The Real World: Redesigning a Welding Class to Match Industry Practices

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Introduction

The need for real-world applications in agricultural mechanics training has never been more crucial, particularly with the increasing demands for industry-aligned skill development. Wells et al. (2021) developed The Agriculture Teacher Education and Agricultural Industry Partnership Model, emphasizing the importance of aligning instructional strategies with current industry practices through collaborative efforts between educational institutions and agricultural employers. This model encourages programs to build strong, sustainable partnerships that provide ongoing input into curriculum design and technical training. By bridging the gap between teacher preparation and industry expectations, students and instructors gain access to evolving tools, methods, and standards that better reflect professional environments (Saucier et al., 2014). However, despite this push toward relevance, many technical programs still rely on outdated or isolated instructional methods that do not fully prepare students for the demands of modern fabrication careers (McCubbins et al., 2019). Instructors recognized the need to create a more integrated, production-focused environment where students could apply skills collaboratively, solve real problems, and engage in workflow processes that reflect those in professional shops. This need served as the foundation for redesigning the course structure to incorporate project-based learning, industry collaboration, and team-oriented production systems.

How it Works

The redesign of the welding course was centered around the fabrication of commercially viable products, such as takedown grills, rocket stoves, and fire pits. Designs were revised to match available CNC sheet sizes and equipment constraints, considering efficient material use and workplace practicality. Division of labor, project timelines, and quality control were highlighted, all of which are key elements of industry-ready instruction.

Table 1. Steps in the redesign of a welding class to model industry fabrication practices

Steps	Activity	Description
Step 1	Project Selection & Redesign	Instructors and students research products currently in demand. Selected items were redesigned to maximize the usage of materials and accommodate the capability of the program's CNC equipment.
Step 2	Team-Based Learning Workflow	The class was divided into six teams using a Team-Based Learning model. Each group was responsible for a specific subassembly, allowing students to specialize and operate in a production-line environment.
Step 3	Industry Collaboration	A partnership with [Industry] provided all steel materials for the course. The company also reviewed designs and offered feedback to ensure projects met standards.
Step 4	Fabrication & Practice	Students practiced with welding coupons before working on final builds. This helped refine skills, minimize errors, and reinforce safety. The final deliverable products included six rocket stoves, six fire pits, and 45 takedown grills.
Step 5	Design Iteration & Innovation	Students and instructors collaborated to propose future improvements, including a hibachi-style griddle attachment for the rocket stove, encouraging creative thinking and continuous improvement.

Results to Date

A total of 57 products were completed over the semester-long course after it was redesigned, including six rocket stoves, six fire pits, and 45 takedown grills. Each item required students to collaborate on multiple subassemblies, operating in teams responsible for different tasks. Each team was required to prep, lay out, weld, grind, and paint their parts before submitting for final inspection. This approach reinforced the importance of coordination and communication, key skills in both small shops and large-scale manufacturing environments. Before final construction, welding coupons were provided for pre-project practice, which allowed students to refine their welding technique and build confidence while reducing the risk of costly material errors. Students developed production efficiency through specialized roles and synchronized workflows, simulating the structure of an assembly line. They also engaged in quality assurance protocols to ensure projects met dimensional and aesthetic standards before completion. Feedback from [Industry] further enhanced the experience, exposing students to external evaluation and preparing them for future interactions with clients or supervisors. Overall, the project gave students meaningful exposure to team-based manufacturing, technical skill application, workplace problem-solving, and iterative design, use in the welding sector.

Future Plans

Moving forward, the course will continue to evolve in response to student feedback and industry needs. Planned improvements include incorporating cost estimation lessons to teach students how to calculate materials, labor, and pricing. These additions may lead to capstone-style projects where students design, build, and market original products. Instructors also aim to host community showcases, giving students the chance to present and sell their work while simulating client interactions and building communication skills. These enhancements are designed to further align the course with real-world practices and ensure students graduate with both technical expertise and workplace readiness.

Costs

Redesigning the course was made possible through strategically using resources and collaborating with strong industry partners. The most significant contribution came from [Industry] donating the steel used in the course, an estimated value of approximately $21,000, including CNC-compatible sheets and additional steel in welding coupon form for welding practice. The donation of 10,000 welding coupons also reduced the amount of time needed to process metal per class and reduced the amount of wear, tear, and maintenance associated with our metal processing equipment. The availability of welding coupons has reduced bottlenecking and increased time on task, allowing students more time to improve welding skills. Without this donation, material costs would have posed a substantial barrier to implementing a full-scale fabrication model. Consumables like wire, gas, and electrodes were supplied through the existing inventory maintained by the Texas State University, which helped keep operational expenses minimal. To further reduce waste and cost, instructors utilized several cost-efficiency strategies, including CNC nesting to maximize material yield, pre-build welding practice using scrap and welding coupons to reduce errors on final projects, and standardized product designs that allowed for bulk fabrication and reduced setup time. Together, these efforts created a high-impact, low-cost instructional model that delivered real-world value without overextending program resources.

References

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