TEACHING SHIELDED METAL ARC WELDING USING PROJECT-BASED LEARNING STRATEGIES

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Shielded Metal Arc Welding (SMAW), or stick welding, remains one of the most essential techniques taught in technical-vocational education due to its versatility, cost-effectiveness, and relevance in various industries. Traditionally, SMAW instruction in schools follows a teacher-centered approach, where students passively observe demonstrations before engaging in repetitive practice exercises. While this method builds foundational skills, it may not fully develop the critical thinking, problem-solving, and collaboration competencies required in real-world welding tasks. To address this gap, educators have increasingly turned to Project-Based Learning (PBL) as an alternative instructional strategy that promotes deeper engagement and better learning outcomes in SMAW education.

In the context of welding, PBL simulates authentic tasks found in the industry—tasks that require interpreting technical drawings, selecting appropriate materials, managing time and resources, executing welds across various positions, and evaluating final outcomes. By embedding technical instruction within hands-on projects, students are better able to contextualize their learning, take ownership of their work, and build both technical and soft skills simultaneously. In this way, PBL mirrors actual workplace conditions, where welders are expected to work collaboratively, solve problems independently, and produce functional outputs.

Designing PBL modules for SMAW instruction involves selecting project tasks that are relevant, feasible, and aligned with technical competencies. Projects such as building a small tool stand, welding a steel frame, or fabricating simple furniture parts offer realistic applications of welding skills. These tasks allow students to practice welding techniques such as flat, horizontal, vertical, and overhead positions while simultaneously learning to plan, measure, cut, fit, and finish metal components. Through structured stages—ranging from ideation and design to fabrication and reflection—learners engage in meaningful activities that reinforce their understanding of both theory and practice. Moreover, the project approach fosters creativity, accountability, and peer learning, all of which contribute to a richer educational experience.

The benefits of applying PBL to SMAW instruction are supported by recent studies. For instance, Putra (2024) developed and validated a project-based SMAW learning module for vocational high school students. The module received high ratings for feasibility and content validity from expert evaluators, indicating that well-designed PBL modules can be both practical and effective. Another study by Yunus et al. (2024) emphasized the importance of integrating innovative digital tools into SMAW instruction. They developed modules that incorporated 3D animations to help students visualize welding techniques before practicing them physically, leading to improved student comprehension and enthusiasm. These findings suggest that PBL, when supported by technology and sound instructional design, enhances learning experiences and outcomes in SMAW education.

Implementing PBL in SMAW also brings about improvements in students' engagement and motivation. Because learners work toward tangible, meaningful goals, such as completing a project they can use or display, their intrinsic motivation to succeed increases. Additionally, the collaborative nature of PBL fosters teamwork and communication—skills that are essential in industrial settings. Learners must negotiate roles, solve unforeseen problems, and make collective decisions, thereby gaining experience in real-life work scenarios. After project completion, students are encouraged to assess their welds, identify areas for improvement, and discuss lessons learned, further reinforcing their learning process.

Despite its benefits, PBL implementation in welding education is not without challenges. For example, a typical workshop setup may not accommodate all students working simultaneously, especially when there is only one welding machine for every eight learners. This constraint can hinder practice opportunities and slow down project progression. Rather than simply delivering lectures or demonstrations, they must act as facilitators, guiding student teams, managing safety protocols, and assessing both process and product outcomes. This shift requires adequate training and support to ensure successful PBL integration.

Another critical consideration is the assessment process. Unlike traditional tests or skill demonstrations, PBL requires multidimensional evaluation. Educators must assess technical performance (e.g., weld quality, adherence to specifications), teamwork, time management, and overall project execution. Creating clear rubrics and providing timely feedback are essential for maintaining fairness and transparency. Additionally, incorporating peer and self-assessments can help students become more reflective and responsible for their learning.

To maximize the impact of PBL in SMAW instruction, some educators are incorporating multimedia and mobile technology. Sudiyono et al. (2024) reported the development of an Android-based multimedia learning tool for SMAW theory, which was positively received by both students and teachers. The tool allowed learners to review safety practices, electrode types, and welding procedures independently, enabling more efficient use of workshop time for actual welding practice. Such innovations not only support differentiated instruction but also promote self-paced learning, which is particularly beneficial in technical subjects where students progress at varying speeds.

References:

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