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Manufacturing Engineering Training for Vocational High Schools Students in East Priangan, West Java, Indonesia

Aceng Sambas[1*], Mujiarto[2], Gugun Gundara[3], Sri Ayu Fujilestari[4]

[1,2,3,4]*Departement of Mechanical Engineering, Universitas Muhammadiyah Tasikmalaya, Indonesia*

**Corresponding author email: acengs@umtas.ac.id*

Abstract:

The main problem in the manufacturing process in vocational schools is the limited number of manufacturing machines for the practical process because the equipment is very expensive. Therefore, the main objective of this activity is to provide training on manufacturing processes both theoretically and experimentally to vocational high school students in Tasikmalaya City. The results of this activity indicate that vocational high school students gain experience and knowledge in operating manufacturing machinery from start to finish.

Keywords: Internet of Thing, Smart agriculture, community services

1. Introduction

Manufacturing process training is carried out to support students' ability to implement product manufacturing processes using conventional lathes and milling machines (Simpson et al., 2017; Rosen, 2014; Plambeck & Ramdas, 2020). In manufacturing process training activities need to go through stages in order to produce products according to the desired specifications (Sutton et al., 2016; Lund & Karlsen, 2020). Understanding of material properties and characteristics as well as various machining processes carried out to form a product that has a function in accordance with what was previously planned (Hung & Leon, 2005; Bradley, 2022; Jackson et al., 2004). There are so many students who do not know about the manufacturing process, especially in the industrial sector (Bull et al., 2015).

All students who register or who become participants, many of them come from non-technical school backgrounds who do not study engineering fields, especially manufacturing. Therefore, holding this manufacturing process training is a new experience for students in the manufacturing sector. After this service activity, it is expected that Vocational High Schools Students in East Priangan are able to read technical drawings, be able to understand the stages of the manufacturing process, be able to choose materials that suit product needs, be able to make workpieces that have inner or outer threads, have a certain surface smoothness and are able to measure dimensions. workpieces according to manufacturing requirements.

Many studies related to manufacturing engineering training have been discussed by various world scientists. Gomez et al. (2008) presented of the the interactive teaching model developed by the education innovation group `New Teaching Methodologies in Mechanical and Manufacturing Engineering Technology' of the Polytechnic University of Madrid. They show that the fundamental advantage of this model is its efficiency in optimizing learning time, given that: (a) all the necessary resources are accessible to the student through electronic teaching support, (b) the laboratory practical classes take place in the same environment, as they are combined and connected to the theoretical concepts without any break in continuity. Martawijaya (2012) developed a learning model that can provide vocational senior high school students with an authentic industrial working experience in the manufacturing and production sector. He shows that TF-6M Model increases students' competences, is preferred by students, increases their time spent at work, and improves their soft and hard skills, motivation, sense of responsibility and work ethics. Megri et al. (2021) proposed teaching students to use Autodesk Inventor, use mathematics to solve engineering problems and use 3D printers. Additionally, the application of materials science is introduced to demonstrate the integration between mathematics and science. They found that the students not only to learn about 3D printing and advanced manufacturing and to help high school students select an engineering discipline for their career but also to help them make the appropriate decision in the choice of engineering discipline or even other disciplines, such as management or business, especially for minority students, who are often not supervised by their own families. Urgo et al. (2022) studied of the offering students a rich and realistic experience exploiting advanced digital tools. Also,

supporting and complementing traditional education schemes by increasing participation and involvement via serious gaming, enhanced by digital/virtual technologies. They have developed a serious game application for the design and analysis of manufacturing systems and also the results extensively analyzed in both quantitative and qualitative terms.

The main objective of this activity is to provide training on manufacturing processes both theoretically and experimentally to vocational high school students in Tasikmalaya City. The results of this activity indicate that vocational high school students gain experience and knowledge in operating manufacturing machinery from start to finish.

2. Material and Method

This service activity was carried out at the Muhammadiyah University of Tasikmalaya on November 20, 2022. Participants who took part in this activity came from SMA and SMK in Tasikmalaya City. In addition, the teachers also participated in this activity. The results to be achieved through this training are thinking skills which have an important role so that they know and are able to operate conventional lathes and conventional milling machines. We set a target that the output of this training could enable students to produce their own products at school.

The method used in this work is a workshop with expert sources in the field of manufacturing, regular training and mentoring, evaluation and monitoring of activities. The skill level of the trainees is measured through the application of the right group and the application of the use of conventional lathes and conventional milling machines. A competitive approach is used to motivate students to make optimal use of this manufacturing process training. The main objective is problem identification, formulation of problem solving, as well as in its implementation to evaluation. Figure 1 shows the method of implementing community service activities for manufacturing activity.

Figure 1: Methodology of community services

3. Results and Discussion

Prior to the manufacturing process training activities, we have observed and mapped problems related to the use/operation of conventional lathes and conventional milling machines. Observation of potential is carried out by conducting discussions with school teachers regarding the potential of students in the use and utilization of conventional lathes and conventional milling machines. The results of potential observations found that the use/operation of conventional lathe technology and conventional milling machines had not been thoroughly used and some even did not know about it. On the other hand, the existing machine tool facilities at schools have not been provided/utilized optimally. In fact, the use of machine tools is often used in the industrial sector for the manufacture of a product.

In the first part of the workshop, resource persons explained about the manufacturing process, occupational safety and health, the operation of conventional lathes, conventional milling machines and the use of measuring tools used. The type of lathe and milling machine used is a conventional lathe. Manufacturing is an industry that deals with the use of sophisticated equipment such as industrial machines, regular and measurable management programs to transform raw materials into finished goods and marketable products. Examples of manufacturing industries include textile companies, garment industries, handicraft industries, electronics industries, and automotive industries. The workshop activities at Bumdes Mulyajaya Ciamis can be seen in Figure 2.

Milling is a process of reducing material to form components or products by means of a rotating cutter and each tooth feeds and the table moves left and right so that the material moves following the movement of the work table, as a result there is an incision or cut by the HSS tool eye (Rahdiyanta et al., 2020; Jeong et al., 2018; Zhu et al., 2018). In this process there is an influence on the results of the surface roughness value due to shearing. In carrying out the milling machining process, the time needed to make a component or product must be as appropriate as possible in order to achieve the best production capacity, but in the process, one must also pay attention to the quality factor, namely the level of surface roughness produced (Baronio et al., 2016; Lee et al., 2017; Jiang et al., 2019). One way to see the quality of production goods that are considered good is usually characterized by good component surface quality (Periyanan et al., 2011; Yudiono et al., 2019; Abizar et al., 2021).

Figure 2: Manufacturing process practicum using machines

In practice, in the field, the training method is by introducing students to the operation of conventional lathes and milling machines. Students are given a group assignment to make a hammer product. First of all, students are given material (iron) to cut according to what is needed. Menwhile, so that this can be aligned, the manufacture of a product can be directly made using a machine, this can make the process easier and faster. For the manufacture of hammer handles it is done on a conventional lathe by means of which the iron is gripped in the chuck (fixed head) then the machine rotates and the chisel cuts the object until the diameter is according to what is needed. Furthermore, for the head of the hammer is done on a conventional milling machine in a way that the machine is turned on (the chisel rotates) and in cutting the workpiece, the table moves according to the surface to be removed.

4. Conclusion

In this paper, we have provided training to students in East Priangan regarding the manufacturing process in operating machine tools. The training activities were held on November 20 2022 at the Manufacturing Laboratory of the Muhammadiyah University of Tasikmalaya. The results of this service show that SMA/SMK students are starting to have knowledge and prepare skills for the industrial world. The implementation of this community service activity is constrained by supporting tools because the tools in the manufacturing lab are still limited. In addition, there is still no Work Instruction Sheet, so that the use in the manufacturing process still needs to be explained in detail.

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