to apply higher thinking skills, and problem solving skills. Therefore, honesty educations are important to apply problem solving learning to expand studentss' thinking skills.

Mimi Mohaffyza Mohamad et.al. (2011) state that problem-solving in building construction (BC) is studentss' ability to solve a given problem, and then to produce new ideas. This is the highest cognitive skills needed in SMK's curriculum. An element analysis was conducted before working, so that students are able to resolve any situations. Carson (2007:11) revised 8 (eight) problem-solving elements, they are; (1) define problems, a students must have knowledge to solve problems; (2) define problem-solving, relationship between thought and knowledge; (3) & (4) algorithms and heuristics are problematic; (5) dichotomy between knowledge and thought; (6) problem solving teaches a creativity; (7) problem solving requires a basic knowledge; and (8) problem solving is a concept application or transfer. Based on these elements, phases, and requirements, DKK problem solving based learning in electronics industry uses problem-solving approach.

Furthermore, Akhmad Sudrajat (2011) states that problem-solving based learning has several characteristics; (1) Orientate studentss to authentic problems and avoid isolated learning; (2) Students center in long term; (3) Create interdisciplinary learning; (4) investigate authentic problems integrated with real-world and practical experience; (5) produce and exhibit products/creations; (6) teach studentss to be able to apply what they have learned at school in their daily life; (7) Learning occurs in small groups (cooperative); (8) The teacher acts as a facilitator, motivator and mentor; (8) Problems are formulated to focus on and to stimulate learning; (9) Problem is a vehicle for the problem-solving skill development; and (10) New information is obtained from self-learning.

Based on the problem solving characteristics, problem-solving based learning is necessary given to the students of SMK, especially in expertise of industrial electronics, basic electronics skills base. DKK learning is a basic learning which needs problem-

solving approach to the Atom Model with Semi Conductor Materials, Various semiconductor materials, and half circuit and wave rectifiers. Therefore, problem solving is a cognitive learning strategy in that studentss accept systematic instruction, and then they analyzes it and give solutions for the DKK problems.

A research result found by Bambang Widarta & Priyono (2014) shows that; (1) the mean score of the students' learning outcomes obtained from problem-solving based learning is significantly higher than the students' mean score studying through conventional methods. (2) the mean score of the students having high motivation is higher significantly than those students with low motivation, and (3) there is no interaction or relationship between the learning method and the students' motivation toward learning outcomes. Therefore, innovative learning based learning model is required in order to help the studentss understand DKK. Besides that, studentss are guided to find solutions using their own ways with a variety of approaches and to produce the right and better solution.

RESEARCH METHOD

Type of this research is a research and development (*Research & Developmental*) Plomp model (2007) to produce learning product which is innovation in learning, i.e.Guidelines model lesson plan (RPP), worksheet student (LKPD), teacher book, student book, Results test Learning and Activity Questionnaire students (Aadp).

Research subject is teacher electronic industry expertise at SMK Negeri 2 Makassar, which totaled 8 peoples. That teacher has teaching experiences more than 5 (five) years and they has been certified educator. Innovation procedure development learning model DKK electronic industry expertise based *problem solving* at SMK using 4 (four) steps that is modified, there are; (1) beginning investigation phase; (2) model/planning learning phase; (3) realization construction phase; (4) test, evaluation, and revision phase. Instrument is used as tool data collections to measure the feasibility model are: (1) student activity observation sheet in learning; (2) teacher skill observation sheet in manage learning; (3) student response questionnaire to component and learning activity; and (4) achievement test. Data analysis which is do in this research is analysis data in descriptive-qualitative.

RESULT AND DISCUSSION

A. Initial investigation result

Initial investigation is conducted through assessment need design analysis with a discussion with a partner team teachers to conduct Focus Group Discussion (FGD) and learning observation in the classroom. FGD result with partner team teachers obtains the following information.

1. Identify learning DKK electronics industry expertise aims on the subjects' basic electronics. Based on results identification learning aims, i.e, for 1 and 2 meeting, there are 14 learning aims. Learning aims is reviewed and integrated to problem solving steps, at suitable material of these approaches. For 3, 4, 5 and 6 meetings, describing 22 learning aims that involve *problem solving*. At that meeting, lesson plan is reviewed on its learning aims.
2. Problems at applications direct learning model. Lesson plan which has been arrange by teacher, and still refer to direct learning, namely speech, discussions, and debriefing. Based on classroom observation is found several weaknesses on the study, namely: (a) students do not pay attention in learning, (b) teacher still haven't build critical thinking skills, (c) completion assingment still monotonous (giving homework and still haven't give homework result response), (d) convey the material through talk, it makes boredom, (e) students unresponsive and difficult to understand the student book, (f) students saturated follow the lesson, (g) teacher still haven't raise student motivation, (h) teacher still haven't use problem solving approach, and (i) learning impressed simple.
3. Initial knowledge and student character

   Initial knowledge is show based learning observation in classroom, this subject is teaches at first semester in X class, generally students have prior knowledge that is knowledge about atoms and magnetization at science subjects physics subject. Prior knowledge is still not enough to understand DKK, thus requiring early explanations about main material which is guided by teacher with clipping assignment. That student's prior knowledge, as a base in providing new material and advanced on the DKK material.

   Students' character is important aspect to know the demands, interests, attitudes, learn motivation, learning styles thinking skills and early ability that students have. Based on observation is obtained information, there are: (a) students have an enthusiastic attitude to new subjects, (b) students have learn motivation that can be

developed, (c) high students discipline, (d) students has been able to explain simple problem, (e) students are still sensitive at emotionally and mentally, and (f) students can accept explanation or suggestion from teacher and classmate.

B. Stage Model or design Learning

Activities is held at this stage by designing Model Code, lesson plan based on syllabus, teacher book, student's book, LKPD, achievement test, Activity Questionnaire learners (Aadp), research instrument. The results design is discussions with teachers team DKK. Lesson plan is designed to integrate with problem solving characteristic approach. It is done so that students' learning ability and self-reliance can systematically achieve.

C. Realization Phase Construction

Realization Model Guidelines, lesson plan, teacher book, student book, LKPD, achievement test, students activity (AApd), and instrument with conducting revise comments/suggestions revision from validator professional and practitioners of industrial electronics expertise.

Validation model guidelines before tested is done by professional and practitioners of industrial electronics expertise. Validator provides assessment and correction both on the sheet provided validation although at the script that is validated and assert model-based problem solving can be used at the stage testing after revised suitable with suggestions for improvements on the model guidelines. After repairing results validator then it discussed again with the subject teachers, results discussion became final draft of the guidelines and learning devices. Some aspects is assessed in guidelines learning model, are: (1) introduction. (2) Model contain,(3) guide implementation learning, and (4) language.

Table 1. Result Validation Guidance Model

No.	Assessed aspects	$\bar{X}$	Information
1.	Introduction	0,75	*Valid*
2.	Content model	0,91	*very Valid*
3.	guide implementation learning	0,87	*Very Valid*
4.	Languange	0.84	*Very Valid*

Based on Table 1, guidelines model result validation is fulfill very valid criteria; however there are some important inputs of validator that encourage revision, toward guidelines model. Some corrections and suggestions for improvements as follows: (a) utilization easier language in understand its meaning by practitioners (teachers) and readers; (b) Learning assessment, i.e. rubric theory assessment and practice is more

clarified; (c) Model application should characterize thinking development; (d) writing format model uses problem solving, and (e) learning practice steps integrate problem solving, and (f) Learning phases in the table form.

Furthermore,level consistent and stability of validator is acquired Percentage of Agreement (PA) 0,81. The reliability coefficient value, is bigger than minimum criteria that is used, i.e. 0.70. Thus, general guidelines models otherwise reliable.

1. Validation result learning Instrument

Learning instrument that made is integrated with problem solving component that is the most important part in learning DKK. Therefore, before testing learning instrument should be validated by professional and practitioners. validation activities Learning instrumentis done by providing a script (lesson plan, guidance model, teacher book, student book, LKPD, and achievement test) and validation sheet to validator. validator result is revised and become learning model. Summary result assessment validator to learning instrument is presented in Table 2.

Table 2
Validation result learning instrument

No.	Instrument learning	$\bar{X}$	PA	Information
1.	Lesson Plan (RPP)	0,87	0,76	Valid
2.	Guidance model	0,87	0,82	Valid
3.	Teacher book	0,89	0,83	Valid
4.	Student book	0,88	0,80	Valid
5	LKPD	0,87	0,74	Valid
6.	Achievement test	0,86	0,70	Valid

Based on the data at table 2, it can be stated that all learning instrument fulfill valid criteria. Here is presented results validator assessment to learning instrument. (Lesson plan, practical guidelines, teacher book, students book, LKPD, achievement test) and students activity.

a. Validation results of lesson plan

Lesson plan is guideline or grip teachers in teaching, because lesson plan contains systematic steps or phases. Lesson Plan is validated by 3 (three) professional and practitioners whose its assesment is review of 6 (six) aspect, i.e. basic competence (KD), achievement indicators KD, content and learning activities, language, and closing. Validation result at table 2, then is compared with has been established criteria, is obtained that lesson plan is valid, and can be used in tasting phase after has been revision appropriate corrections and suggestions validator.

Furthermore, to determine consistency and stability level validator to lesson plan learning is obtained Percentage of Agreement (PA) 0,76. This result shows consistency and stability level of validator to lesson plan.

Although, professional and practitioners state that lesson plan fulfill valid criteria, but still provide improvements corrections and suggestions. Some revision from validator either on validation sheet, nor lesson plan script which is related with: formulation indicators basic competence achievement, learning activities, language, and time. Based on some revision note from validator, and then is repair as improvement lesson plan, i.e.(1) Lesson plan made from I to IX meetings; (2) lesson Plan format adapted with format lesson Plan at school; (3) learning materials only write the title of sub-subject of each meeting.

b. Result validation guidance model

Guidance model is a practical guide for teachers and students to doing DKK learning. Therefore, before is used in study, is necessary need validated. Guidance model validasi, is done by professional and practitioners whose assessmentsis review of four (4) aspects, i.e. format, language, illustration, and content.

Based on Table 2. Is found that guidelines models are valid be accompanied some revision notes as follows.

(1) Learning aims are adapted to basic competencies and basic competence indicators.
(2) Target activities utilizations laboratory is all teachers and students of expertise electronics industry field that followed practice learning. Laboratory can also be used for teachers who will conduct research action and researchers at universities.
(3) Implementation activities only contain a description activities and practice materials.
(4) Practitioner task and practicum instructor teacher is adapted with task is used in schools
(5) Instrument assessment at guidelines learning based on problem solving with regard lesson plan and instrument assessment in testing school.

Besides a note above, there is used term has been changed, like; (1) study programbecome program expertise or competency skills; (2) field study becomefield expertise; and assistant become garage manager/laboratory/toolman. Input from the validator, further is done revisions to models guidelines is obtained coefficient Percentage of Agreement (PA) 0.82. These results show consistency and stability level from validator to results validation guidelines models.

c. Validation result teacher book

One of learning model that is very important at the school is teacher book. Teacher book contains a set of materials/substances subject that is arranged systematically, display full figure of competence masteredby students in learning activities. Teacher books enable students can learn a competence or basic competence in a coherent and systematic, thus accumulatively able to master all the competencies intact and integrated. Therefore, before teacher book is test needed validated by professional and practitioners

Assessment is reviewed of 4 (four) aspects, i.e. format, language, illustrations, acontent and is provided general assessment toward teaching materials. Based on that aspect, it is concluded that the teaching materials are valid. Nevertheless, there are still some things require revision based on the corrections and suggestions validator, i.e. ;(1) Teachers book is equipped with instructions or problem solving steps;(2) utilization operational sentence on basis competence indicator; (3) utilization repeated term should be avoided; and (4) utilization words or sentences that communicative with teachers and students without decrease its scientific meaning.

Furthermore consistency and stability level of validator to teaching material is obtained coefficient Percentage of Agreement (PA) 0,83. This result shows the consistency and stability level of validator to teacher books result validate.

d. Achievement test result validation

Test competence learning result and rubric assessment is done validated contents by professional and practitioners in expertise electronics industry field, stages which is done to discuss and thrifty carefully together professional and practitioners about test content that will be given to students according to teachers books and students books already made. The next stage, make points test according to the level of knowledge (analysis, application, synthesis and evaluation).

Result validation analysis that show at table 2, afterwards compared with criteria, concluded that results learning test fulfill content validity. Furthermore consistency and stability level of validity toward test competency results learning is obtained coefficient Percentage of Agreement (PA) 0.74. These results show the consistency and stability level of validity toward learning test result.

2. Validation result instrument

All instruments are used in development learning model DKK previously been assessed for feasibility by professional and practitioners. Feasibility assessment of each

instrument is reviewed by 3 (three) aspects, i.e. instructions utilizaton, materials (content), and language (mean score 3,78). Refers to data regarding, can be state that 5 (five) instruments feasibility is used without revision and 2 (two) instruments feasibility is used with revision. Revision is done include improvement sentence, a statement which has double meaning, understanding the same concepts, and writing consistency. Thus instrument has been revised feasibility is used to collect data validity, practicality, and effectiveness. DKK learning model based problem solving.

Like other validation sheet, some improvements and suggestions which is done to validation sheet, i.e. (1) Language and Grammar is corrected so students is easy understood; (2) produces learning model that contains components syntax, social system, accompanist and support impact, learning theories base problem solving which is part of innovation learning at SMK; and (3) produce final product based on validation result with considered that the product fertilization is used to next test process.

D. Phase Test, Evaluation and Revision

Activities at this stage is done at the next research stage, by conducting test initial product that has been designed and review then implemented in limited classes and expanded class.

Result research was supported by research Atiko Nur Oktaviani & Sunyoto Eko Nugroho (2015) which resulted that learning Creative Problem Solving familiarize students to develop creative mind processes in resolving a problem with structure steps so students is better to understand the concepts and be able to communicate his mind Maryuli Darmawan (2013) stated that based on the I and II cycle observation, it can be seen an increase towards independently 19% from first value is 72% to 91% by using learning strategies problem solving. Furthermore results resource Tri Kuncoro & Amat Mukhadis (2012) state that learning strategies open ended problem solving is more superior than closed-ended problem solving strategy to group learning styles diverging, assimilating, converging and accommodating. Learning styles converging is more superior to diverging learning styles at learning open ended problem solving and closed-ended problem solving.

CONCLUTION

First, initial investigations results already produce need analysis learning design based problem solving, namely; (1) Identify aims learning DKK with related subject electronics industry expertise, (2) various problem implementing direct learning model;

and (3) prior knowledge and student character; and various learning problems based problem solving. *Second*, produce learning models that contains syntax component, social system, accompanist and supporter impact, learning theories based problem solving. This model is produce based on suggestions / improvements result of the validator. *Third*, produce final result validation with consideration that it model is feasible used to next experiment process.

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