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Self-design Project Based Learning: An Alternative Learning Model for Vocational Education

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Abstract: The purpose of this study was to obtain a self-design project based learning model as an alternative model to improve students skills. The design-based research and descriptive analytic was implemented using interview, Focus Group Discussion (FGD), observation and document analysis. An interview was implemented to explore the basic orientation regarding product design, FGD was utilized to obtain the characteristics of the learning model that adopted the project-based learning (PBL) and work-based learning (WBL) involving expert participants from industry practitioners, vocational school teachers (mechanical engineering) and representative from professional certification bodies. An observation was to evaluate the competency standard involved the industry partner, and document analysis was to finalize the suitability of competencies that meet the standard. The result; this study suggests an integrative composition of materials that may applicable to guide and improve students' learning; comprises of teaching and learning guidance in the integrative composition materials that might be able to make learning industrial nuance. The concept of vocational education is expected to produce competence graduates who meet the demand from industry. An application of this model provides an opportunity for students to gain experience as an industrial workers, as well as to grasp the actual competencies needed in the workplace.

Keywords: Skills competency, self-design project based learning, design based research, work based learning, project based learning

1. Introduction

The main purpose of vocational education is to prepare students to be able to become entrepreneurs or be able to work in industry (Al-Najar & El Hamarneh, 2019; Handayani, Ali, & Mukhidin, 2020). This means that to become a workforce must have the knowledge, skills and attitudes that are in accordance with the world qualifications of work. In order for vocational school graduates to be able to work or be entrepreneurs, vocational school graduates must have competencies, namely abilities demanded by industry and there is official recognition of these abilities (Ana et al., 2016).

The development target of implementing vocational education is directed to be able to play an active role in increasing economic growth and community welfare. Vocational education must be able to provide a skilled, expert, and skilled workforce accompanied by personality traits that refer to aspects of the value system (Köpsén, 2014). The level of quality and relevance of competence with the chosen field of work can meet the demands of the industry. In order for the quality of vocational school graduates to match the demands of the industry, it is necessary to plan an educational program where students are trained in a similar environment when they work later (Rosina et al., 2021). For vocational school graduates, it is very important to first identify the industrial world. In addition, in order for graduates' competencies to be in line with working conditions in the industry, it is necessary to provide knowledge through a work competency development model.

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Mastery and competence improvement of vocational school graduates is very important (Klotz, Billett, & Winther, 2014). With this effort, it is hoped that vocational school graduates will easily adapt to the increasingly high demands of the industry. Indeed, the main point is the teachers that must be adapted in any situation to do and apply their creativities for improving students understanding. Teachers must improve their skills and use anything from the environment for making student to understand (Nandiyanto et al., 2020a; Nandiyanto et al., 2020b; Nandiyanto et al., 2020c; Handayani et al., 2020a; Hidayat et al., 2020; Ana. 2020).

The purpose of this study was to obtain a self-design project-based learning model so that it became alternative learning to improve work skills. The novelty of research on learning models includes students having (1) the ability to design their own products to be made and (2) the results of this study are able to improve work Learning according to Syam et al., (2018) is a process carried out by learning participants to get a change in behaviour in interaction with their environment, competencies, and entrepreneurial abilities.

2. Characteristics of Vocational Learning

Learning is a process to help students to understand well (Maryanti et al., 2021). Students who experience learning aim to make changes in individual behaviour due to interactions with their environment. Learning according to Syam et al., (2018) is a process carried out by individuals to obtain a new behaviour change as a whole, as a result of the experience of the individual himself in interaction with his environment. According to the National Education System Law No. 20 of 2003, it describes a systematic effort to create educational interaction activities between two parties, namely between students and educators. There are six characteristics of effective learning, namely: (1) students examine their environment through observing, comparing, and finding similarities and differences, then forming concepts and generalizing based on the similarities found, (2) the teacher provides materials (3) student activities are based on assessment, (4) the teacher provides direction and guidance to students in analyzing information, (5) learning orientation is aimed at mastering lesson content and developing thinking skills, and (6) teachers using techniques teaching that is suitable and in accordance with the objectives. Vocational education is one type of education in the national education system related to the type of work and profession that is in accordance with technological developments and the needs of society or industry. Vocational education prepares students in work and is often faced with changes in the industry.

A vocational learning program is a special learning program that is directed so that graduates can work in the industry or be able to become entrepreneurs in their fields. Vocational relates to practicum (Ana, 2020; Handayani et al., 2020b; Esa et al., 2017). The program and learning process in vocational schools are applicative programs, so that everything that is taught in vocational schools, allows students to be able to survive through the skills acquired from the education process. For this reason, learning programs implemented in vocational schools must equip graduates with skills in a comprehensive manner in order to answer the challenges of the industry. Learning in the environment of vocational education must be able to create learning how to learn, easy to be retrained and have the basics of capabilities needed by stakeholders.

To achieve this goal, the development of learning programs must be oriented to market needs (demand-driven), which are packaged in competencies based training (CBT), and learning strategies implemented through production activities (Production Based Training, PBT) or project work. According to Hayati, Supardi, and Miswadi (2013), project-based learning as an instructional method that challenges students to 'learn how to learn and work cooperatively in finding solutions to real problems. The learning approach that is carried out emphasizes student-centred learning and mastery learning.

3. Development of Alternative Learning in Vocational Schools

One of the demands of learning carried out in vocational schools is the involvement of industry (Dania, Bakar, and Mohamed, 2014). Industry involvement can be applied with the adoption of developing competencies into material for subjects, the presence of guest teachers from industries that provide enlightenment for students' knowledge (Hordern, 2014; Köpsén, 2014). Besides that, there are jobs to make industrial products that are carried out by students in schools, so that the industry's nuances arise in learning.

The concept of vocational education must also prepare a person after graduating at a particular place of work, ready to work and ready to continue learning and developing further (Klotz, Billett, & Winther, 2014). On the basis of these opinions, the concept of learning in vocational schools must be the atmosphere of the industry to prepare students in work and are often faced with changes in the industry. Alternative learning that will be developed begins with the development of integration material as shown in the following Figure 1. The concepts of the forms of learning discussed include also adopting the concept of work-based and production-based learning models. The flow of thought in the form of learning development, adopting the characteristics of both learning models can be seen in the following Figure 2.

This research is very important to do, among others, to bridge the gap between student work competencies produced by schools and the demands of the industrial world.

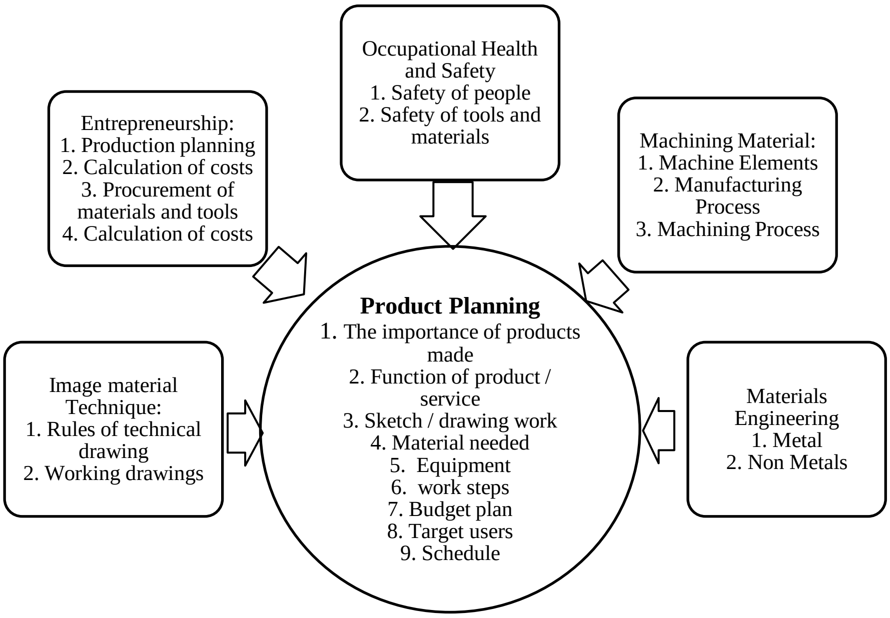

Fig. 1 - Scheme for the development of integration materials

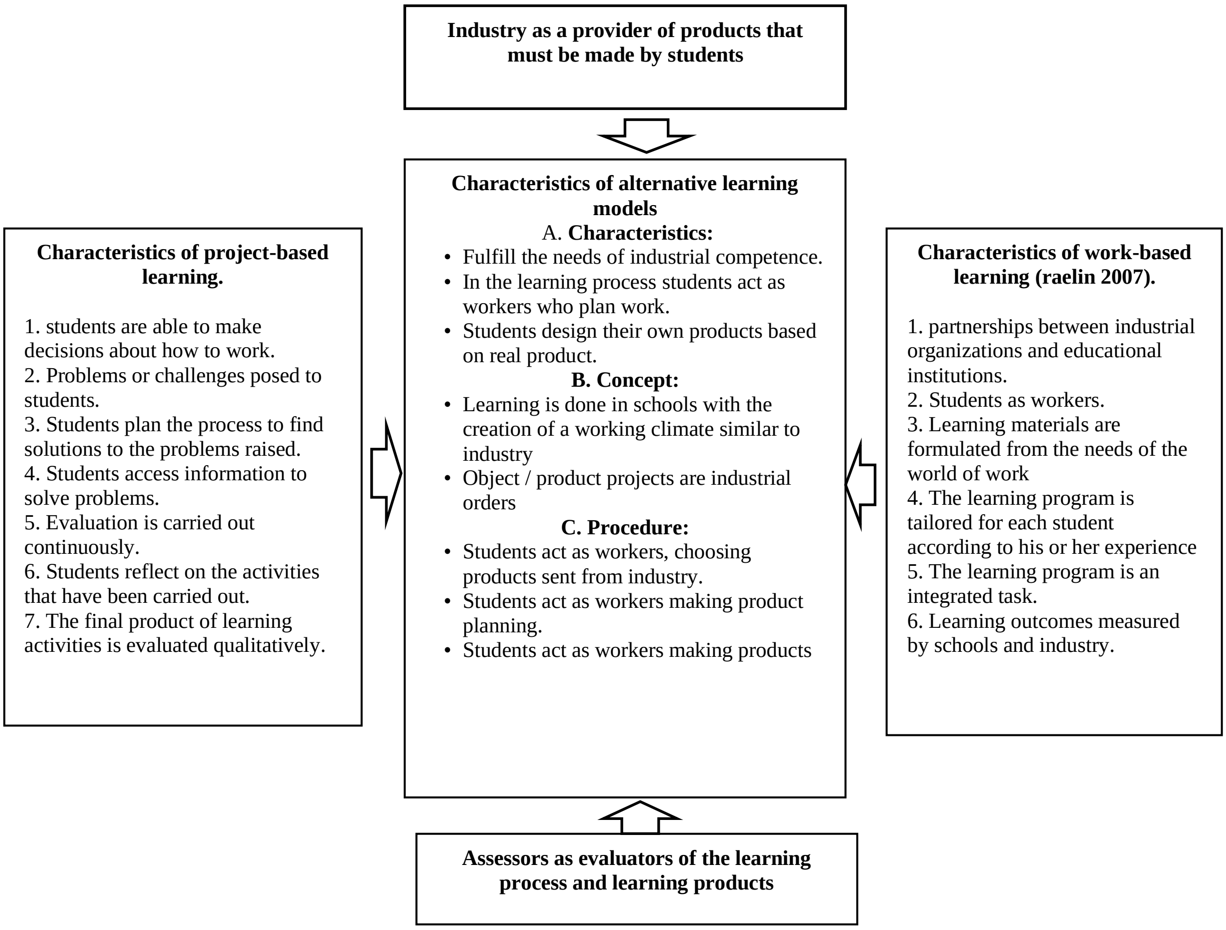

Fig. 2 - Concept of the adoption of forms of learning

4. Method

The design-based research (Reeves, McKenney, & Herrington, 2011) was implemented to propose a new learning model. This study uses descriptive-analytic, involved four main data collection techniques; namely, 1) Interviews with teachers and partners from industries; the major purpose was to gather data orientation regarding the steps of preparing product design; 2) Focus Group Discussion (FGD) was implemented involving expert teachers from selected schools (vocational school; SMK), industrial practitioners, and a representative from professional certification bodies, the main purpose was to capture the data orientation regarding characteristics of the learning model that adopting the project-based learning (PBL) and work-based learning (WBL); 3) Observation was implemented to capture the data regarding the relevancy of learning outcomes and the demands of competency standards in the actual practical learning environment in a vocational school; 4) Document analysis was to finalize the suitability of competencies that meet the standard.

4.1 Interview with Teacher and Industry Parties

An interview session was conducted by the researcher involved 9 teachers and 4 industry representatives. Participants were selected based on several criteria including the area of expertise and minimum experience in their respective fields. The interview was conducted face-to-face in their respective office, with an audio recorder and field notes. Participants were made to understand and agree by filling up the consent form. Two sets of interview protocols were developed for teachers and industry participants, but mostly pertaining to the implementation of curriculum, steps and work process, standard task and competencies, and unit of competencies. The data was transcribed and processed/compiled and clarified to the participants to be used as final data. The detailed information is shown in Table 1.

Table 1 - Interview participants, areas of expertise and criteria

Teacher participant	Areas of expertise	Participant Criteria	Question instrument
• SMK 2 Bandung • SMK 2 Bandung • SMK 2 Bandung • SMK 6 Bandung • SMK 6 Bandung • SMK 6 Bandung • SMK 12 Bandung • SMK 12 Bandung • SMK 12 Bandung	• Machining • CNC • Metal fabrication • Machining • CNC • Metal fabrication • Machining • CNC • Metal fabrication	• Minimum 5 years teaching experience • Have a teacher certificate	a. Implementation of machining practicum. b. Product manufacturing steps c. Implementation of K3.
• PT. Surya Pratama Logam • PT. Dirgantara Indonesia • CV Mandiri Teknik	• Manufacturing Engineering • Manufacturing Engineering. • Manufacturing Engineering	• Experience as / field at least 8 years • Have a competency certificate	a. Working standard of machining operator. b. Work competence in the industry
• Professional Certification Institute (LSP) for Metal Machinery Indonesia	Professional certification	• Master Assessor	Units of competence that must be mastered by a machining operator

*Note: SMK is a vocational school.

4.2 Focus Group Discussion (FGD) and Data Analysis

FGD was utilized to obtain the characteristics of the learning model that adopted the project-based learning (PBL) and work-based learning (WBL) involving expert participants from industry practitioners, vocational school teachers (mechanical engineering) and a representative from professional certification bodies. The FGD was held at SMK 2 Bandung, guided by the researchers, involved 12 expert teachers in mechanical engineering and five industry experts representative. A set of questions were used to guide the discussion, including learning materials and content, competency standard, and appropriate step and strategies for delivery.

The data were analysed by taking into account the principles of developing learning materials, namely the principles of relevance, consistency, and adequacy. Meanwhile, the analysis of the steps of the learning model and competency standards are adjusted to suit the learning material that will be delivered to students. Participants who were selected as subjects for the interview are shown in Table 2.

Tabel 2 - FGD participants

Participant origin	Participant position	Number of participants	Subject of discussion
• SMK 2 Bandung • SMK 6 Bandung • SMK 12 Bandung	• Headmaster • Deputy Principal for Curriculum. • Productive teachers of mechanical engineering skills program	• 3 principals • 3 principals • 6 teachers	a. Learning materials/content to be designed b. Competency standards mastered by SMK graduates to face the demands of the industrial world c. The steps of the learning model to convey the material to students
• PT. Surya Pratama Logam • PT. Dirgantara Indonesia • CV Mandiri Teknik	• Senior operator in manufacturing	• 3 principals	
• LSP Logam Mesin Indonesia	Master Assessor	• 2 principals	

*Note: SMK is a vocational school.

4.3 Observation

Observations were carried out in several schools including SMK 2, SMK 6, and SMK 16 in Bandung. The specific schedule was planned for observation during weekdays at each venue. It was carried out by researchers and assisted by students from the Mechanical Engineering Education Study Program in Universitas Pendidikan Indonesia. A set of the checklist was used to ease the data collection. The checklist was designed based on the supporting learning materials for the implementation of product manufacturing practices (see Table 3). The data were analysed using frequency analysis.

Table 3 - A list of questions to determine the competence of each subject

No	Question	Yes	No	Note
1	Can you make working drawings (orthogonal projections) with American and European systems?			
2	Are you skilled at including the size and various marks of workmanship on technical drawings?			
3	Are you able to choose a suitable material as a material for making products?			
4	Can you select machining parameters.			
5	Can you install workpieces in the machining process.			
6	Can you sharpen the chisel.			
7	Can you do work with a lathe.			
8	Can you explain the function of work safety tools in the field of machining,			
9	Can you apply work safety.			
10	Can you make a budget plan for making a product.			

4.4 Document Analysis

The document analysis was implemented to finalise the suitability of competencies that meet the standard. In this case, a number of practical materials documents provided to students with the number of competencies required by workers in the industry were collected. Most of the documents were collected from SMK, including the Semester Learning Plan (RPS) of the Mechanical Engineering Education Study Program, which includes indicators that have been determined by productive teachers to achieve competency standards. To organize the data into a simplified version, a matrix table was used to record and identify the competency and standards that appear in these documents. A list of competencies was produced and compared to the applicable competency units from the industry.

4.5 Data Analysis

Generally, all sources of data collection produced in the previous exercise were collected and a triangulation approach was performed in designing the project-based learning model. The data was compared with the theories and current research results obtained from the literature. Detailed information regarding the obtainment of the literature review is explained elsewhere (Nandiyanto et al., 2020d; Azizah, Maryanti, & Nandiyanto, 2021; Husaeni & Nandiyanto, 2022).

The next step was testing the model. A complete set of instructions was designed and implemented into students who enrolled in a specific course (ie Technical Drawing, Engineering Material, Machining Engineering, Occupational Health and Safety, Cost Accounting /Entrepreneurship) involved 32 students for 8 weeks (1 week = 2 meetings; 1 meeting = 4 hours). To test the effectiveness of the session, a set of the instrument was used (see Table 3) indicating students achievement. From the data, we observe competence by using data analysis. Specifically, the research procedure is presented in Figure 3.

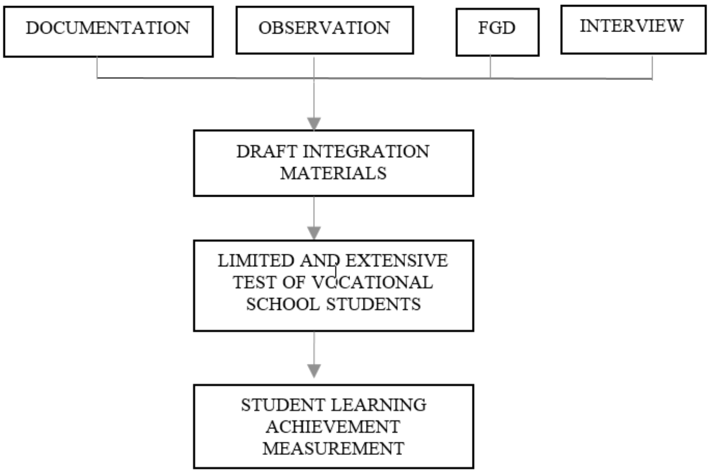

Fig. 3 - Research method and flow

5. Results and Discussion

5.1 Interview

The results of interviews with participants from the industry on the questions had yielded interesting findings, typically regarding standards and competencies of working with machining operators. For the standards; students in carrying out practice at school must apply work standards in the industry, the equipment used in practice in schools should have the same standards as the industry, and the number of facilities and infrastructure must have a good ratio between the number of students and the number of machines needed. As for the work competence; learning materials in the machining course must refer to the Indonesian National Work Qualification Standards (SKKNI), and students are required to master industrial work competencies so that in carrying out practices in schools in accordance with workers in the industry.

In addition, the results of interviews with productive teachers were regarding the specified implementation of machining practice, the implementation of machining practices in schools is carried out in accordance with the specified learning module, and the machining practice carried out refers to the SKKNI so that students can master the competencies. Teachers have raised concerns on the steps for making the product, the steps for making the product have been determined as stated in the worksheet, and the technique of checking the quality of the resulting product uses standard measuring instruments. Also, teachers highlighted the implementation of Occupational Safety and Health in terms of; all students must understand the function of work safety equipment, and all students use personal protective equipment during practice.

Meanwhile, results of interviews with participants from LSP with questions about Units of competence that must be mastered by a machining operator; if the student who acts as a machining operator must master the unit of competence in the field of machinery. Examples of competency units from lathe machining include: Applying Occupational Health and Safety (K3) principles in the workplace, Implementing quality procedures, Measuring using measuring tools, Taking precise measurements, Reading technical drawings, Conducting product inspections, Planning production, Using hand tools, Basic turning, and Complex turning. Furthermore, if the student has mastered the competency unit, the student can take the competency test conducted by the LSP. So that students are able to face the demands of the industrial world.

5.2 Focus Group Discussion (FGD)

Based on the Focus Group Discussion result, competency standards that apply in the industry must be in line with the learning program to produce quality learning outcomes. The agreement of all FGD participants was that practical learning carried out in Vocational Schools must apply industrial competency standards and the learning has an industrial climate where students act as industrial workers. The FGD participants will have their respective roles in producing SMK graduates. The conclusion of the results of the FGD activities regarding the relevance of the material, competency standards and learning flow as well as the role of each institution can be seen in Figure 4

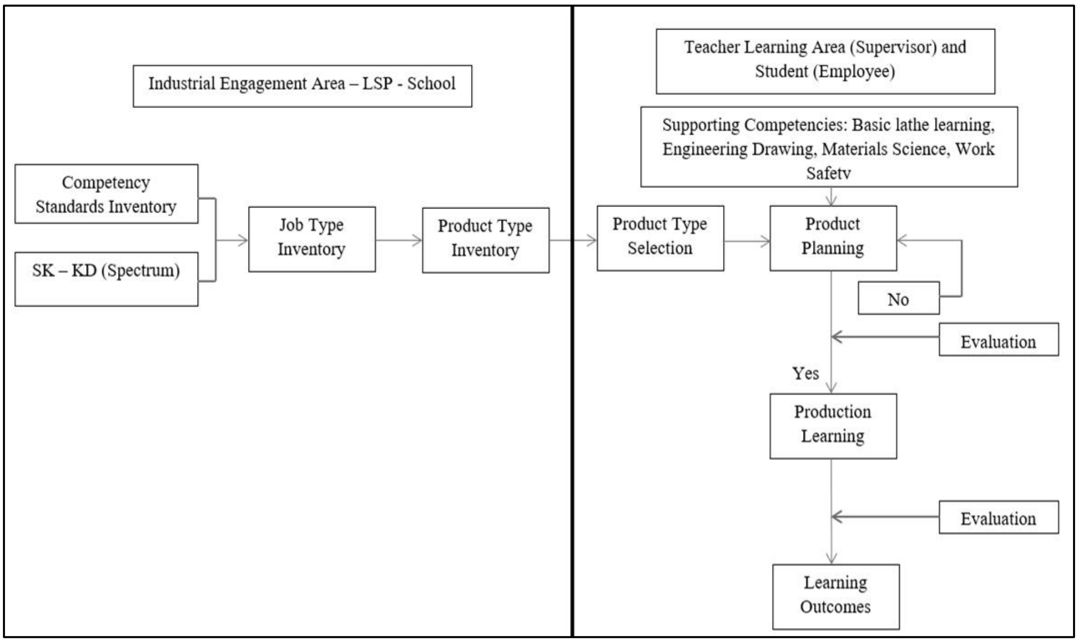

Fig. 4 - Steps of the Learning Model as a result of the FGD

5.3 Observation

Based on the observation, the competence of each student who became a respondent in the observation can be seen in table 4. The number of respondents in this activity was 32 students.

Table 4 - The results of observations about student competencies in each subject

Student	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	TOTAL
1	1	1	1	1	1	1	1	1	1	1	9
2	1	0	1	1	1	1	1	1	1	1	8
3	1	1	1	1	1	1	1	1	1	0	8
4	1	1	1	1	1	1	1	1	1	0	8
5	1	1	1	1	1	1	1	1	1	1	9
6	1	1	1	1	1	1	1	1	1	1	9
7	1	1	1	1	1	1	1	1	1	0	8
8	1	1	1	1	1	1	1	1	1	1	9
9	1	1	1	1	1	1	1	1	1	1	9
10	1	1	1	1	1	1	1	1	1	1	9
11	1	1	1	1	1	1	1	1	1	1	9
12	1	1	1	1	1	1	1	1	1	1	9
13	1	1	1	1	1	1	1	1	1	1	9
14	1	1	1	1	1	1	1	1	1	1	9
15	1	1	1	1	1	1	1	1	1	1	9
16	1	1	1	1	1	1	1	1	1	1	9
17	1	1	1	1	1	1	1	1	1	1	9
18	1	1	1	1	1	1	1	1	1	1	9
19	1	1	1	1	1	1	1	1	1	1	9
20	1	1	1	1	1	1	1	1	1	1	9
21	1	1	1	1	1	1	1	1	1	1	9
23	1	1	1	1	1	1	1	1	1	1	9
24	1	1	1	1	1	1	1	1	1	1	9
25	1	1	1	1	1	1	1	1	1	1	9
26	1	1	1	1	1	1	1	1	1	0	8
27	1	1	1	1	1	1	1	1	1	1	9

28	1	1	1	1	1	1	1	1	1	1	9
29	1	1	1	1	1	1	1	1	1	0	8
30	1	1	1	1	1	1	1	1	1	1	9
31	1	1	1	1	1	1	1	1	1	1	9
32	1	1	1	1	1	1	1	1	1	1	9

Based on this finding, it can be concluded that students' competence in machining activities has a good value. These student competencies will be used in the preparation of alternative learning models.

5.3 Document Analysis

The amount of material provided in schools must be in line with industrial work competencies so that SMK graduates are able to face the demands of the industrial world. To see the relevance of the learning material with the SKKNI being taught, a documentation study was conducted. Documentation analysis were conducted on the core material of the learning activities, namely the practice of making products. The data needed will be seen from the Semester Program Plan (RPS) for lathe machining engineering subjects. The material to be taken is an indicator of learning achievement indicators for lathe machining engineering subjects. Then these data will be compared with the competency elements in the Competence in the Indonesian National Work Competency Standards (SKKNI). As a result of matrix table analysis, as shown in Tables 5 and 6.

Table 5 - Relevance of machining engineering material taught with competency elements in SKKNI

No	Indicator on RPS	Competency Element in SKKNI
1	Able to explain in general the SOP for machine workshop practices	Determine the work steps
2	Able to do workpiece installation on lathe	Installing the workpiece on the lathe
3	Able to sharpen lathe chisel skillfully	Selecting and preparing cutting tools
4	a) Capable of making stratified outer and inner diameters with angled surfaces. b) Able to cartel, make outer and inner tapers, make outer and inner rectangular threads	Doing complex turning

Table 6 - Relevance of engineering drawing material taught with competency elements in SKKNI

No	Indicator on RPS	Competency Element in SKKNI
1	Able to make orthogonal images Able to perform image validation.	Choosing technical drawing
2	Able to distinguish drawings of components, assemblies or drawings of arrangement. Able to identify dimensions appropriately to meet needs. Able to apply symbols in technical drawings	Interpreting technical drawings

5.4 Data Triangulation

The results of triangulation of data from FGDs, observations, documentation and interviews obtained the core activities of the learning model called self-design-project learning (SDPL) which include:

a) Preliminary stage.
Step 1, students act as workers receiving/choosing the type of product to be worked on. Workers check samples of products to be made.

b) Core Stage
Step 2, workers make product manufacturing plans including preparation of 1) The importance of the product to be made; 2) Explain the function of the product/service; 3) Making sketches/ working drawings; 4) Analyze the materials used; 5) Determine facilities/equipment; 6) Determine the production process (steps/work systematics); 7) Make a budget plan; 8) Analyze target market/user, and 9) Designing the implementation schedule.
Step 3, workers make products according to the results of planning by implementing occupational safety and health, work steps according to SOPs and carry out quality control, matching sizes, levels of precision,

workpiece functions in accordance with the work drawings made. The indicators that students must master from each of the points above can be seen in Table 7.

Table 7 - Indicators of student ability at the product design stage

No.	Planning Steps	Capability Indicators
1	The importance of the product to be made	a. Can describe in general about technology b. Can explain the importance of a product made. c. Can mention problem identification of a theme/product to be made. d. Can mention problem identification of a theme/product to be made
2	Explain the function of the product/service.	a. Can mention the main parts of the product. b. Can explain product function
3	Making sketches/ working drawings	a. Can apply engineering drawing theory correctly b. Can make working drawings properly
4	Analyze the materials used	a. Can explain the reasons for choosing the material to be used for the product. b. Can choose materials that are suitable for a particular product
5	Determine facilities/equipment	a. Can explain the function of the facilities/equipment that will be used in the manufacture of the product b. Can mention the facilities/equipment used in the manufacture of the product.
6	Determine the production process (steps/work systematics)	a. Can determine work safety steps b. Can determine the order of work steps manufacture of products c. Determine the process of activities that will be made d. Make a flow-chart of the process
7	Make a budget plan	a. Can determine the time period used as the basis for preparing the production budget. b. Can determine the number of products to be produced c. Can determine the standard use of resources (raw materials, direct labor and use of facilities).
8	Analyse target market/user	a. Can identify users according to product functions b. Can identify target users according to their needs
9	Designing the implementation schedule	a. Can calculate the time of the manufacturing process b. Can determine the schedule for the execution of the manufacture according to the order

c) Closing stage
The teacher as the person in charge of the learning program observes and evaluates learning outcomes, processes and learning programs. From the three steps above, it can be described the steps for implementing this learning model as shown in Figure 5.

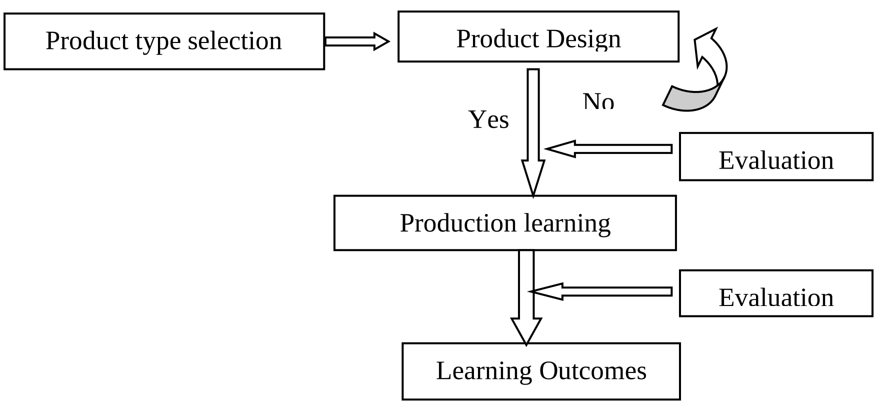

Fig. 5 - Schematic of the implementation of the self-design-project learning learning model

5.5 Learning Model Testing

In the process of testing this model, vocational students were shown various products from the industry. The product is a component which in this study is a component made using a lathe machining process. Before making the product, students are required to make a design about the product by explaining each point in part (core stage) above. Based on the results of this extensive trial, students' competence in terms of product planning has been able to meet the indicators of each pointof ability to compose a design. Besides that, with the increasing ability of students in planning a product, it can be stated that it can fulfil the core material of entrepreneurship subjects given in vocational school. So that through this learning it can be mentioned that there is an increase in the ability of students' entrepreneurial insight in the field of machining (Wijaya, 2007).

If students have made product plans, the next step is product manufacture. Students are required to collect the necessary tools such as chisels, measuring tools, the required keys, and other machine tools. When making products, students are prohibited from borrowing the tools used in their work. This is done so that students have good habits as well as being a worker in the industry.

The standard value of the product made by students will be used by the performance/skills assessment standard issued by the National professional certification body (BNSP), where there are five aspects/components to measure skills, namely work preparation, process (systematics & work methods), work results, work attitude and time. The average value of practice achieved by students (respondents) for each type of product work can be seen in table 8.

Table 8 - Average value achieved by students (respondents) in the product manufacturing test

No	Rated Components	Average Value Achieved by Respondents for Products:		
		Hammer handle	Head of hammer	Train connecting pen
1	Work preparation	9.5	9.5	9.5
2	Process (Systematics and How It Works),	9.4	9.3	9.5
3	Work result	9.3	9.4	9.3
4	Work attitude	9.5	9.5	9.5
5	Creation time (minutes)	85	55	45

From Table 8, based on the achievement of the lathe machining skills, it can be stated that all students are included in the competent category (in the value range of 9.00 - 10.00) which is able to meet the qualifications needed by the industry (Klotz, Billett, & Winther, 2014). The results of making this product are compared with the results made by workers in the industry where product samples are made, the quality of products made by students is close to the same or it can be said that the products made by students can be used.

Regarding the assessment of the time needed to work on the product by each student, about 84% (26 students) were able to complete the product according to the time they designed in the product planning document. Meanwhile, 16% (6 students) need more time (10%) than the time that has been designed by them in product planning. So it can be concluded that learning achievement by using self-designed learning models and learning where the conditions are industrial, student work competencies are achieved well (Hamdani, 2016).

There is an increase in quality in terms of using the right time (according to planning), because of the conditioning of learning to make products that are close to the actual conditions as an operator (Martawijaya, 2012, Metso, & Kianto, 2014). For example, is the fulfilment of the necessary tools for the manufacture of products before the manufacture of products is carried out. This method is important so that the time that must be taken in making the product continues without being constrained by waiting for the tool that is being used by other operators/students.

Like the current learning conditions, if students are going to carry out practical activities, the model used is by using a job sheet (Nandiyanto et al., 2020e; Nandiyanto et al., 2020f). In using this worksheet, students only carry out the commands listed in the worksheet without the ability to plan what they will make. So the effect is less developing their competence. In learning using self-design-based learning models, students can develop product designs, improve work competencies and entrepreneurial competencies in the field of mechanical engineering (Hamdani, 2016). In addition, if learning has an industrial climate, it will improve competence better.

From the results of the discussion, it was seen that there was an improvement in student competence using the self-design project-based learning model. Industrial nuanced learning will stimulate students' motivation to improve their competence.

6. Conclusion

The self-design project learning model is one of the learning alternatives that can improve the skills demanded by the industry. The self-design project learning model is a more flexible learning alternative in exploring knowledge. This research implies that the application of the self-design project learning model can produce student competence in both product planning and product manufacturing. The self-design project learning model is an alternative learning model, emphasizing work insights which include product planning, making work steps, cost planning and product quality control. For further research, it can be tested for other areas of expertise programs in vocational schools. The research results can be applied to the vocational learning process which is expected to improve students' ability to face industrial demands.

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