DEVELOPING KKNI BASED TEACHING ADMINISTRATION AND THE PROBLEM SOLVING IN ORDER TO INCREASE THE LEARNING OUTCOMES OF STUDENTS IN BEAM STRUCTURE-I CLASS, CIVIL ENGINEERING, STATE UNIVERSITY OF SURABAYA

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ABSTRACT

The main problems that undergraduate students of PTB 2014 face are they are still passive during the class, students activity during the class has less of development especially in the context of skills, students outcomes in planning beam construction building are not satisfying yet, students have less interest towards the lesson, and the teaching administration of Beam Structure-I Class needs development in the terms of knowledge, attitude, and skills. This research is aimed to analyze the validity of the teaching administration, the level of teaching and learning performance, students' activity, students' outcomes, and their responses towards the teaching and learning process. This research is developing teaching administration of 4-D model which is adapted from Thiagarajan. The subject of this research is undergraduate students of PTB 2014 who take Beam Structure-I Course in even semester of 2015/2016 in Engineering Faculty of State University of Surabaya. The plans of Trial I and II used one group pre-test post-test design. The data collection used validation sheet of the teaching administration, observation, students' final test, and survey response. Descriptive analysis and quantitative approach were used for this research. This research found that: (1) the validity level of the teaching administration is (> 75%); (2) the teaching and learning performance is (> 85%); (3) the students activity during the class is (> 3,2) with the reliability of (>88%); (4) the students outcomes after the treatment increased until (> 75) with mean of (> 75), the increasing of the students outcomes reached (> 0,6), the completeness of classical learning and the learning goals in the term of knowledge reached (> 85%), in the term of skills reached (> 70%), and in the term of attitude reached (> 100%); and (5) the positive response of the students towards the lesson reached (> 85%) or very high. This research suggests: (I) Civil Engineering Department of Engineer Faculty of State University of Surabaya is recommended to provide Computer Lab. In order to train the students to use analysis structure software which can be used off the class under the supervision of the course lecturer; (2) Civil Engineering Department of Engineer Faculty of State University of Surabaya is recommended to start bridging with planning consultant, supervisors, the contractors of beam construction, and the stakeholders of the Public Works Service of Surabaya in order to acquire the standardized beam construction and can be adopted into the syllabus of Civil Engineering Department; (3) the lecturers are recommended to use problem based approach hence the students will have opportunities to do a research or experiment in a real problem either individually or in groups; and (4) the students are strongly recommended to use the opportunities of doing a research or experiment in a real problem seriously in order to make the best outcome.

Keywords: KKNI Based Teaching, Problem Solving, Beam Structure, Increasing The Learning Outcome.

INTRODUCTION

Educational challenges in the era of global field engineering jobs civil engineering sooner or later still faced by graduates S1 PTB, and therefore to deal with it is necessary to increase the quality of education for students of S1 PTB in order to become quality human resources and excel in various fields of work civil engineering. The era of globalization also demanded for every student S1 PTB is able to cope with complex problems both

education and the field of civil engineering work.

National Qualification Framework (KKNI) set up by the government in the Presidential Decree No. 8 of 2012 and the elaboration of the regulations is higher. Indonesian Presidential Regulation No. 8 of 2012 on article 1 states that "National Qualifications Framework Indonesia, hereinafter referred KKNI, is the framework on the ladder competence and qualifications to reconcile, equalize, and integrate the field of education and the field of vocational training and work experience in order to award recognition work competence in accordance with the structure of employment in various sectors ".

Permendikbud No. 49 Year 2014 on National Standards of Higher Education (SNPT) in the second part of Graduates Competency Standards Article 5 states that "The standard of competence of graduates is minimal criteria of qualification ability of graduates that includes attitudes, knowledge, and skills that are expressed in the formulation of outcomes of learning graduates (compulsory refer to the description of the learning outcomes of graduates KKNI; and as an equal with the level of qualification on KKNI) ".

Problem Based Learning Model is basically oriented on real-world situations or conditions, contextual, meaningful, and the provision of learning resources and counseling. Lecturer serves as a facilitator or mentor while students are required to develop proficiency in the field of knowledge and problem solving skills on him. Students are asked to identify the real problem and learning related needs required to obtain a viable solution through the investigation. Lecturers using real-world problems to train the students learn through investigate, questions, and challenging student thinking. Problem Based Learning Model provides authentic experiences that encourage active learning, supporting the construction of knowledge,

and integrate naturally learn in lectures and real life.

The role of the faculty in the implementation of Problem Based Learning Model is to provide authentic problems to students, facilitate student inquiry, and support student learning (Nur, 2011). Problem Based Learning Model is a learning-oriented complex issues that require investigation authentic, namely investigations that require a real settlement of the problems of the real (Trianto, 2007). Students are required to be able to solve the problems that authentic with the intention to construct their own knowledge, develop inquiry (to develop students' ability to investigate a problem systematically, so that they can formulate their own invention), the skills to think critically, and develop independence and confidence.

The problems authentic learning is more emphasis on the use of real-world problems using projects and that allow students to explore and discuss issues that are relevant to the real world. Problem Based Learning Model is used with the aim to be able to grow and develop higher-level thinking students to situations oriented problem solving and covers about how the process of learning. Problem Based Learning Model in order to be as good as lecturers to apply that learning is able to create and make the classroom environment in which can occur the exchange and sharing of ideas in an open, sincere and honest. The main characteristics of Problem Based Learning Model based on the expression of a variety of developers in the field of education are: (1) Submission of a question or a problem; (2) Focusing on interdisciplinary; (3) Investigations authentic; (4) Produce real works or presenting real work; and (5) Collaborate.

Problem solving is the process and the steps to find the relationship, the relationship between the experience of the past with the present further problems

these students are able to act to solve them. Using the settlement problem is mathematically able to increase the analytical and able to assist students in applying these skills in various situations. Students who are used to solve the problem would have the ability to make decisions so that students have the skills to collect relevant information, analyze information, and realize the importance of re-evaluating the results that have been obtained.

Developing indicators troubleshooting capabilities by Snyder (2008) consists of three indicators. Three indicators, including: (1) Submission of arguments; (2) Identification of the Strategy; and (3) evaluation of the solution. All three indicators are described and presented in Table 1.

Table 1. Indicators of problem-solving skills by Snyder (2008)

No.	Indikator	Deskripsi
1	Filing arguments	Students are able to put forward arguments based on the skills and knowledge they already had
2	Identification Strategy	Students are able to work out and adopt a problem solving strategy
3	Evaluation of the solution	Students are able to evaluate logically troubleshooting solutions, capable of analysis, determine decision-making based on the results of investigation data

Source: Adapted from Snyder (2008).

G. Polya in his book "**How to Solve It**" suggests that in solving the problem, there are four important steps that must be done. Four troubleshooting steps are presented in Table 2.

Table 2. The four-step problem-solving abilities by G. Polya in his book "How to Solve It"

No.	Langkah	Penjelasan
1	Understanding the problem	• Give a mark or label • Identify the facts in question • Identify the terms and conditions • Analyze the data that has been known • Determine the relationship between facts • Analyze the problem situation • Make a formulation of the problem • Determine solutions to problems • Make a hypothesis • Describes the knowledge before being used for the completion of the technical framework
2	Devising plan	• Writing back the issue if necessary • Develop a plan for settlement • Choosing a strategy • Using problem-solving techniques that have been
3	Carrying out the plan	• Implement the plan • Revise the settlement plan if necessary • Make a diagram/table • Solve the problem • Re-evaluate the truth of settlement related problems • Determine whether or not the logical answer results
4	Looking Back	• Check back all the answers • Finding alternative solutions to problems other • Saving forms and means of solving problems into long-term memory to be used to solve the problem in the future

Source: Adapted from Polya (1973)

Based on the indicators and measures problem-solving ability that has been described above, a student has the ability to problem-solving if the person concerned has been able to: (1) Understanding the problem; (2) Make a plan and choose the right strategy to solve the problem; (3) Solving the problem

using the correct technique and systematic; and (4) Re-examine the suitability related strategies, as well as the truth of the results of the solution that has been done.

Research-based learning software development and troubleshooting KKNI aims to analyze the validity of the device, the level of adherence to learning, student activities, student results after obtaining the learning, and student response to learning.

Expertise must be owned graduates S1 Technical Education Building, Faculty of Engineering, State University of Surabaya in the field of civil engineering is to have the ability and expertise to complete the work in the field of civil engineering construction of concrete and steel construction based competency standards National Qualifications Framework Indonesia (KKNI) level 6, and Standard Operating Procedure (SOP) of the Department of Public Works Division of Human Settlements and Spatial Surabaya. This study discusses the skills that must be owned graduates S1 Technical Education Building, Faculty of Engineering, State University of Surabaya field civil Engineering to complete the work in the field of civil engineering steel building construction field.

Learning innovations based on Graduates Competency Standards on the National Qualifications Framework Indonesia (KKNI), Books Curriculum Development of Higher Education, Academic Paper Curriculum Development Unesa, and Standard Operating Procedure (SOP) of the Department of Public Works Division of Human Settlements and Urban Spatial Surabaya related to planning steel building construction is indispensable. The learning innovation within the application using the "Software Development Based Learning KKNI and Troubleshooting".

Study of relevant theory, namely: learning theories of John Dewey, Constructivist learning theory, learning theory of Jean Piaget, Lev Vygotsky's theory of learning, and learning theories of Jerome Bruner. The variables measured in the study, include: (1) the validity of the learning device; (2) adherence to learning; (3) Student activity; (4) the results of student learning; and (5) student response to learning. Instruments used include: learning device validation sheets, observation sheets teaching and learning performance Events Unit Class (SAP), observation of student activities, student achievement test and questionnaire responses of students. The study design development method 4-D (four D model) adapted from Thiagarajan, and Semmel Semmel (1974: 5) and the design of I and II trials using the one-group pretest-posttest design.

Results to be achieved from the "Software Development KKNI Based Learning and Problem Solving" is obtaining proper learning tools are used, including: (1) the learning device is valid; (2) adherence to an effective learning device; (3) The active category of student activities; (4) improve student results so thoroughness student results realm of knowledge, skills, and attitudes are met; and (5) student response to a positive learning course on Steel Structures-I.

Based on the description above, it can be predicted that KKNI Based Learning and Problem Solving can improve student learning outcomes S1 Technical Education Building (PTB) forces in 2014 in the Department of Civil Engineering, State University of Surabaya. Systematics framework in this study are presented in Figure 1.
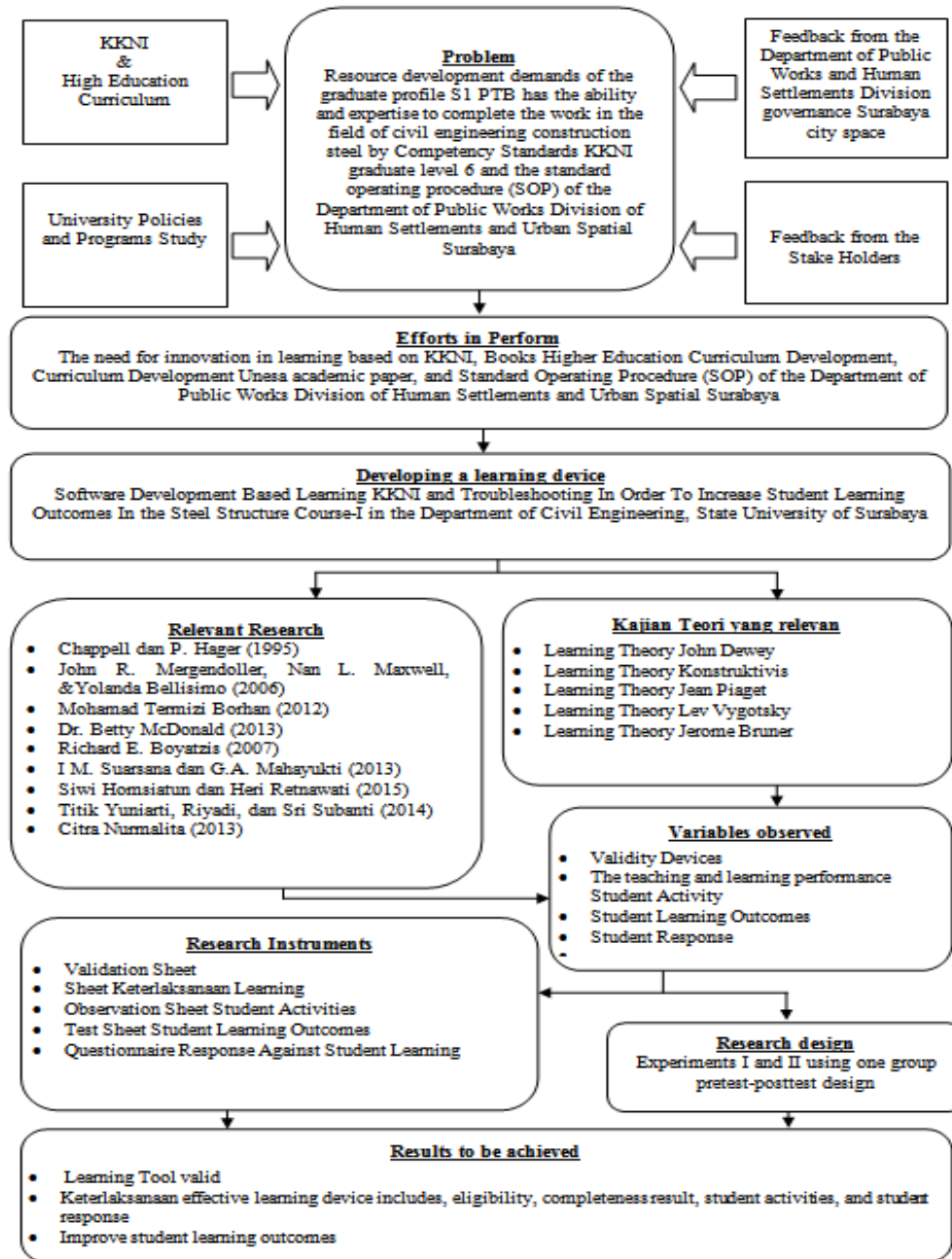
Figure 1. Worldview research

METHOD

The study design used software development refers to the 4-D models (four D model) of the book Thiagarajan et al (1974: 5). The development of the learning device model 4-D (Four D model) consists of four stages, include: (1) definition (define); (2) design (design); (3) development (develop); and (4) the spread (disseminate). The subjects used in this study is a student of S1 Technical Education Building 2014 Steel Structures programming courses in Semester-I Academic Year 2015/2016 at the Department of Civil Engineering, Faculty of Engineering, State University of Surabaya. The subjects used in this research is the development of students of S1 Technical Education Building in 2014 as many as 45 students. Implementation of this research in A4 Building Department of Civil Engineering, Faculty of Engineering, State University of Surabaya. I trials conducted on students of class S1

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Technical Education Building 2014 a number of 15 students. II trials conducted on students of class S1 Technical Education Building 2014 a number of 45 students. The design of the trial I and II trials learning device is performed using one group pretest-posttest design.

Data collection techniques in this study using four methods: sheet validation device, observations, test results of student learning and student questionnaire responses. Analysis of the validity of KKNI based learning and problem solving using sheet validation and analysis experts. Events teaching and learning performance Analysis Unit Class (SAP) using the score of the observations obtained during the learning takes place. Analysis of activity of students during the learning process based on the results of data observations made by the observer. Analysis of the results of student learning using data analysis sensitivity, validity and reliability of the test items, test data analysis of the right hand, the analysis of data normality, the analysis of whether there is a difference between the pre-test to post-test, and analysis of student learning outcome. The response of students to the learning obtained through a questionnaire then analyzed by descriptive use of a percentage of the questions on the questionnaire.

RESULTS AND DISCUSSION

Result

The results of the analysis of the validity of the learning device that includes a Lesson Plan Semester (RPS), Syllabus, Unit Event Class (SAP), Module Instructional Materials, Sheet Performance Students (MFI), Sheet Knowledge Assessment (Cognitive), Sheet Assessment Skills (Motor), Sheets Ratings attitude (Affective), and problem Solving ability Assessment Sheet successively given a score of 77.27%, 94.12%, 88.89%, 81.82%, 83.33%, 100.00%, 100, 00%, 100.00% and 86.96%.

The results of the analysis of the level of adherence to the learning test I is 89.29% with the percentage of suitability teaching and learning performance classroom learning by 100%. Thus the level of enforceability of Learning test I had a very decent teaching and learning performance assessment criteria. The results of the analysis of the level of learning teaching and learning performance II trial amounted to 90.48% with the percentage of suitability teaching and learning performance classroom learning by 100%. Thus the level of adherence to the Learning II trials have a very decent teaching and learning performance assessment criteria.

The results of the analysis of activity of students during the learning process is known by observation trials I obtained an average value of 3.30 that is included in the category of active and has a reliability value of 88.89%. The results of the analysis of activity of students during the learning process is known by observation trials II obtained an average value of 3.20 that is included in the category of active and has a reliability value of 88.89%. Thus students in participating in learning activities included in the active category.

Student results after obtaining the learning based on the results of data analysis using computer sofwere on one test sample t-test trial I can reach a value of 81.36 and II trials can reach a value of 77.94. Student results after obtaining the learning based on the results of data analysis using computer sofwere in paired samples t-test trials I obtained an average value of 77.33 (post-test) than previously amounted to 35.66 (pre-test) and test II average value of 75.56 (post-test) from the previous 35.66 (pre-test). Improving the ability of student learning outcomes criteria N-Gain in the first test of 0.65 and II trials of 0.62 so that both included in the medium category. Mastery learning classical and learning objectives realm of knowledge (cognitive) testing first by 86%

and trial II by 88%, the realm of skills (motor) testing first by 80% and trial II by 73%, and the realm of attitudes (affective) trial I of II trial of 100% and 100%.

The results of the analysis of the response of students to study at the trial I had a positive response to the percentage value (+) amounted to 85.39% and II trials have positive response percentage value (+) amounted to 90.01%. Thus the response of students to study in the experiment I and II trials included in the category of very powerful.

Discussion

The validity of the learning device that includes a Lesson Plan Semester (RPS), Syllabus, Unit Event Class (SAP), Module Instructional Materials, Sheet Performance Students (MFI), Sheet Knowledge Assessment (Cognitive), Sheet Assessment Skills (Motor), Sheet assessment Attitudes (affective), and problem Solving ability Assessment Sheet obtain a value of (> 75%), so that the learning device that contains the instrument well enough so that they can express reliable data (Arikunto, 2006: 178). Instruments learning device is said to be good if the value of reliability coefficient ≥ 75% (Borich, 1994: 385 in Trianto, 2009: 240). Thus it can be concluded that given the KKNI based learning and problem solving of good quality because of its validity and reliability have been tested so that used in learning.

Activity of students during the learning process of obtaining a value of (> 85%). Thus obtained an average reliability of those three meetings by 88.89%, so that the instrument can be said to be reliable student activities as a percentage of the observations of the two observers (≥ 75%). Instruments student activities said to be good if the value of reliability coefficient ≥ 75% (Borich, 1994: 385 in Trianto, 2009: 240).

Student results after obtaining a free trial lesson I can reach a value of 81.36

and II trials can reach a value of 77.94 so it can be said that the learning outcomes of students after obtaining KKNI Based Learning and Problem Solving larger than KKM (gain value> 70 or above the value of B). The average value of the first test of 77.33 (post-test) than previously amounted to 35.66 (pre-test), and the average value of 75.56 II trials (post-test) from the previous 35.66 (pre -test). Improving the ability of student results on the first test of 0.65 and II trials of 0.62 so that both included in a category is based on criteria N-Gain. Mastery learning classical and learning objectives realm of knowledge (cognitive) testing first by 86% and trial II by 88%, the realm of skills (motor) testing first by 80% and trial II by 73%, and the realm of attitudes (affective) trial I of II trial of 100% and 100%. Mastery learning students realm of knowledge (cognitive) in classical and learning objectives can be declared complete, if the completeness of the value of learning, classical and learning objectives gained ≥ 85% (Department of Education in Trianto, 2010: 241). Completeness value of learning (KB Individual) declared complete if the proportion of correct answers ≥ 65% of students complete their study (Department of Education in Trianto, 2010: 241).

The response of students to study at the trial I had a positive response to the percentage value (+) amounted to 85.39% and II trials have positive response value (+) amounted to 90.01%. Thus the response of students to study in the experiment I and II trials included in the category of very strong based on criteria of interpretation score student responses.

CONCLUSION

Based on the research results and discussion can be summarized as follows: (1) Devices Based Learning and Problem Solving KKNI good quality, because it has been tested for validity and reliability so

that used in learning; (2) The level of adherence to KKNI Based Learning and Problem Solving can be accomplished is greater than 85% that is included in the criteria very decent; (3) Activities of students in using the Device-Based Learning and Problem Solving KKNI had a reliability greater than 85% that are included in the active category; (4) The results of student learning after obtaining KKNI Based Learning and Problem Solving larger than KKM (obtaining a value of> 70 or above B); and (5) The positive response of students to KKNI Based Learning and Problem Solving greater than 85% that are included in the category of very powerful.

Based on the conclusions that have been described, the following are given some suggestions to the "Software Development Based Learning KKNI and Troubleshooting": (1) Department of Civil Engineering, Faculty of Engineering, State University of Surabaya should provide facilities and infrastructure such as computer labs to practice using sofwere computer structural analysis which can be used by students outside of lecture hours under the guidance of lecturer structural analysis; (2) Department of Civil Engineering, Faculty of Engineering, State University of Surabaya should establish cooperation with the consultant planner, supervisor, contractor field of steel construction as well as the Department of Public Works Division of Human Settlements and Urban Spatial Surabaya goal that planning outcomes steel building construction according to the Standard Operating Procedure (SOP) can adopted into Semester Lesson Plan (RPS) for S1 PTB specialized expertise in civil engineering; (3) teaching experience in the subject of Structural Analysis, Structural Steel-I and Structural Steel II preferably using Problem Based Learning Model in lectures so that students can have the opportunity to conduct an investigation / experiments on real problems both

individually and in groups; and (4) Students S1 PTB should use the opportunity to conduct an investigation / experiments on real problems both individually and in groups in earnest in order to obtain the best learning results.

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