TEACHING FACTORY LEARNING PROCESS AT VEHICLE'S BODY REPAIRING AND PAINTING WORKSHOP OF FACULTY OF ENGINEERING YOGYAKARTA STATE UNIVERSITY

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Abstract

The learning objectives of teaching factory learning process are to: 1) improve the students' competency, 2) increase the students' entrepreneurial spirit, 3) produce the products/services that have added value, 4) increase the schools' sources revenue, and 4) increase the relationship with industry. This research use approach research and development.. The location of this research at the Automotive Engineering Education of Faculty of Engineering Yogyakarta State University, with research subjectsare lecturers and students, practitioners of the industry. Collecting data grouped into two parts, namely, the study introduction and development of the model, as well as model validation. Data analysis techniques using descriptive analysis with percentage. Teaching factory learning process to be applied in the Vehicle's Body and Painting Workshop of Automotive Engineering Department of Faculty of engineering Yogyakarta State University consists of planning, implementation, and evaluation. The planning process consists of making the syllabus, lesson plans, instructional strategy, methods, and media preparation. The learning process consists of socialization to students about teaching factory, industrial visits, learning-based training, and learning-based production. While the evaluation system consists of competency test, consumer satisfaction questionnaire, and economic analysis of students' activities while producing goods/services. The conclusion of this study are: 1) The level of competence of conformity subjects very accordance with the needs of the industrial (82.11% and 86.75%). 2) Achievement of student competence are very well. 3) The resulting product is a body repair services and painting and reconditioning body components so that the vehicle fit for sale back. 4) Enhance cooperation with industry are invited cooperation consisted of 8 workshops body repairs and painting, one industry Sales of paint, and one vocational school. 5) Teaching factory model that will developed consist of: a) the resulting product, in the form of reconditioning and repair of body components are damaged, b) management of teaching factory, c) facilities and supporting infrastructure, d) financial, e) cooperation with the industry, f) curriculum, g) learning process, and h) human resources. The learning process will be applied as part of the development of teaching factory model at Vehicles' Body Repairing and Painting Workshop of Automotive Engineering Education of Faculty of Engineering Yogyakarta State University.

Keywords: Teaching Factory, Learning Process, Vehicle's Body Repairing and Painting

1. Introduction

a. Definition of Teaching Factory

In simple concept teaching factory is the development of a production unit that is already implemented in vocational educational institutions. Furthermore, the concept of teaching factory is the development of vocational schools into a school based production. According to Grenert and Weimann in Heru Subroto (2004), there are three basic models of production schools, namely: 1) Simple production schools; 2) Develop production schools and 3) Teaching factory schools.

The third model, teaching factory school, is the school where production in the form of factories as places of learning. Teaching factory integrating the learning process and work at the same place. There is no longer separated between the delivery of theoretical and production/practice material. Implementation of teaching factory at a vocational school in Indonesia is formed of production activities or services that are part of the learning process (Moerwishmadhi, 2009). Thus the school is required to have a factory, workshop or other business units for learning activities.

Factory, workshop or other business units of the production have to produce goods and services that meet the quality standards that can

be accepted by consumer. Similarly, Directorate PSMK (2008) notes that teaching factory integrating learning process to produce a product or service that is worth selling to generate added value for schools. Moreover, production activities in form of goods or services can be widely foster vocational school to explore the sources of financing. It could give more subsidy for the learning process in the vocational schools.

It can synthetically concluded that the teaching factory is the learning activities in which students directly perform production activities in the form of goods or services in the educational environment of the school. Goods or services produced has a quality that is worth selling and accepted by the public or consumers. The result of the gains expected to increase sources of schools' income that are useful for the sustainability of education. Teaching factory brings the industry/real work in the school environment to prepare graduates are ready to work.

Teaching factory can be implemented by various strategies/methods in accordance with the conditions of the school institutions. Models of teaching factory according to Zainal (2014), namely: a) Model 1: Teaching factory is a workshop and laboratory owned by the vocational schools itself. Teaching factory management and implementation are integrated into the academic system. Students practice in the workshop/laboratory to generate a product in the form of goods or services sold to consumers, b) Model 2: Vocational schools made an agreement with industry to build teaching factory. Teaching factory is located inside or outside the school depends on the agreement. Teaching factory management is not integrated with the academic system, but the students could use it to practice regularly according to academic schedules, and c) Model 3: Teaching factory built in cooperation with industry/company as special programs (collaboration class). The students have to go to the industry during their practice. It's similar like on job training, but it's more manageable for the content material and activity during the class in the industry. Implementation of teaching factory support the implementation of competency-based curriculum. Competency-based curriculum is currently the curriculum applied in Europe (Biggs & Tang, 2007; Bergstroom, 2011) and also in Indonesia.

Teaching factory at vehicle's body repairing and painting workshop of Automotive Engineering Education Department of Faculty of Engineering Yogyakarta State University is in the process of development. The development was conducted to producing products (good/service), integrating with academic activities, fostering cooperation with industry, and creating teaching factory model for vocational education. Teaching factory model was created in vehicle's body repairing and painting workshop because of the students' achievement and strong correlation with the industry.

b. Suitability of the body repairing & painting courses with the needs of industry and students' achievement.

Body repairing and painting courses are one kinds of courses taught in Automotive Engineering Education Department of Yogyakarta State University. Body repairing and painting courses consist of 3 credits semester, 1 credit semester of theory and 2 credit semester of practice. The level of competence conformity taught in body repairing and painting courses with the needs of industry are very high with the suitability rates of 82.11% and 86.75% respectively (Noto Widodo, et al, 2015). While the students achievement in the body repairing and painting courses are sufficient with the number of students scoring above B in 2013 were 69 students (83.13%) and 74 students (91.36%) respectively, and in 2014 were 37 students (84.09%) and 70 students (88.61%) respectively (Noto Widodo, et al, 2015).

The data showed in the previous paragraph become one of the main drivers of the teaching factory development at vehicles' body repairing and painting workshop. Suitability level courses to the needs of the industry indicates that the learning process has been very beneficial for students to preparing their self to go to the industry. And students' achievement levels indicated that students have the ability to repairing and painting vehicles' body. Learning and assessment process carried out recently is limited on learning based training. The learning process using the object-based training and simulation practices of real-work conditions. Therefore, it is necessary for the development of practice with real objects and engage consumers as a factor in the assessment/evaluation in the form of teaching factory activity.

Questions to be answered in this study is: Does the implementation of teaching factory can: 1) improve the competence of students? 2) increase the entrepreneurial spirit; 3) produce the product in the form of goods and/or services that have added value? 4) increase the sources of schools' revenue? 5) increase the colaboration with industry or relevant business entities ? and

6) How does teaching factory models that can be implemented in vocational school

2. Discussion

a. Teaching factory learning process

Learning is viewed as a series of activities that progress from simple to more complex, higher-order cognitive processes. Lower level cognitive processes typically include knowledge acquisition, understanding and application, all of which contribute to an ability to transfer and recognize principles in other situations. And higher-level processes are closely linked to analysis, evaluation, and creative thought (Krathwohl, 2002). Moreover, learning is a process by which the learners builds and constructs new knowledge based on their experience, application, and reflection (Golowich, 2013).

Learning in college aims to provide academic skills/hard skills, soft skills/success skills, entrepreneurship skills, and leadership skills so that students are ready to enter the real working world/industry after completing the study (HELTS, 2004; Mursid, 2013). To achieve these objectives, the learning process should be conducted in accordance with the learning objectives. Therefore, before the learning process was implemented, it's necessary to preparing the models, methods, and also the strategies to achieve the learning objectives.

The purpose of the teaching factory learning process are to producing and selling products in form of goods/services in the market in order to increase students' competency and entrepreneurial spirits. To achieve these objectives, the teaching factory learning process at Vehicles' Body Repairing and Painting Workshop of Automotive Engineering Education Department of Yogyakarta State University includes planning, implementation, and evaluation/assessment of students' achievement (Figure 1).

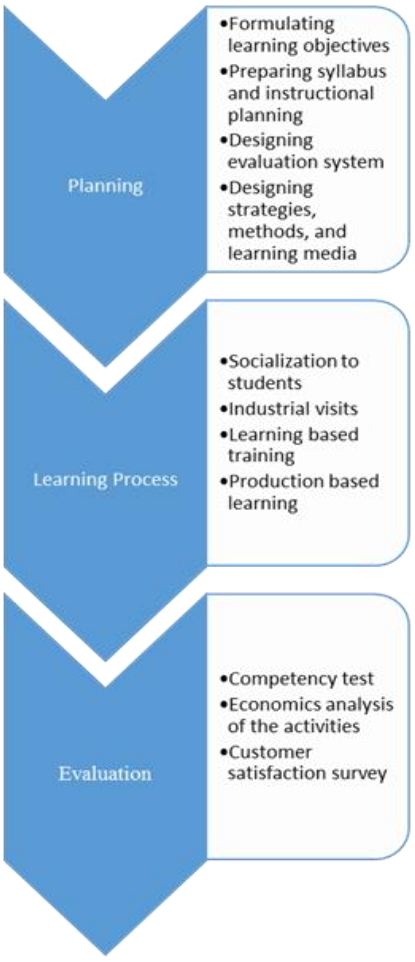

Figure 1. Teaching factory learning process

1) Planning

Setting the instructional design is a routine matter for instructors. But the instructors should be aware with the activity. Instructional design is one of the important steps from whole actions. In the proposed instructional design process, the clear delineation of objectives is an essential foundation for the next steps in learning activity (Hamilton & Klebba, 2011). From beginning to end, the process typically includes assessing the need for instruction, analyzing students' characteristics, defining the learning objectives, selecting the appropriate teaching approach, trying out the strategy to see how effective they are, making revision, as well as implementing and maintaining the instruction (Eberhardt, 2012).

Instructional design of teaching factory learning process was conducted on the formulation of learning objectives, syllabus and instructional plans, and evaluation systems design. Instructional design of teaching factory

learning process also consists of selecting appropriate learning strategies, methods, and media. Furthermore, instructional design of teaching factory learning process also contains the time allocating for each topics or activity during the learning process (Arends, 2004). All those activities purport to create productive environment fostering the students to achieve the learning objectives.

The learning objectives of teaching factory learning process are to 1) improve the students' competency, 2) increasing the students' entrepreneurial spirit, 3) produce the product in the form of goods or services that have added value, 4) increase the sources of schools' revenue, and 4) increase cooperation with industry or the relevant business entities (Sudiyanto, Yoga, Ibnu, 2012). To achieve the learning objectives, there are some activities conduct in teaching factory learning process. The activities include socializing and explaining of teaching factory learning process to students, visiting the body repairing and painting workshop of the industry partners, training about body repairing and painting, producing goods or services, and evaluating the students' achievement.

Body repairing and painting learning courses carried out during 1 (one) semester or 16 weeks. Each week consists of 1 x 50 minutes of theory and 4 x 50 minutes of practice. Each class meeting should divided into some activities according to the learning objectives. Time allocating for teaching factory learning process on Body repairing and painting courses showed in the table 1.

Table 1. Time allocating of teaching factory learning process on Vehicles' Body repairing and painting courses.

No	Week	Activity
1	1	Socialization and explanation of teaching factory learning model to students
2	2 & 3	Industrial visits
3	4,5,6,7,8,9,	Body repairing and painting training/practice
4	10,11,12,13,14	Producing teaching factory products
5	15&16	Evaluation

Development of strategies, methods, and media learning and evaluation systems are described further in the learning process.

2) Learning process

a) Socialization and explanation of teaching factory learning model to students

Socializing and explaining to the students needed so that the students know the teaching factory learning process to be followed. Socialization activities carried out with gave explanations to the students on the learning objectives, the learning activities to be carried out, as well as the evaluation systems. One of the important thing should be knowing by students that the learning process of teaching factory is also associated with the consumer. Therefore, students need to get details on how to communicate with consumers and facing complaints from consumers. Socializing and explaining to the students performed at the beginning of the lecture.

b) Industrial visits

A visit to the body repairing and painting workshop of industry partners in order to observe directly on body repairing and painting workshop's activities. Students visiting the body repairing and painting workshop of industry who have formed an agreement to cooperate.

Activities commenced during the industrial visit include observation on body repairing and painting activities ranging from consumer acceptance, body repairing and painting activities, and the calculation of body repairing and painting services charges. The industrial visits are expected to improve the students' interest and motivation about body repairing and painting industry. The activity is providing additional knowledge and experience to students by directly observing the activities in the industry and associating them with the learning process in the schools (Bhusry & Ranjan, 2012). Industrial visit is also a sample of experiential learning techniques through the students' involvement in specific service learning activities (Robinson, Sherwood & DePaolo, 2010).

c) Body repairing and painting training/practice

Succeeding implementation of the teaching factory learning process is the body repairing and painting practice. Time allocating for the students to practice consists of 6 times meeting/class. Moreover, the topics of body repairing and Painting practice shows in the table 2.

Table 2. Learning activities during training/practice

Week	Body repairing	Body painting
1	Creating car's door profile	Surface preparation
2	Creating car's door profile	Putty application and sanding
3	Creating car's door profile	Masking
4	Creating car's body panel	Color matching
5	Creating car's body panel	Painting
6	Creating car's body panel	Painting

In addition, the learning activities during body repairing and painting training similar with the activities in the body repairing and painting industry, but on a smaller scale. Thus, the learning activities enable students to learning by actively engaging and increase of its transferability to the more realistic, intricate situations encountered in a real situation (Hamilton & Klebba, 2011). The final results of the body repairing and painting training evaluated by lecturers and technicians in order to determine the groups for the next activities.

d) Producing goods and/or services of teaching factory

The learning process following the training is conducting production goods/services on body repairing and painting. Time allocating for the production of goods/services consists of 5 times meeting/class. The production activities conducted in groups. Each group consists of 4 to5 students. The formation of groups based on the training results has been done before. Each group consists of students pursued with heterogeneous competencies that can enable peer learning among students systemically occur.

The products of teaching factory learning process of body repairing and painting are the recycling of vehicle body components and/or painting services. The activities on producing part of body components recycling and/or painting services offering activity that are students needed to achieve specific learning goals within a specific time frame (Utley, 2012). Because of the inadequate time, the students asked to produce simple part of vehicle body recycling and/or repairing/painting small scratch on the car. Time allocating to produce goods and/or services only 5 times. And each times consists of 4 x 50 minutes. Its mean that the totally time available are 1000 minutes or 16 (sixteenth) hours. Time needed to repairing and painting of small scratch on vehicle body estimated no more than 3 days. Even tough, it's no more than 1 day if the treatments needed are simple. Considering the consumer needs and students' activity on the other courses, the process of body repairing and painting is possibly done by block systems.

Consumer need refers to consumer expectation when they repairs their car. The consumer need to fixes their car as soon as possible. They don't want to leave their car in the workshop for long period only for small/simple damages. And students' activity on the other courses refer to students' activity in the same semester. Commonly, the students take 7 to 10 courses each semester. The students have to allocating time for other courses activities. And the block systems indicated that the learning activity can be finished in one time (2 days). If the students can finish the job, they don't have to do it again in the following week. The students only waiting for the competency tests.

The products of teaching factory learning process of body repairing and painting are the recycling of vehicle body components and/or painting services. Who are the consumer for the products? The consumers may possibly come from the peoples around the university, teachers, employees of the university, students, or industry partners who already forming an agreement to support the teaching factory activities.

The teaching factory learning model requested the students to generate a product at least 1 product/service for each semester and each group. Each student are nurtured to have a real experience on repairing and painting vehicles' body. The learning process through real-world activities encouraging students to scaffold theirs knowledge and skills (Tanner, 2012). The activities support the students to learning through concrete experience, reflective observation, active experimentation, and abstract conceptualization (Jong & Wierstra, 2006).

During the teaching factory learning model are implemented, there are some points to be

concerned. Depdiknas (2003) notes that (1) the learning activities need to pay attention to individuals' ability differences to develop their talents and potential optimally (competency based learning); (2) the learning activities focused on the establishment of real experience in daily life according to the needs of the industry and related on the application of concepts, rules, principles, and disciplines; (3) the learning activities directed on the encouraging students to communicate their knowledge and finding to the public; and (4) the learning activities aimed on creating a climate of competition which can lead students to be more innovative and productive.

3) Evaluation

Evaluation/assessment is an integral element within the instructional design and learning process (Bowman, 2015). Evaluation is one of important stage in the learning process (Mursid, 2013). The main purpose of evaluation is to provide valuable information to teacher and stakeholders to made decisions about the learning process or whole curriculum (Stufflebeam & Shinkfield, 1985).

The evaluation/assessment depends on the syllabus, learning objectives, teachers' approach on teaching (teaching methods), and on how the learning environment is arranged. (Bergstrom, 2011). There are some types of evaluation/assessment. Each evaluation approach has their own strengths and weaknesses (Alkin & Taut, 2003; Bauman, 2008). There is no a single evaluation approach or strategy that appropriates with all instructional design/process (Boody, 2009). For instance, if the learning objectives are dominant on students' knowledge, the writing tests are sufficient as the assessment. Nevertheless, if the learning objectives are dominant on students' skills, the performance test are more appropriate. Assessment on students' competency directed to measure and assess the students' performances (knowledge, skills, and attitudes), either directly at the time of learning activities and indirectly is through evidence of learning outcomes (evidence of learning) in accordance with performance criteria/indicator (Winarso, 2013).

The evaluation/assessment of the teaching factory learning process consists of competency test, questionnaire of customers' satisfaction, and economics analysis of the students' activities on producing goods/services during the learning process. Competency test aims to assess the students' competency individually. Competency test of the body repairing and painting courses are both in the form of theory and practice. While the following evaluation method are the questionnaire of customers' satisfaction. The questionnaire given to the consumer who entrust their car fixed by the students. The questionnaire shows the level of customer satisfaction with the students' work. The consumer could be from the industry partners who have forming partnership. Involving consumers in evaluation/assessment reveals the consumer recognition on the products/services produced (Winarso, 2013).

Additionally, the next evaluation methods are a report analysis of the economic calculation on the students' activities during the producing goods/services in the teaching factory learning model. The analysis conducted to encourage the students reflecting on all the activities. Reflection is one of the activities that encourage students to achieve higher order of thinking skills (Hamilton & Klebba, 2011).

This research use approach research and development (R&D) simplified step, ten step (Borg & Gall, 1983: 773), into three stages, namely: study the introduction, development, and testing implementation. The location of this research at the Automotive Engineering Education of Faculty of Engineering Yogyakarta State University, with research subjects are lecturers and students. In this study also involving experts and vocational education practitioners of the industry in order development of model design and validation / test implementation.

Collecting data grouped into two parts, namely, the study introduction and development of the model, as well as model validation. In preliminary studies and development, selected technical questionnaire, observation, and documentation. Data analysis techniques using descriptive analysis with percentage.

3. Conclusion

The conclusion of this study are: 1) The level of competence of conformity subjects taught in to be applied in the Vehicles' Body Repairing and Painting courses very accordance with the needs of the industrial (average concordance rate of 82.11% and 86.75%). 2) Achievement of student competence in the Vehicles' Body Repairing and Painting courses are very well with the number of students scoring above B is 69 students (83.13%) in 2013 and 74 students (91.36%) in the year 2014 in the Vehicles' Body Repairing subjects and 37 students (84.09%) in 2013 and 70 students (88.61%) in the year 2014 for the course painting. 3) The resulting product is a body repair services and painting and reconditioning body

components so that the vehicle fit for sale back. 4) enhance cooperation with industry are invited cooperation consisted of 8 workshops body repairs and painting, one industry Sales of paint, and one vocational school. 5) Teaching factory model that will developed consist of: a) the resulting product, in the form of reconditioning and repair of body components are damaged, b) management of teaching factory, c) facilities and supporting infrastructure, d) financial, e) cooperation with the industry, f) curriculum, g) learning process, and h) human resources. The learning process will be applied as part of the development of teaching factory model at Vehicles' Body Repairing and Painting Workshop of Automotive Engineering Education of Faculty of Engineering Yogyakarta State University.

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