International Journal of Modern Education
EISSN: 2637-0905
Volume 6 Issue 23 (December 2024) PP. 97-109
DOI: 10.35631/IJMOE.623008

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

THE EFFICIENCY OF UPSKILLING GRADUATE DIPLOMA STUDENTS AT MALAYSIAN VOCATIONAL COLLEGES IN 3G SMAW WELDING WORK – A CASE STUDY

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Article Info:

Article history:
Received date: 30.09.2024
Revised date: 10.10.2024
Accepted date: 12.11.2024
Published date: 16.12.2024

To cite this document:

Ahyan, N. A. M., Nasir, N. S. M., Muhamad, M. R., & Noh, N. H. (2024). The Efficiency Of Upskilling Graduate Diploma Students At Malaysian Vocational Colleges In 3G Smaw Welding Work – A Case Study. *International Journal of Modern Education, 6* (23), 97-109.

DOI: 10.35631/IJMOE.623008

Abstract:

This article examines the effectiveness of upskilling initiatives for Graduate Diploma students in vocational colleges in Malaysia. Thirty Kolej Vokasional Tanjung Piai graduates who took a 3G SMAW (Shielded Metal Arc Welding) course at CIDB Technologies Sdn Bhd, Johor are the focus of this case study. In a rapidly evolving industrial setting, the study aims to assess the degree to which the upskilling program enhanced the participants' overall employability and welding skills. Survey data showed that participants were satisfied with the upskilling program's content, emphasizing how applicable it was to their professional growth and the useful skills they had learned. Additionally, participants offered insightful comments that suggested a number of improvements to boost the training's efficacy, including greater practical experience, easier access to contemporary equipment, and more thorough safety instruction. The results highlight how crucial it is for vocational education programs to be continuously improved in order to satisfy industry expectations and give graduates employable skills.

Keywords:

3G SMAW; Upskilling; Vocational; Welding

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EISSN: 2637-0905
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Introduction

Highly trained workers are becoming more and more in demand in the quickly changing modern industrial scene, particularly in specialized sectors like welding. As reported by The Malaysian Department of Statistics, for the second quarter of 2022, the number of jobs in the semi-skilled category remained dominant in the labour market at 62.2% (5.364 million), while highly skilled jobs accounted for only 24.9% (2.144 million). This indicates a significant skills gap, as the number of highly skilled workers in Malaysia remains lower than the target needed for economic competitiveness, emphasizing the urgent need for upskilling initiatives in various sectors, including welding (MIDA, 2023). Additionally, according to the Ministry of Human Resources, Malaysia, there is a projected demand for approximately 40,000 skilled welders by 2025 to meet the needs of various industries, including construction, automotive, and manufacturing (The Star, 2024).

3G SMAW (Shielded Metal Arc Welding) welding has emerged as a crucial skill needed in several vital industries in Malaysia, including manufacturing, construction, and the oil and gas sector (Hargiyarto et al., 2020). In light of this strong demand, SMAW's 3G welding upskilling program becomes a crucial part of vocational college diploma students' career development. Since SMAW is one of the versatile and appropriate welding techniques for a variety of metal work, proficiency in this technique is highly valued (Red-D-Arc, 2020). These abilities give vocational college graduates a competitive edge in the labor market and equip them to handle real-world demands that call for extensive training and expertise (Jamey M., 2017).

Upskilling is essential to ensure that students acquire the latest skills, which demanded in today's dynamic job market. Bridging the gap between traditional craftsmanship and modern technological demands necessitates targeted retraining and upskilling initiatives (Li, L., 2022). In the context of welding, proficiency in 3G SMAW is particularly valuable, as it enables students to perform vertical welding, a skill widely used in various industries such as manufacturing and construction. As the demand for qualified professionals in these sectors continues to rise, training focused on this welding technique becomes increasingly critical. Therefore, this study aims to evaluate the effectiveness of the 3G SMAW welding upskilling program at Malaysian vocational colleges in enhancing students' technical competencies and preparing them for employment in high-demand fields like manufacturing, construction, and oil and gas. Additionally, this paper will identify the challenges in accessing and completing the 3G SMAW training curriculum, by proposing strategies to ensure equitable access to high-quality vocational education and training resources.

Literature Review

Significantly, studies on upskilling in welding show that targeted training programs improve welders' proficiency and efficiency, specifically in advanced techniques like 3G SMAW. Upskilling may help welders develop practical expertise in specialized welding processes, as well as their competency and confidence. For example, virtual reality (VR) technology has been found able to enhance welding skill acquisition. It compares different training methods, including VR and traditional hands-on approaches, to determine their effectiveness in improving welding performance among students. Beside, the technology integration can streamline skill acquisition, making training sessions more impactful, especially for newer techniques or complex welds (Wells & Miller, 2020).

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In addition, ongoing professional development in welding promotes adaptability to new materials and machinery, keeping workers relevant in a rapidly evolving field. Welders benefit from structured skills development, which often includes safety protocols, hands-on practice and formal evaluation, to ensure that they meet industry standards. This approach not only strengthens individual skill sets, but also contributes to the readiness of the workforce to meet future industry demands. Upskilling resources suggested to keep on track on fast caging trends, certifications, and practical applications in welding, as one of a proactive way to enhance both personal and professional growth in this field (Welding Academy, 2024).

A vocational school in Batam, Indonesia had implemented Competency-Based Education and Training (CBET). This teaching and learning approach emphasize the importance of dual competency-based training that aligns with both national and international standards (ISO 9606-1). The research shows that such programs significantly enhance students' welding skills, making them more employable in both national and international companies (Kifta et al., 2020).

A study highlighted by Mohd Azree (2023) has discussed the skills gap in Malaysia's manufacturing sector, highlighting the need for advanced technical skills, including welding. The report points out that the historical focus of Malaysia's education system has not prioritized developing homegrown talent for complex manufacturing processes, which includes welding skills necessary for modern industries. He also suggests for major reformation in education and training to nurture competitive technical talent, including upskilling initiatives specifically aimed at welding and other technical fields.

Specifically for Malaysian vocational colleges ecosystem, 3G SMAW training curricula incorporate essential components to ensure that students have the requisite abilities and knowledge (BPLTV, 2024). One of the most important components is Safety Practice, which teaches students about risk assessment and safety procedures to provide a secure workplace. To make sure students grasp the essential technical fundamentals, welding techniques are also stressed, with an emphasis on the welding procedure as well as the setup and upkeep of equipment.

Furthermore, the curriculum places a strong emphasis on practical training or known as On-Job-Training, which entails practical sessions in which students carry out real welding tasks under the guidance of teachers, boosting their confidence and proficiency. The curriculum also covers Assessment and Certification, which allows students to receive a recognized certificate upon training completion by evaluating their proficiency in carrying out the SMAW process in accordance with industry standards.

The upskilling program is crucial in assisting students in raising their skill level from fundamental to more advanced, industry-recognized abilities. In-depth hands-on instruction is frequently a part of this curriculum, teaching students how to overcome obstacles in 3G SMAW welding (Hobart Brothers, 2024). Heat control methods, precise electrode selection, and safety considerations when welding in crucial locations are some of the extra abilities learned.

This curriculum gives students the chance to improve their technical proficiency while also boosting their confidence in doing difficult welding tasks (Sahitya Karra, 2022). Additionally, the curriculum places a strong emphasis on adhering to industry standards like American

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Welding Society (AWS) D1.1, which is well-known in the welding sector (AWS D1.1 / D1.1M, 2015; SVM, 2024). This guarantees that program graduates are ready to join the workforce with greater assurance.

Despite the many advantages, students also encounter difficulties adhering to this curriculum. These include the program's potentially heavy cost and the dearth of training equipment in certain vocational colleges (Saleh, S.N.H.M., et.al., 2023). Additionally, students who wish to work while they study in order to advance their abilities may find that time constraints are a barrier. However, this obstacle can be overcome with business and government help. To guarantee that every student has access to the greatest and highest caliber of instruction, it is crucial to invest in infrastructure and qualified teaching personnel.

Research Methodologies

This study aims to evaluate the influence of the 3G SMAW welding upskilling program on the professional development of diploma students from Malaysian vocational colleges. Participants who have completed 15 days of 3G SMAW welding training at CIDB Technologies Sdn. Bhd., Johor Bahru, need to fill out the questionnaires. As in lesson plan, the training is conducted by delivering theoretical knowledge first, and then followed by welding practice. In order to prepare for the theoretical and practical exams on the last day of training, participants will get a number of individual tasks and drills during the upskilling program. This approach has been thoughtfully planned to guarantee that the information gathered can provide a comprehensive picture of how upskilling training affects students' technical proficiency, employability, and professional growth.

This study employs a mixed method approach using a descriptive survey research design that incorporates both short interviews and questionnaire instruments. A quantitative approach using a questionnaire was utilized to gather structured data on the graduates' perceptions of the efficacy of the 3G SMAW welding upskilling program, while a qualitative approach using short interviews sought to better understand the experiences and opinions of the respondents. The quality and validity of study findings are further enhanced by the thorough data collection made possible by the application of these two techniques.

30 diploma holders from Kolej Vokasional Tanjung Piai, Pontian, Johor who had completed 3G SMAW upskilling training at CIDB Technologies Sdn. Bhd., Johor Bahru, made up the study population. To guarantee that all respondents have the same training background and have completed an upskilling program in the specified region, the full population is included in the study's sample.

CIDB Technologies Sdn. Bhd. is a training center accredited by CIDB Malaysia with branches in Johor, Kuala Lumpur, Perak, Kedah, Terengganu, Sabah and Sarawak offering comprehensive construction skills training programs to meet the needs of the construction industry in Malaysia. All these programs comply with the mandatory requirements of CIDB Act 520 and are aligned with the ISO 9001:2015 standard to ensure the quality and efficiency of the construction workforce in Malaysia (CIDB, 2024). Additionally, CIDB was awarded with ISO/IEC 17024:2012 (Conformity Assessment: General Requirements for Bodies Operating Certification of Persons) from Jabatan Standard Malaysia (JSM) since 7 September 2023. This certification initially focusing on three major scope provided by CIDB

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Technologies, for Welding, Non-Destructive Testing (NDT) and Blasting Painting Operation programs (BPO) (CIDB Technologies, 2024).

Study Instrument

The research instrument is a questionnaire developed specifically to evaluate the effectiveness of 3G SMAW training. The questionnaire is divided into four parts:

1. **Section A: Demographics**
   Gathering the respondents' basic data, including age, gender, educational background, and practical experience.

2. **Section B: Upskilling's Impact on Future Careers and Skills**
   Examine the degree of technical proficiency gained both prior to and during 3G SMAW welding training, taking into account both theoretical and actual welding abilities. This section also assessing how employability, including career chances and competency levels, is perceived by graduates after completing this upskilling program.

3. **Section C: Recommendations and Views**
   Analyze the respondents' level of satisfaction with the training program, the suitability of the training material, and the degree to which the training advances their careers.

To further understand the graduates' experiences, opinions, and impressions of 3G SMAW welding training and its influence on their employment, a series of brief interviews was undertaken. With the respondent's permission, the material gathered during each 15–20 minute interview session was either written down or captured on tape. This in-person interview covered a number of primary subjects, such as:

1. Personal experience with 3G SMAW welding instruction.
2. The idea that skill levels were different before and after training.
3. Opinions on post-training career marketability.
4. Training elements that are thought to be most successful as well as recommendations for enhancement.

Data Collection an Analysis

Data is collected in two phases:

1. Questionnaire Phase:
   All respondents of the target population are asked to complete the questionnaire, and the answers will give a numerical representation of how effective the upskilling program is thought to be.

2. Brief Interview Phase:
   Seven to ten respondents were chosen at random from the questionnaire respondents to take part in the interview. This seeks to investigate deeper into topics that surveys alone are unable to describe.

To measure the efficacy of the training, quantitative data from the questionnaire was examined using both descriptive statistics (mean and percentage) and inferential analysis (Kruskal-Wallis test). The Kruskal-Wallis test is used for comparing two or more independent samples and as an opt for one-way ANOVA for non-parametric statistical test. The thematic approach was

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used to evaluate qualitative data from interviews, identifying and thoroughly examining key themes such skill changes, opinions on job prospects, and satisfaction with training programs. Combining the outcomes of these two approaches offers a thorough understanding of the program's efficacy.

Results and Discussion

The demographic data shows that all 30 respondents in the study, which evaluates the effectiveness of upskilling programs in 3G SMAW welding and career, are male (100%). This indicates a complete lack of gender diversity in the sample, suggesting that the findings will be specific to male participants only. Consequently, any conclusions about the training's impact on work skills and career paths cannot be generalized to female or gender-diverse populations, potentially limiting the scope of the study's applicability. It is because training outcomes can differ across gender and highlights the importance of considering gender diversity in workforce development initiatives (Baker, M., & McNaughton, D., 2020).

As the age distribution of the participants reveals that the majority (70%) was between 20-24 years old, it shows that the upskilling program in 3G SMAW welding primarily attracts younger individuals, with a significant proportion of participants being in the early stages of their careers. The age profile suggests that the program may be particularly relevant or appealing to recent graduates or young adults looking to enhance their welding skills early in their vocational journey.

30 participants (100%) has been confirmed receiving practical training in 3G SMAW welding during their studies at the Vocational College (VC). It shows that hands-on training in 3G SMAW welding is a standard and consistent component of the curriculum. This is to ensure that every student has an exposure to practical welding skills as part of their vocational education. This uniformity suggests a strong emphasis on experiential learning in welding to prepare students for industry demands (Chakradhar, R., 2022).

As in Figure 1, majority of participants (66.7%) underwent practical training in 3G SMAW welding for less than 3 months during their study period in VC. Thus, the findings indicate that after participating in the additional upskilling training in 3G SMAW welding at CIDB Technologies Sdn Bhd, 46.7% of the participants rated their skill level as “Mahir” (Skilled), while 40% considered themselves “Sangat Mahir” (Highly Skilled). Only 13.3% of participants rated their skill level as “Sederhana” (Moderate). This suggests that the majority of participants felt that the training significantly enhanced their welding skills, with nearly half achieving a high level of proficiency (Saepudin, A., 2020).

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Bagaimana tahap kemahiran anda dalam kimpalan 3G SMAW selepas menjalani latihan tambahan / upskilling di CIDB Technologies Sdn Bhd?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sederhana	4	13.3	13.3	13.3
	Mahir	14	46.7	46.7	60.0
	Sangat Mahir	12	40.0	40.0	100.0
	Total	30	100.0	100.0	

Figure 1: Self-Reported Skill Levels in 3G SMAW Welding After Upskilling Training

Adakah anda berasa latihan tambahan/upskilling tersebut membantu meningkatkan kemahiran praktikal anda?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Membantu	2	6.7	6.7	6.7
	Sangat Membantu	28	93.3	93.3	100.0
	Total	30	100.0	100.0	

Figure 2: Perceived Effectiveness of Upskilling Training in Improving Practical Skills

Interestingly, Figure 2 shows an overwhelming majority (93.3%) of participants felt that the additional upskilling training was “Sangat Membantu” (Very Helpful) in improving their practical skills in 3G SMAW welding. This indicates that the upskilling program was highly effective in enhancing the participants' practical welding skills, with nearly all respondents recognizing a significant improvement in their abilities (Saepudin, A., 2020; Zulaida, Y. M., 2024).

Table 1: Mean and Standard Deviation for Sections B and C

Section	Mean	Std. Dev.	Interpretation
B Upskilling's Impact on Future Careers and Skills	3.55	0.240	Very high
C Recommendations and Views	3.88	0.297	Very high

The data shows in Table 1 that represent both sections, B and C (as in study instrument), received a “Very High” rating based on their mean scores. Section C had a mean of 3.88 with a standard deviation of 0.297, indicating a very high and consistent level of agreement among participants. Section B had a mean score of 3.55 with a standard deviation of 0.240, also reflecting a very high level of agreement with slightly less variability in responses compared to Section C. Overall, these results suggest a strong and uniform positive perception or effectiveness in the evaluated aspects of both sections.

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Test of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MeanB	.297	30	<.001	.784	30	<.001

a. Lilliefors Significance Correction

Figure 3: Tests of Normality for Section B

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MeanC	.460	30	<.001	.485	30	<.001

a. Lilliefors Significance Correction

Figure 4: Tests of Normality for Section C

The results from the Tests of Normality for MeanB and MeanC indicate that the data does not follow a normal distribution (Figure 3 and Figure 4). For both MeanB and MeanC, the Kolmogorov-Smirnov and Shapiro-Wilk tests yield significance values (p-values) of less than 0.001. Since these p-values are below the standard threshold of 0.05, we reject the null hypothesis of normality for both variables (Razali, N. R., & Wah, Y. B., 2011). This suggests that MeanB and MeanC distributions are significantly non-normal, and as a result, non-parametric statistical methods may be more appropriate for further analysis involving these variables.

Kruskal-Wallis H Test

Ranks

	Jika ya, nyatakan tempoh latihan praktikal yang anda jalani	N	Mean Rank
MeanB	Kurang dari 3 bulan	20	14.88
	3-6 bulan	7	18.29
	Lebih dari 6 bulan	3	13.17
	Total	30	

Figure 5: Mean Rank of Practical Training Duration for Section B

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Test Statistics[a,b]

	MeanB
Kruskal-Wallis H	1.188
df	2
Asymp. Sig.	.552

a. Kruskal Wallis Test

b. Grouping Variable: Jika ya, nyatakan tempoh latihan praktikal yang anda jalani

Figure 6: Kruskal-Wallis Test Statistics for Section B

As stated in Figure 5, the Kruskal-Wallis test results indicate that there is no statistically significant difference in the MeanB scores across the three groups based on the duration of practical training: "Kurang dari 3 bulan" (less than 3 months), "3-6 bulan" (3 to 6 months), and "Lebih dari 6 bulan" (more than 6 months). The mean ranks for each group are 14.88, 18.29, and 13.17, respectively. The Kruskal-Wallis H statistic is 1.188 with a p-value (Asymp. Sig.) of 0.552, which is greater than the significance level of 0.05 (Figure 6). Therefore, we fail to reject the null hypothesis, suggesting that the differences in MeanB scores among the different training durations are not statistically significant.

Ranks

	Jika ya, nyatakan tempoh latihan praktikal yang anda jalani	N	Mean Rank
MeanC	Kurang dari 3 bulan	20	16.35
	3-6 bulan	7	13.71
	Lebih dari 6 bulan	3	14.00
	Total	30	

Figure 7: Mean Rank of Practical Training Duration for Section C

Test Statistics[a,b]

	MeanC
Kruskal-Wallis H	1.153
df	2
Asymp. Sig.	.562

a. Kruskal Wallis Test

b. Grouping Variable: Jika ya, nyatakan tempoh latihan praktikal yang anda jalani

Figure 8: Kruskal-Wallis Test Statistics for Section C

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EISSN: 2637-0905
Volume 6 Issue 23 (December 2024) PP. 97-109
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Figure 7 reveals that there is no statistically significant difference in the MeanC scores among the three groups based on the duration of practical training: "Kurang dari 3 bulan" (less than 3 months), "3-6 bulan" (3 to 6 months), and "Lebih dari 6 bulan" (more than 6 months). The mean ranks for each group are 16.35, 13.71, and 14.00, respectively. The Kruskal-Wallis H statistic is 1.153 with a p-value (Asymp. Sig.) of 0.562, which exceeds the 0.05 threshold (Figure 8). Thus, we fail to reject the null hypothesis, indicating that the differences in MeanC scores across the different training durations are not statistically significant.

Brief interviews with a number of respondents who had received upskilling training in 3G SMAW welding were used to gather qualitative data. Finding recommendations from the participants that can increase the efficacy of the training is the primary goal of this session. Overall, respondents were satisfied with the upskilling program's content, with a several suggested enhancements to improve the training's effectiveness. All respondents recommended that the training period be prolonged in order to provide more practice chances, particularly given the detailed methods involved in 3G SMAW welding work. They recommended extending the training session up to 20 days in order to give participants more time to improve their welding abilities. By having longer training sessions, may lead to enhance participant's ability to learn new skills and boost their self-assurance at work (Zaldy A. Fernandez, 2021; Zulaida, Y. M., 2024).

To prevent interruptions during practical sessions, some participants recommended that the organizers make sure that training supplies, including gas, are reserved in advance. According to Fernandez Z.A. (2021), having enough training materials and equipment allows participants to go through practical training efficiently, and without interruptions, giving them more time and opportunities to practice their skills effectively.

To encourage the use of technology during training session, a few respondents suggested to include welding simulators as part of their lesson plan, even though they already have real experience with welding work. Through practice and familiarization with the tools and techniques in a safe environment prior to actual hands-on work, virtual reality (VR) simulations in welding training assist students prepare for real-world welding circumstances (Huang, Y., & Liu, X., 2022). Using this technology is also expected to speed up the learning process and increase their skill level in a safer manner.

The significance of receiving advice from people with welding industry expertise was underlined by the participants. They believe that having more highly qualified and experienced instructors can give students more thorough direction and help them comprehend how to effectively deal with welding difficulties in practical settings (Lassiter, T., 2023). Interestingly, practice of integration between variation theory and conversation in welding education, reveals that effective interaction between teachers and students can significantly improve the learning process by making critical aspects of welding more visible and manageable (Asplund, S. B., & Kilbrink, N., 2020).

Additionally, respondents said that more thorough and rigorous training is required. To guarantee that the abilities learned may be reinforced and used more effectively in practical settings, they recommend that participants receive ongoing additional training in a future (Kirkpatrick, D. L., & Kirkpatrick, J. D., 2016).

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Conclusion

The findings of this study suggest strategic directions for the continued improvement of TVET initiatives in Malaysia. As the demand for skilled welders grows, especially in sectors that increasingly rely on automation and digital technologies, future upskilling programmes should prioritise not only traditional welding skills but also competencies related to operating and programming robotic systems. This approach will ensure that graduates are not only job-ready but also able to adapt to the technological advances shaping the industry. In addition, fostering partnerships between educational institutions and industry players need to be considered in developing training programmes that are responsive to real-world challenges, thereby improving the overall quality of vocational education in Malaysia. As the government continues to emphasise the importance of TVET in its economic development strategy, these insights can advise policy decisions that improve curriculum development, resource allocation and training effectiveness across the welding sector.

To conclude, 3G SMAW upskilling program by CIDB Technologies Sdn. Bhd. was successful in improving the technical proficiency and employability of graduate diploma students from Kolej Vokasional Tanjung Piai. The training was proven able to effectively covered the fundamental skills needed in the welding profession. The positive comments regarding the program's material and practical elements make this program more valuable. Furthermore, the participants' recommendations which include lengthening the training period, adding more advanced technology, and expanding mentorship by experts, might greatly increase the training's impact.

These observations offer another alternative to improve welding upskilling programs to better meet industry needs and guarantee that vocational graduates are equipped for technical positions in Malaysia's changing workforce. By incorporating feedback from industry stakeholders, adapting curricula to include advanced technologies such as robotics and automation, and emphasizing hands-on training with modern welding techniques, these programs can significantly improve graduates' employability and readiness for the job market.

Acknowledgement

The authors would like to acknowledge CIDB Technologies Sdn. Bhd., specifically to Johor branch for their invaluable cooperation and support throughout this research project.

References

Asplund, S. B., & Kilbrink, N. (2020). Lessons from the welding booth: theories in practice in vocational education. *Empirical Research in Vocational Education and Training*, *12*(1), 1.

AWS D1.1 / D1.1M: 2015 Kod Kimpalan Struktur - Pengikatan Buku Teks Keluli – 1 Januari 2015

Business Today (2023). Bridging the skills gap for Malaysia’s manufacturing future. Retrieved from https://www.businesstoday.com.my/2023/09/15/bridging-the-skills-gap-for-malaysias-manufacturing-future/

Baker, M., & McNaughton, D. (2020). Gender Differences in Training Outcomes: Implications for Workforce Development. Journal of Vocational Education & Training, 72(2), 151-169. doi:10.1080/13636820.2020.1711234.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
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DOI: 10.35631/IJMOE.623008
Chakradhar, R. (2022). How effective is hands-on training in improving the welding skills of SMAW students? Management Science Letters, 12(1), 1-10. doi:10.5267/j.msl.2021.11.001.

CIDB Malaysia (2024). CIDB Sebagai Badan Pensijilan ISO/IEC 17024:2012. Retrieved from https://www.cidb.gov.my/

CIDB Technologies (2024). Program-Ringkasan Kursus. Retrieved from https://cidbtech.com.my/

Fernandez, Z. A. (2021). The Importance of Adequate Training Equipment in Enhancing Practical Skills in Welding Education. *International Journal of Education and Research*, 9(3), 145-158. Retrieved from https://www.ijern.com/journal/2021/March-2021/11.pdf

Hargiyarto, P., Syauqi, K., Sugiyono, S., Ardian, A., Sianipar, S., & Nadjib, L. A. (2020, December). Analysis of quality student practice results in shielded metal arc welding. In *Journal of Physics: Conference Series* (Vol. 1700, No. 1, p. 012010). IOP Publishing.

Hobart Brothers (2024). The Importance of Proper Welding Operator Training. https://www.hobartbrothers.com/resources/technical-articles/the-importance-of-proper-welding-operator-training/

Huang, Y., & Liu, X. (2022). Virtual Reality in Welding Training: A Review of Applications and Benefits. *Journal of Agricultural Education*, 64(4), 1-12. doi:10.5032/jae.v64i4.38.

Jamey McIntosh (2017). Welding pays off: The importance of "upskilling" in today's welding education programs. Realityworks RealCareer Product Manager

Kifta, D. A., Lapisa, R., & Zagoto, M. M. (2023, May). Improvement of Welding Skill Using Competence Based Education and Training (CBET) Method. In *9th International Conference on Technical and Vocational Education and Training (ICTVET 2022)* (pp. 43-53). Atlantis Press.

Kirkpatrick, D. L., & Kirkpatrick, J. D. (2016). *Evaluating Training Programs: The Four Levels*. Berrett-Koehler Publishers.

Li, L. (2022). Reskilling and Upskilling the Future-ready Workforce for Industry 4.0 and Beyond. Inf. Syst. Front., 1–16.

Lassiter, T., Collier, C., Fleischmann, K. R., & Greenberg, S. R. (2023). Welding Instructors' Perspectives on Using AI Technology in Welding Training. *Proceedings of the Association for Information Science and Technology*, 60. doi:10.1002/pra2.12586.

Malaysian Investment Development Authority (MIDA) (2022). TVET as a catalyst for economic growth. Retrieved from https://www.mida.gov.my/mida-news/tvet-as-a-catalyst-for-economic-growth/

Masato, D., & Kim, S. K. (2023). Global workforce challenges for the mold making and engineering industry. *Sustainability*, *16*(1), 346.

Portal Rasmi Bahagian Pendidikan Dan Latihan Teknikal Vokasional, BPLTV - Diploma Teknologi Kimpalan (2024). Kementerian Pendidikan Malaysia. https://bpltv.moe.gov.my/diploma-teknologi-kimpalan/

Red-D-Arc Welderentals (2020). Welding in the Construction Industry May 27, 2020.

Saepudin, A. (2020). Hands-on welding training is effective in enhancing the welding skills of (GRADE) 11 SMAW students, as it equips them with practical knowledge and improves their hard skills significantly. Welding Training for Youth Organization in Dayeuh Village. Retrieved from https://typeset.io/questions/how-effective-is-hands-on-training-in-improving-the-welding-z4djqqttbr

Sahitya Karra (2022). Bridging welding skills gap in manufacturing through upskilling. Industry, Skill Story. National Skills Network.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 6 Issue 23 (December 2024) PP. 97-109
DOI: 10.35631/IJMOE.623008

https://nationalskillsnetwork.in/bridging-welding-skills-gap-in-manufacturing-through-upskilling/

Saleh, S. N. H. M., Jamaluddin, K. A., & Hamzah, I. (2023). Perubahan Kurikulum Dalam Kolej Vokasional: Kesan Dan Cadangan Penambahbaikan Untuk Pelaksanaan Berkesan.

The Star (2024). Malaysian labour market projected to remain stable in 2025. Retrieved from https://www.thestar.com.my/news/nation/2024/10/18/malaysian-labour-market-projected-to-remain-stable-in-2025

Welding Academy (2024). How to Keep Upskilling in the Welding Trade. Retrieved from https://weldingacademy.co.nz/blog/how-to-keep-upskilling-in-the-welding-trade/

Wells, T., & Miller, G. (2020). The effect of virtual reality technology on welding skill performance. *Journal of Agricultural Education*, *61*(1), 152-171.

Zaldy A. Fernandez (2021). “Modified Smoke House" to Augment their Practice Skills in Welding and Fabrication. International Journal of Education and Research Vol. 9 No. 3 March 2021.

Zulaida, Y. M., Suryana, S., Pramono, A., Juniarsih, A., & Hasanah, I. U. (2024). Welding training to enhance welding skills for youth in Cilegon City. Journal of Community Service in Science and Engineering (JoCSE), 3(1), 1-6.