JOURNAL OF COMMUNITY SERVICE IN SCIENCE AND ENGINEERING

P-ISSN: 2962-1003 E-ISSN: 2962-0767

Homepage jurnal: http://jurnal.untirta.ac.id/index.php/JoCSE/

Welding Training to enhance welding skills for youth in Cilegon City

Yeni Muriani Zulaida [1], Suryana Suryana, Agus Pramono, Andinnie Juniarsih, Indah Uswatun Hasanah

Department of Metallurgical Engineering, Faculty of Engineering, Universitas Sultan Ageng Tirtayasa, Jl Sudirman KM 3 Cilegon, Banten 42435, Indonesia

[1]E-mail: yeni_m_zulaida@untirta.ac.id

ARTICLE INFO

Article history:
Submitted 19 February 2024
Reviewed 29 February 2024
Received 10 March 2024
Accepted 20 March 2024
Available online on 1 April 2024

Keywords:
Welding training, Cilegon City, Purwakarta Sub-district.

Kata kunci:
Pelatihan pengelasan, Kota Cilegon, Kecamatan Purwakarta.

ABSTRACT

Cilegon is one of the cities in Banten. The large number of factories in Cilegon City makes this city known as an industrial city. Several industrial activities, ranging from primary to supporting activities, require a lot of labor. The need for labor in Cilegon, especially in the manufacturing sector, is increasing. To increase the competitiveness of local communities in obtaining more excellent employment opportunities, young people of productive age, especially, need to be equipped with skills that support industrial activities. One of these skills is metal welding. To introduce this skill, a welding training program was conducted for young people in Cilegon City. The methods used include lectures, demonstrations, and welding practice. The material provided during the training consists of an introduction to welding equipment, essential steps in the welding process, K3 in the welding industry, and home industry planning in the field of metal welding. This training successfully attracted several young people from Grogol and Purwakarta sub-districts. After this training, they can improve their skills, expand job opportunities, and even become self-employed in welding.

ABSTRAK

Cilegon adalah salah satu kota di Banten. Banyaknya pabrik-pabrik di Kota Cilegon membuat kota ini disebut sebagai kota industri. Beberapa kegiatan industri mulai dari kegiatan utama hingga kegiatan pendukung membutuhkan banyak tenaga kerja. Kebutuhan tenaga kerja di kota Cilegon terutama di bidang manufaktur meningkat. Untuk meningkatkan daya saing masyarakat lokal dalam mendapatkan peluang kerja yang lebih besar, khusus para pemuda usia produktif, perlu dibekali keahlian yang menunjang kegiatan industri tersebut. Salah satu keahlian tersebut adalah pengelasan logam. Dalam rangka mengenalkan keahlian ini maka dilaksanakan kegiatan program pelatihan pengelasan bagi para pemuda di Kota Cilegon. Metode yang digunakan meliputi ceramah, demonstrasi dan praktek pengelasan. Materi yang diberikan selama pelatihan meliputi pengenalan peralatan pengelasan, langkah-langkah dasar proses pengelasan, K3 pada industri pengelasan dan perencanaan industri rumahan di bidang pengelasan logam. Pelatihan ini berhasil menjaring beberapa pemuda dari kecamatan Grogol dan Purwakarta, Diharapkan setelah pelatihan ini dapat meningkatkan keahlian, memperluas peluang kerja bahkan dapat berwiraswasta di bidang pengelasan.

Available online at http://dx.doi.org/10.36055/jocse.v3i1.24356.

1. Introduction

Community service is a concept where individuals or groups have the awareness and responsibility to actively contribute positively to the surrounding community. The service includes various activities to improve community welfare, solve social problems, and positively impact a local, national, or even global scale. Community service activities can include social service activities, community education, economic empowerment, public health programs, environmental conservation, and many other activities that can positively contribute to and increase the community.

The Tri Dharma of Higher Education is a fundamental concept determining the three main functions universities must carry out. Indonesia and several other countries implementing similar higher education systems adopt an education system with three main pillars: education, education, and community service. The primary functions are education, research, and community service [1]. Universities provide higher education to form and develop quality human resources for educational purposes. The educational function includes organizing lectures, laboratories, and other academic activities aimed at

transferring knowledge and skills to students. In the research function, universities carry out scientific research activities by lecturers and students to produce new knowledge and innovation and contribute to the progress of science and technology. Research in higher education can solve various societal problems. The third function is community service. Universities contribute to overcoming social and economic issues. The contributions include applying knowledge and skills higher education institutions possess to benefit society directly. This activity is also known as community service or community service. Community service activities are carried out by members of educational institutions, including lecturers, education staff, and students [2].

Cilegon is an industrial city because many factories are built there. The need for labor is one of the concerns in industrial activities. Competition for jobs occurs between residents and outside the area. Many prospective local workers cannot compete with prospective foreign workers because of inadequate skills. The problem is the aim of carrying out community service activities by the Department of Metallurgical Engineering, Universitas Sultan Ageng Tirtayasa (Untirta). Activities are aimed at people living near the Faculty of Engineering, Untirta. The two sub-districts that were chosen were Grogol Sub-district and Purwakarta Sub-district. Apart from being close to institutional locations, these two sub-districts are also very close to the Cilegon Industrial Area. Based on Cilegon statistical data, around 68.31% and 68.94% of the population of Grogol District and Purwakarta District are of productive age [3-4].

Metallurgy is a branch of engineering that studies metals' physical and chemical properties and the techniques used in processing, producing, and using metals. The field of welding is one of the studies related to metallurgy production. Metallurgy is essential in various industries, including automotive, building, aviation, electronics, and manufacturing. One of the labor needs in Cilegon City is in the manufacturing sector. Young people who are productive need to be given supporting skills to make local communities more competitive. One of these skills is metal welding. A welding training program was implemented for youth in Cilegon City to increase added value for society. This training aims to contribute from educational institutions, especially metallurgical study programs, to the community in metal welding. Through this training activity, it is hoped that young people in Cilegon can improve their skills, expand job opportunities, and even become entrepreneurs in the welding field.

Welding is a process of joining two or more metal materials by melting or pressing the materials so that molecular bonding occurs between the metals. This process usually uses a high heat source, such as an electric arc or hot gas, to melt metal or filler material, forming a solid connection after cooling. The welding process generally involves several stages, including surface preparation, work material preparation, filler material selection, and control of temperature and cooling speed. Various welding techniques include electric arc welding (SMAW, GTAW, or GMAW electric arc welding), resistance welding, gas welding (such as oxyacetylene welding), and many more. Welding has various applications in various fields, from the manufacturing industry, construction, and vehicle repair to engineering projects. This process is essential for creating sturdy and durable structures and is used to assemble and repair various metal products [5].

Electric arc welding is the welding most widely used in industry, one of which is Shielded Metal Arc Welding (SMAW) or SMA welding. This welding, also known as protected electrode arc welding or stick welding, is a commonly used welding method. In the SMAW process, an electric arc is formed between the flux-coated electrode and the work material to be connected. Following are the basic steps of the SMAW process:

1. Surface Preparation: Metal surfaces must be cleaned of dirt, oxide, and paint to ensure good welding results.
2. Electrode Selection: The electrode is selected according to the type of metal to be welded and the specific welding requirements.
3. Arrangement of Work Materials: Cut or arrange work materials according to design and specifications.
4. Electrode Positioning: The electrode must be oriented correctly to achieve optimal welding results.
5. Arc Formation: An electric arc is formed by touching an electrode to a metal surface and then pulling it back slightly.
6. Welding: During arc formation, the electrode melts and forms a filler material that fills the gap between the work materials.
7. Protective Flux: The electrode's flux coating is removed during welding, forming a protective layer that protects the molten metal from oxidation and atmospheric contamination.
8. Cooling: The joint formed is cooled and solidified after welding.

SMA welding has advantages that include its ability to work in various conditions, including outdoors and in harsh environments. However, the limitations of this process include lower productivity compared to some other arc welding methods. One of the factors that can increase the productivity of the welding process is the welding position. Welding position refers to the relative position of the workpiece or material being welded to the position of the welder or welding operator. Some common welding positions used in welding are the flat, horizontal, vertical, and overhead positions [6]. In this training, flat and horizontal positions will be used. Based on the AWS D1.1 standard, these two positions have 2 types of welding: for the flat position, there are types 1F and 1G, and in the horizontal position, there are types 2F and 2G. The requirement for the workpiece to be able to be rotated in both positions is shown in Figure 1. Usually, basic welding training uses these two positions.

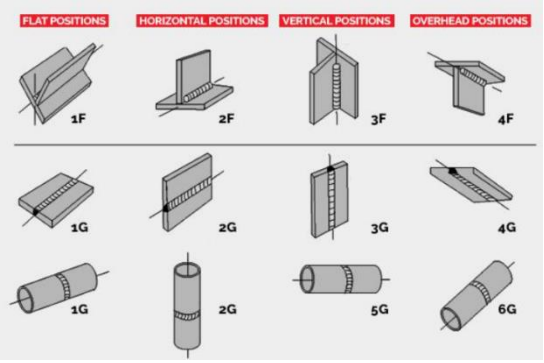

Figure 1. Welding position.

Training methods in welding include various approaches used, such as the approach to knowledge, skills, and attitudes of training participants. Several training methods are commonly used, namely:

1. Classroom instruction.
2. Practice welding.
3. Welding simulation.

4. On the Job Training (OJT) or collaborative training.
5. Preparation for certification.
6. Continuing education and professional development.

The training includes instruction classes by giving lectures covering the theory of welding, exceptionally high school welding, instructions on the basic steps of the welding process, and work safety and security in the welding field [7]. Then, simulate welding through a welding demonstration carried out by the instructor and continue with welding practice.

2. Method

The implementation of the activity is somewhat limited because it is still during the 2019 Covid pandemic. This activity should be attended by many participants but only with a maximum limit of twelve participants while adhering to strict health protocols. Training activities were carried out for three days using lecture, demonstration and practice methods.
Metoda Ceramah

2.1. Lecture Method

This lecture method is used to provide general knowledge related to the basic theory of metal welding, especially the Shielded Metal Arc Welding (SMAW) welding process. The reason for choosing the SMAW welding process in training is because this process is the easiest and cheapest among other types of electric arc welding processes. The lecture material includes basic knowledge of SMA welding, welding positions and an introduction to several technical codes for welding, using SMA welding machines, planning to create a welding workshop and material related to occupational health and safety.

2.2. Welding Demonstration Method

The following training method is the demonstration method. In this activity, the welding instructor shows the participants the steps that must be taken when starting welding, from the preparation stages, welding work and final work. The instructor also explains how to read the welding procedure specification (WPS). The purpose of this activity is to provide an overview of the work that will be carried out by training participants. What steps need to be taken and paid attention to. Anything that has the potential to be dangerous in the welding process. After the instructor demonstrated the welding process using this method, the participants were invited to try it themselves as demonstrated.

2.3. Practice Method

The welding practical activity is divided into two stages, the first stage is carrying out basic welding practice and the second is that participants must complete a project by making a product that has been determined by the activity committee. In basic welding practice, participants are asked to be able to carry out ridge welding, welding in positions 1F and 2F. This activity aims to introduce participants to the welding process in the field. Next, participants are given the task of working on a project to make a shoe rack or flower rack. To facilitate field practice, the training committee has prepared welding equipment in the form of:

a. SMAW welding machine;
b. Hammer;
c. Metal brush;
d. Electrodes;
e. Safety clothing (chest and hand apron);
f. Google;
g. Grinding.

3. Results and Discussion

On the first day, the instructor's material included an introduction to the SMAW welding method, welding equipment, welding workshop management, and occupational health and safety. The training was conducted during the pandemic, so participants' seats were spaced according to health protocol regulations. The placement of participant chairs is carried out as shown in Figure 2.

Figure 2. The instructor provides welding material.

On the second day, the training began by demonstrating how the instructor did welding. Before the participants tried the welding process directly, the instructors provided examples and directions regarding welding equipment, procedures for using welding machines and welding equipment, and welding safety. Next, the participants tried individually with specimens prepared by the committee, as seen in Figures 3 (a) and 3 (b). During welding practice, participants are still accompanied by an instructor who always provides direction. The basic welding technique for the specimens provided is 4 plates with a width of 5 cm and a length of 10 cm. The results of the first welding activity showed that the weld results still needed to be neat and good. Welding practice was carried out several times, alternating between participants, as seen in Figure 4. After carrying out the welding process several times, the primary welding results were getting better and neater. In the next activity, the participants were given a project assignment to make a welding product.

(a)  (b) 

Figure 3. (a) The instructor gives examples; (b) Participants carry out welding practice accompanied by an instructor.

In project assignments, participants are divided into several groups. One group consists of 2 people. Each group must complete a welding project. Participants are asked to be able to make a shoe rack or flower rack by starting to plan the welding stages. The committee has determined the product design. The materials used are angle iron and concrete rods. The iron pieces are then cut according to the design given by the participants. After the iron has become components of the appropriate size, the connection is carried out using the SMAW welding process, as shown in Figure 5.

Figure 4. Basic weld results.

After being cut according to the existing guidelines, each iron component begins to be connected. The instructor accompanies and directs the steps that must be taken so that the weld results are promising, symmetrical and do not bounce. Participants must understand the sequence of the welding process. After welding, the welding results begin to form one by one, as seen in Figure 6. This multi-purpose rack has a simple design, making it easy for beginners to make. The welding results on the project task are neater.

Figure 5. Welding project work process.

Figure 6. Products resulting from training participants' welding.

At the end of the training activities, an evaluation process was carried out on implementing the activities, which were carried out for three consecutive days. The evaluation questionnaire results in Table 1 show good welding results. These results show that the other participants showed readiness and enthusiasm for activities. The three-day training period yielded significant results; there were changes in the participants' welding abilities. Some participants who, at the beginning of the training, did not know or understand the SMAW welding process were able to make a simple welded product at the end of the training. Participants who already have essential welding experience show an increase in the neatness of the welding results.

Table 1. Participants' responses to welding training activities.

No	Pertanyaan	SS	S	N	TS	S
1	Instuktur dapat menyampaikan materi dengan baik	5	6	-	-	-
2	Instruktur/pemateri menguasai materi pelatihan	7	4	-	-	-
3	Materi pelatihan bermanfaat	5	5	1	-	-
4	Materi Pelatihan mudah dipahami	4	5	2	-	-
5	Waktu pelatihan seuai baik teori maupun praktek	4	4	3	-	-
6	Selama kegiatan, kebersihan, kesehatan, keselamatan kerja sudah baik	6	4	1	-	-
7	Materi Teori dan praktek berkaitan	6	4	1	-	-
8	Kegiatan sesuai dengan protokol kesehatan	7	3	1	-	-

Based on the questionnaire results, several things can be evaluated in this activity, one of which is that the material provided could be easier to understand. The difficulties may be due to the terms in welding being strange for the participants because there are usually different terms or designations at the welding level. Likewise, theoretical problems that must have a scientific basis make them challenging and easier to understand. Improvements can be made by providing more straightforward and easier-to-understand material adapted to the participants' conditions. Another area for improvement is training time. Participants felt more than three days were needed to learn the welding process. The participants hope this training can be carried out over an extended period. Improvements will be made to get better results.

4. Conclusion

This welding training activity for Cilegon City youth skills has been successfully implemented. This activity is very popular with the community, especially young people, as can be seen from the enthusiastic attitude seen when carrying out welding practice. The result of the activity is an increase in the knowledge and skills of the participants with welding results that produce quite good welding products. The activity participants stated that the learning material was easy to understand and matched the theory provided with practice in the field.

Acknowledgement

We want to thank the Faculty of Engineering Untirta, for financial support in carrying out community service activities sourced from Internal Research Grants from the Faculty of Engineering Untirta in the Community Partnership Program (PKM) Scheme and the Department of Metallurgical Engineering Untirta for support of laboratory facilities and welding equipment for practical welding activities on training.

REFERENCE

[1] Olo, D., Correia, L., & Rego, C. (2021). Higher education institutions and development: Missions, models, and challenges. *Journal of Social Studies Education Research*, vol. 12, no. 2, pp. 1-25.

[2] Serow, R. C., & Dreyden, J. I. (1990). Community service among college and university students: Individual and institutional relationships. *Adolescence*, vol. 25, no. 99, pp. 553-566.

[3] Badan Pusat Statistik Kota Cilegon. (2021). *Kecamatan Grogol dalam Angka 2021*. Cilegon: Badan Pusat Statistik Kota Cilegon.

[4] Badan Pusat Statistik Kota Cilegon. (2021). *Kecamatan Purwakarta dalam Angka 2021*. Cilegon: Badan Pusat Statistik Kota Cilegon.

[5] Wiryosumarto, H., & Okumura, T. (2000). *Teknologi Pengelasan Logam, 8th ed*. Jakarta: PT. Pradnya Paramita.

[6] American Welding Society. (2020). *Structural Welding Code Steel*. Florida: American Welding Society.

[7] Blunt, J., & Balchin, N. C. (2002). *Health and safety in welding and allied processes*. Cambridge: Woodhead Publishing Ltd..