



Utilization of AI in Agriculture Mechanics



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Introduction

Artificial Intelligence (AI) is already being utilized in school-based agricultural education classrooms and laboratories for content and lesson planning, image generation, assessment creation, and writing/ speech improvement (Pehrson et al., 2025). In Texas, there is desire from public school administrators for an increasing number of Industry-Based Certifications. As such, agricultural mechanics teachers have expressed a need for training in many content areas, including metalworking and welding (Wells et al., 2021). AI may provide a useful tool to assist teachers with visual weld appraisal.

Objectives

- 1) Evaluate the ability of commonly available AI tools to accurately perform visual weld inspections and identify surface-level discontinuities.
- 2) Determine if common AI tools can make recommendations for weld improvement.

Methods

- Students in AGSC 1451 at Texas A&M University-Kingsville completed an AWS 1.1 weld test using shielded metal arc welding.
- We photographed each weld using the same camera, lighting, and white backdrop; the classroom included LED and fluorescent lights for consistency.
- We submitted weld images to ChatGPT Pro® using the prompt:
“Perform a visual appraisal of the provided weld image. Describe any weld imperfections including porosity, inclusion, undercut, or lack of fusion. Then provide any recommendation on how to improve this weld.”
- We then had a Certified Weld Inspector (CWI) evaluate the welds and provide visual appraisal comments.
- We recorded the AI responses and CWI feedback, then compared both for defect identification and improvement recommendations.



Implications & Conclusions

These findings suggest that AI-generated feedback can support agricultural mechanics instruction by providing students with consistent and immediate evaluation. Integrating AI tools into welding programs can enhance learning outcomes, streamline assessments, and introduce students to the digital tools shaping modern agricultural industries. This should not be used as an official certification testing tool but can be used by novice instructors to provide general visual weld appraisal. Teachers utilizing such tools should try to use the same prompt for each weld. They need to have a set place for photos that provides enough light to minimize shadows and an effective backdrop.

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References

- Pehrson, S., Sorensen, T. J., Wood, M. J., Burrows, M. S., & Furse, J. (2025). Examining AI perceptions and utilization among agricultural educators in Utah. *Journal of Agricultural Education*, 66(3), Two. doi.org/10.5032/jae.v66i3.2910
- Professional Welding Certifications - Elevate Your Welding Career, www.aws.org/certification-and-education/professional-certification/.
- Say, D., Qaisar, S. M., Krichen, M., & Zidi, S. (2025). Artificial intelligence assisted non-destructive testing of welding joint: A review of techniques, X-ray image processing and applications. *Engineering Applications of Artificial Intelligence*, 160, Part C. doi.org/10.1016/j.engappai.2025.111792
- Valdez, E. D., & Johnson, S. (2020). *Mismatch? Aligning secondary career and technical education with regional workforce demand*. Texas Public Policy Foundation.
- Wells, T., Hainline, M., Rank, B. D., Sanders, K. W., & Chumbley, S. (2021). A regional study of the agricultural mechanics knowledge and skills needed by school-based agricultural education teachers. *Journal of Agricultural Education*, 62(2), 148–166. doi.org/10.5032/jae.2021.02148



ChatGPT

Preliminary Findings

- Students found that ChatGPT Pro® provided more detailed weld evaluations than the free version. The AI accurately identified key weld characteristics such as bead consistency and visible defects (porosity, slag inclusion), which were validated by the Certified welding Instructor (CWI).
- One limitation of AI was that it could not measure weld dimensions (e.g., 5/16" weld face) or pinpoint the exact locations of defects.
- AI provided general welding recommendations, such as adjusting amperage or arc length, but lacked specific values. In contrast, the CWI gave precise, actionable guidance, including maintaining a 1/8-inch arc length and slowing travel speed at weld completion.
- Overall, students agreed that AI helped determine whether welds were satisfactory, but CWI feedback was more effective for improvement.