

Challenges and opportunities of teachers and learners of shielded metal arc welding specialization in senior high school

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Abstract

The study determined the challenges and opportunities of teachers and learners in Shielded Metal Arc Welding (SMAW) specialization in senior high school. It specifically examined the difficulties encountered by teachers in terms of technical skills and competency, learning resources, and learner engagement, as well as the challenges faced by learners in mastering technical skills, understanding theoretical concepts, safety and practical work experience, and access to tools and equipment. It also identified opportunities that can be maximized in SMAW instruction and proposed an instructional guide based on the findings. A descriptive research design was used in the study. The respondents were selected through purposive sampling for teachers and stratified random sampling for students to ensure relevant and representative data. A validated survey questionnaire using a five-point Likert scale was utilized as the main data-gathering instrument. Data were analyzed using frequency count, percentage, and weighted mean to describe the level of challenges and opportunities in SMAW instruction and learning. The findings revealed that teachers experience the highest challenge in technical skills and competency, while learners encounter the greatest difficulty in access to tools and equipment. All identified areas were generally described as much challenging. The study also found that key opportunities include mensuration and calculation competency, alignment with TESDA standards, and mastery of welding skills, while digital learning resources remain underutilized. The study concluded that improving technical training, enhancing resources, and integrating practical and theoretical instruction can strengthen SMAW education and better prepare learners for employment.

Keywords: Shielded Metal Arc Welding; Technical Skills; Learning Resources; Learner Engagement; TESDA Standards; Senior High School

1. Introduction

Technical vocational education and training (TVET) plays a vital role in preparing learners with job-ready skills in response to labor market demands. In the Philippines, the inclusion of the Technical-Vocational-Livelihood (TVL) track in the K to 12 Basic Education Curriculum through Republic Act No. 10533 strengthened the country's commitment to skills-based education (Department of Education, 2013). In support of this, Republic Act No. 7796 created the Technical Education and Skills Development Authority (TESDA) to oversee and ensure the quality of technical education and skills development programs (Republic of the Philippines, 1994). Among the core competencies under TVET is Shielded Metal Arc Welding (SMAW), a widely used welding process essential in industries such as construction, manufacturing, shipbuilding, and infrastructure development (Technical Education and Skills Development Authority, 2025). workers in the locality.

Quality education is essential for all learners, as emphasized in Sustainable Development Goal 4 (SDG 4) of the United Nations (2015), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities. In senior high school, the TVL track, particularly SMAW, provides students with practical skills necessary

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for future employment. However, both teachers and learners encounter challenges such as lack of tools, limited training, and difficulties in teaching and learning the subject. This study seeks to identify these challenges and explore opportunities for improvement in SMAW instruction and learning. In doing so, it aims to enhance teaching effectiveness and support learners in acquiring employable skills, thereby contributing to the achievement of SDG 4 (United Nations, 2015).

Despite the importance of SMAW in TVET, technical-vocational schools continue to face challenges such as inadequate facilities, outdated equipment, limited consumable materials, safety concerns, and insufficient hands-on training opportunities. Although government initiatives and competency-based training frameworks are in place, gaps in implementation remain evident at the school level. Hence, there is a need to examine the challenges and opportunities in the teaching and practice of SMAW in technical-vocational schools to identify areas for improvement and enhance training quality, student competency, and program effectiveness. This study is expected to provide insights for improving instructional practices and addressing gaps in SMAW training delivery, as well as support the development of more effective strategies that strengthen both teaching practices and learner outcomes in technical-vocational education.

As observed in classroom settings, there is a need to improve the performance of students in SMAW specialization. Many students experience difficulty understanding welding concepts and performing required skills, which affects their confidence and work readiness. Some learners also lack sufficient hands-on practice and struggle with proper procedures and safety measures. At the same time, teachers encounter challenges such as lack of tools and equipment, limited training, and difficulty managing large classes during practical activities. These issues indicate the need to improve both teaching and learning in SMAW. This study is important because it aims to enhance students' skills and performance, support teachers in using more effective instructional strategies, and contribute to the goal of providing quality education as promoted by SDG 4 (United Nations, 2015).

1.1. Statement of the Problem

This study aims to determine the challenges and opportunities of teachers and learners of Shielded Metal Arc Welding specialization in senior high school.

1.1.1. Specifically, it seeks to answer the following questions:

- What are the challenges encountered by teachers in the teaching and learning process of shielded metal arc welding in terms of:
 - technical skills and competency,
 - learning resources, and
 - learner engagement?
- What are the challenges encountered by the learners in shielded metal arc welding along:
 - mastery of technical skills,
 - understanding theoretical concepts'
 - safety and practical work experience' and
 - access to tools and equipment?
- What are opportunities that should be maximized by teachers and learners of Shielded Metal Arc Welding?
- What Instructional Guide can be designed based on the findings of the study?

1.2. Scope and Delimitation

This study focuses on identifying and analyzing the challenges and opportunities experienced by teachers and learners in the teaching and learning process of Shielded Metal Arc Welding (SMAW) specialization in Senior High School, particularly in terms of technical skills, learning resources, learner engagement, and instructional practices, it includes 117 students, and 10 teachers in 3 public senior high schools under the Technical-Vocational-Livelihood (TVL) track as the main respondents within the chosen municipality of Ligao City, Albay offering SMAW specialization. It covers SY 2025-2026 during which the data were collected and with the aim of providing an empirical basis for improving SMAW instruction and serving as inputs for school administrators, curriculum planners, and policymakers in enhancing teaching strategies, learning resources, and overall program effectiveness.

This study is delimited to the assessment of the challenges and opportunities encountered by teachers and learners in the Shielded Metal Arc Welding (SMAW) specialization in selected public Senior High Schools offering the Technical-Vocational-Livelihood (TVL) track in Ligao City, Albay during the School Year 2025–2026. The respondents of the study are limited to SMAW teachers and Grade 11 and Grade 12 learners who are currently enrolled in the SMAW

specialization. The study focuses only on selected variables such as teachers' technical skills and competency, availability of learning resources, and learner engagement, as well as learners' mastery of technical skills, understanding of theoretical concepts, and access to tools and equipment. Other factors such as administrative leadership, funding allocation, industry

partnerships, curriculum design beyond SMAW, and learners' socio-economic background are excluded from the scope of this study. Furthermore, the study employs a descriptive research design using survey questionnaires and does not include experimental methods or longitudinal analysis.

2. Materials and Methods

2.1. Research Design

In this study, the descriptive design was used to describe the challenges faced by teachers in teaching Shielded Metal Arc Welding. These challenges include technical skills and competency, learning resources, and learner engagement. It also described the challenges faced by learners in SMAW in terms of mastery of technical skills, understanding of theoretical concepts, safety and practical work experience, and access to tools and equipment. The study also described the opportunities that teachers and learners can maximize in the SMAW specialization program. It focused only on gathering information based on the actual experiences of teachers and learners. The design helped present the real situation in SMAW instruction and learning. The results of the study may serve as a basis for improving teaching methods, learning support, and skills development in technical vocational education.

2.2. Respondents of the Study

The respondents of the study were selected based on specific inclusion criteria to ensure their direct involvement in the teaching and learning of Shielded Metal Arc Welding (SMAW). The teacher-respondents were required to be currently teaching SMAW under the Technical-Vocational-Livelihood (TVL) track or in Technical Education and Skills Development Authority (TESDA)-accredited programs and must have at least one year of teaching experience to ensure adequate exposure to instructional practices and challenges. The student-respondents were those officially enrolled in SMAW courses during the academic year of the study, regardless of grade level, provided that they had already completed both theoretical and practical welding sessions. These criteria were established to ensure that all respondents possessed relevant knowledge, experience, and involvement in SMAW instruction and training, which is essential for obtaining valid and reliable data (John W. Creswell and J. David Creswell, 2018).

2.3. Research Instrument

The researcher made use of the following tools in gathering of data

2.3.1. Survey Questionnaire

Survey Questionnaire is a data-gathering instrument that is specifically created by the researcher for the purposes of a particular study. It includes original questions, items, and response formats developed to measure the study's targeted variables or concepts. Because it is tailored to the research context, it offers flexibility and relevance, but it also requires processes such as expert validation and pilot testing to ensure its reliability and validity.

The survey questionnaire was developed by the researchers based on the objectives of the study and a review of related literature on technical-vocational education and Shielded Metal Arc Welding (SMAW). The instrument was designed to gather data on the challenges and opportunities in the teaching and learning of SMAW among senior high school teachers and students. It consists of several parts, including the challenges encountered by teachers and learners, opportunities in SMAW instruction, and recommendations for improvement. A five-point Likert scale ranging from Strongly Agree (SA) to Strongly Disagree (SD) was used to measure the respondents' level of agreement with each statement. To ensure the validity and clarity of the instrument, the questionnaire was reviewed and validated by experts in the field, and necessary revisions were made before its final administration.

After validation, the questionnaire was distributed to the selected SMAW teachers and senior high school students in the chosen schools. Permission was obtained from school authorities prior to data collection, and the purpose of the study was clearly explained to the respondents to ensure informed participation. The survey was administered through printed copies. After a given period, the accomplished questionnaires were retrieved personally by the researchers. All responses were checked for completeness and accuracy, and only valid questionnaires were included for data analysis.

3. Results and Discussion

3.1. Summary of Challenges Encountered by Teachers in the Teaching and Learning Process of Shielded Metal Arc Welding

Teachers in the teaching and learning process of Shielded Metal Arc Welding face challenges such as limited resources, maintaining safety standards, varying student skill levels, and sustaining learner engagement while effectively developing technical competencies. These challenges highlight the need for improved facilities, continuous training, and more engaging instructional strategies to enhance teaching effectiveness and learner outcomes.

Table 1 Summary of Challenges Encountered by Teachers in the Teaching and Learning Process of Shielded Metal Arc Welding

Evaluation Criterion	Weighted Mean	Verbal Interpretation	Rank
Technical Skills and Competency.	4.13	Much Challenging	1
Learning Resources	4.11	Much Challenging	2
Learner Engagement	4.09	Much Challenging	3
Average Weighted Mean	4.11	Much Challenging	

Table 1 4 presents the summary of challenges encountered by teachers in the teaching and learning process of Shielded Metal Arc Welding. The data show that technical skills and competency obtained the highest weighted mean of 4.13, interpreted as much challenging and ranked first. Learning resources followed with a weighted mean of 4.11 and ranked second. Learner engagement recorded a weighted mean of 4.09 and ranked third. The overall weighted mean is 4.11, described as much challenging, indicating that all areas are perceived to be challenging by the teachers.

The results indicate that challenges related to technical skills and competency are the most significant among the three areas, showing that teaching welding requires a high level of expertise and precision. Learning resources ranked second, which suggests that lack of materials and equipment continues to affect the delivery of instruction. Learner engagement, although ranked lowest, still shows a high level of challenge, meaning that maintaining student interest and participation remains difficult. The small differences in weighted means show that all areas are closely related and equally important in the teaching process. These findings support Garcia¹, who emphasized the need for continuous teacher training to improve technical competence. Lewis² also found that teacher skills directly affect student performance, which explains the high ranking of technical competency challenges. Santos and Cruz highlighted that limited resources hinder effective teaching and reduce opportunities for hands-on practice, supporting the result in learning resources. Reyes³ noted that limited practice time and instructional constraints affect student engagement, which aligns with the findings in learner engagement. These studies confirm that challenges in teaching SMAW are interconnected and affect both instruction and learning outcomes.

The findings suggest that improving SMAW instruction requires equal attention to teacher skills, availability of resources, and student engagement. The results show that no single area can be addressed alone since all aspects contribute to the overall teaching and learning process. This implies that providing continuous training for teachers, improving access to equipment and materials, and enhancing teaching strategies can help reduce these challenges. Strengthening these areas can lead to better instruction and improved competency among students.

3.2. Summary of Challenges Encountered by the Learners

Learners in Shielded Metal Arc Welding face overall challenges in mastering technical skills, understanding theoretical concepts, maintaining safety, staying engaged, and accessing adequate tools and materials, all of which affect their ability to achieve consistent and high-quality welding performance. Many learners require additional guidance and repeated practice to fully grasp welding competencies. Limited resources further restrict opportunities for hands-on learning and experimentation. Safety concerns also reduce learners' confidence in performing practical tasks. In addition, gaps in theoretical understanding make it harder for students to apply concepts correctly in real situations. Overall, these challenges highlight the need for improved instruction, resources, and training support.

Table 2 Summary of Challenges Encountered by The Learners in Shielded Metal Arc Welding

Evaluation Criterion	Weighted Mean	Verbal Interpretation	Rank
Mastery of Technical Skills	3.77	Much Challenging	3
Understanding Theoretical Concepts	3.79	Much Challenging	2
Safety and Practical Work Experience	3.77	Much Challenging	3
Access to Tools and Equipment	3.87	Much Challenging	1
Average Weighted Mean	3.80	Much Challenging	

Table 2 presents the summary of challenges encountered by learners in Shielded Metal Arc Welding. The data show that access to tools and equipment obtained the highest weighted mean of 3.87, interpreted as much challenging and ranked first. This is followed by understanding theoretical concepts with a weighted mean of 3.79, ranked second. Mastery of technical skills and safety and practical work experience both recorded a weighted mean of 3.77 and ranked third. The overall weighted mean is 3.80, described as much challenging, indicating that learners experience challenges across all areas.

The results indicate that the greatest challenge for learners is access to tools and equipment, which shows that limited resources directly affect their ability to practice and develop skills. Understanding theoretical concepts ranked second, suggesting that learners also struggle with abstract ideas and classroom-based discussions. Mastery of technical skills and safety practices ranked lowest but still remain challenging, which means that learners experience difficulty in both performing tasks and maintaining safe practices. The small differences in weighted means show that all areas are closely related and contribute to the overall learning experience. These findings support Santos and Cruz⁴, who emphasized that lack of equipment and materials reduces hands-on opportunities and affects skill development. Mendoza⁵ found that learners often lack strong foundational skills, which explains the difficulty in mastering both technical and theoretical aspects. Lee and Garcia highlighted that integrating theory with practice improves understanding, which supports the need to connect lessons to actual tasks. Ramos and Thomas⁶ also emphasized that safety concerns influence learner performance and participation in practical work. These studies confirm that challenges in learning SMAW are interconnected and affect both knowledge and skill development.

The findings suggest that improving learner performance in SMAW requires addressing multiple areas at the same time. The results show that access to resources, understanding of concepts, technical skill development, and safety practices all play important roles in the learning process. This implies that providing adequate equipment, strengthening instructional methods, and ensuring proper guidance can help reduce these challenges. Improving these areas can lead to better learning experiences and higher competency among learners.

3.3. Opportunities that should be Maximized by Teachers and Learners of Shielded Metal Arc Welding

Teachers and learners in Shielded Metal Arc Welding should maximize opportunities such as hands-on practice, industry exposure, use of modern equipment, and continuous skills development to enhance competency and employability. These opportunities help bridge the gap between classroom learning and real workplace requirements. Regular practice allows learners to improve accuracy, consistency, and confidence in welding tasks. Industry exposure provides insights into current standards and technologies used in the field. The use of modern equipment ensures that learners are trained in relevant and up-to-date practices. Continuous skills development supports long-term professional growth and adaptability. Overall, these opportunities contribute to producing more competent and job-ready graduates. These initiatives also foster stronger collaboration between educational institutions and industry partners.

Table 3 Opportunities that should be Maximized by Teachers and Learners of Shielded Metal Arc Welding

Evaluation Criterion	Weighted Mean	Verbal Interpretation	Rank
1. Maximizing the curriculum's alignment with TESDA standards allows learners to gain national certifications that are recognized for local and overseas employment.	4.02	Agree	2
2. Teachers can use the "Environment and Market" module to guide students in identifying local business opportunities, such as small-scale metal fabrication or repair shops.	3.98	Agree	5
3. Mastering "Technical Drafting" and "Welding Symbols" gives learners a competitive edge in interpreting complex global engineering designs.	3.91	Agree	8
4. Following "Material Management" protocols allows the school to implement recycling programs where scrap metal is repurposed for smaller projects or sold to fund supplies.	3.91	Agree	8
5. The "Mensuration and Calculation" competency provides a practical way for students to apply geometry and algebra to real-world construction and fabrication.	4.04	Agree	1
6. Maximizing the use of "Oxy-Acetylene" and other cutting equipment prepares learners for specialized roles in shipyards and heavy manufacturing beyond basic welding.	3.94	Agree	6
7. Utilizing the "LRMDS" (Learning Resource Management and Development System) portal mentioned in the CG allows teachers to access updated digital modules and simulations.	3.866	Agree	10
8. Implementing the "OHS (Occupational Health and Safety)" standards allows students to develop leadership roles as safety officers within the workshop environment.	3.94	Agree	6
9. Mastering "Edge Preparation" and "Tack Welding" enables learners to take on precision fabrication jobs that require high-quality fit-up skills.	4.02	Agree	2
10. The curriculum allows teachers to map out student progress from Grade 7 exploratory courses to Grade 12 specialization, ensuring a clear "Career Path" in the industrial arts.	4.00	Agree	4
Average Weighted Mean	3.96	Agree	

Table 3 presents the opportunities that should be maximized by teachers and learners in Shielded Metal Arc Welding. The data show that the mensuration and calculation competency obtained the highest weighted mean of 4.04, interpreted as agree and ranked first. This is followed by curriculum alignment with TESDA standards and mastery of edge preparation and tack welding, both with a weighted mean of 4.02 and ranked second. Mapping student career paths recorded a weighted mean of 4.00 and ranked fourth. Identifying local business opportunities obtained 3.98 and ranked fifth. Maximizing oxy-acetylene equipment and implementing occupational health and safety standards both recorded 3.94 and ranked sixth. Technical drafting and material management both obtained a weighted mean of 3.91 and ranked eighth. The lowest weighted mean of 3.866 was observed in the use of LRMDS resources, ranked tenth. The overall weighted mean is 3.96, described as agree.

The results indicate that learners and teachers see the greatest opportunity in applying mensuration and calculation skills, which shows the importance of connecting mathematics to real-world welding tasks. Opportunities related to certification and technical skill mastery also ranked high, which suggests that learners value competencies that improve employability. The lowest-ranked opportunity involves the use of digital learning resources, which may indicate limited access or familiarity with these tools. The findings support Torres⁷, who emphasized that alignment with industry standards and certifications improves employment opportunities for learners. Navarro⁸ noted that digital tools and simulations enhance understanding, although their lower ranking suggests that these are not yet fully utilized. Jensen and Novak highlighted that combining theory and practice strengthens competency, which aligns with the high ranking

of applied skills such as mensuration and welding techniques. Galula⁹ also emphasized that skill development and mentorship improve learner readiness for work. These studies confirm that practical skills, industry alignment, and career preparation are key opportunities in SMAW education.

The findings show that SMAW education provides several opportunities that can improve learner skills and future employment. The results suggest that focusing on practical competencies, certification, and career pathways can help maximize these opportunities. It also implies that increasing the use of digital resources and strengthening instructional support can further enhance learning. Maximizing these opportunities can lead to better preparation of learners for industry demands and long-term career success.

4. Conclusion

In consideration of the objectives of the study, the following conclusions were derived.

- The result shows that teachers have the most difficulty in technical skills and competency which means that performing and demonstrating welding skills is the main challenge in SMAW instruction. It also shows that learning resources and learner engagement are still challenging which means that all areas affect the teaching and learning process.
- The result shows that the main difficulty of learners is limited access to tools and equipment which affects their ability to practice and develop welding skills. It also shows that understanding lessons and applying safety and technical skills are still challenging which affects overall learning performance.
- The result shows that the most important opportunity in SMAW is the use of practical skills like mensuration and calculation and technical competencies that support employability. It also shows that digital learning resources are less used which limits some learning opportunities.
- The proposed instructional design shows that SMAW instruction can be improved by combining practical training, theory integration, and digital learning to address both challenges and opportunities. It also shows that focusing on competency-based and blended learning can enhance learner skills and teacher effectiveness.

Compliance with ethical standards

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Disclosure of conflict of interest

I declare that I have no conflicts of interest related to this research. I have no personal or financial relationships that could influence my work.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

References

- [1] Garcia, L. M. (2019). Professional development needs of technical-vocational teachers in welding technology. *Journal of Industrial Education*, 7(2), 33–47.
- [2] Lewis, J. (2019). Teacher competence and student performance in vocational education programs. *Journal of Career and Technical Education*, 34(2), 88–102.

- [3] Reyes, K. L. (2021). Student engagement in hands-on technical training programs. *Journal of Vocational Learning*, 9(2), 44–59.
- [4] Santos, P. R. (2019). Resource constraints in vocational education and their impact on student learning. *Asian Journal of Education Studies*, 11(3), 77–89.
- [5] Mendoza, A. R. (2022). Foundational skill gaps among students in technical-vocational programs. *Philippine Journal of Vocational Education*, 5(1), 20–34.
- [6] Ramos, E. (2020). Safety practices in welding education: A review of risks and preventive measures. *Journal of Occupational Safety Education*, 6(1), 10–25.
- [7] Torres, L. (2023). Industry partnerships in technical-vocational education. *Journal of Workforce Development*, 14(3), 95–110.
- [8] Navarro, D. (2024). Digital tools and simulation in welding education. *International Journal of Educational Technology*, 18(1), 90–105.
- [9] Galula, J. P. (2024). Mentorship and peer learning strategies in technical skills development. *International Journal of Skills Training*, 12(1), 40–55.