Trial By Arc:

Exploring AR Welding Simulators In Agricultural Technology Laboratories

Introduction

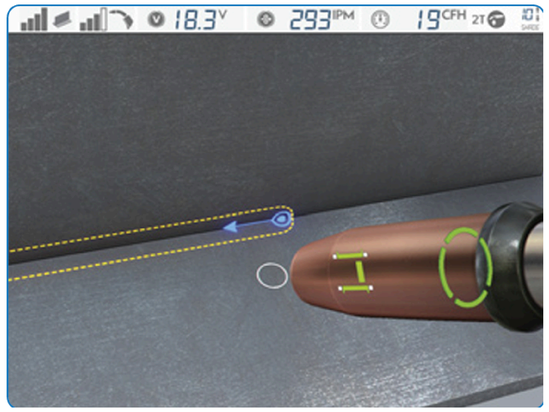
- Agricultural mechanics courses introduce students to welding and fabrication, but students' perceived skill often doesn't match their actual ability.
- Augmented reality welding simulators offer a safe, measurable, and repeatable way to build skills and confidence.
- Rooted in Kolb's Experiential Learning Theory (1984) and Bandura's Self-Efficacy Theory (1997)
  - AR simulators can improveperformance, boost confidence, and reduce anxiety.

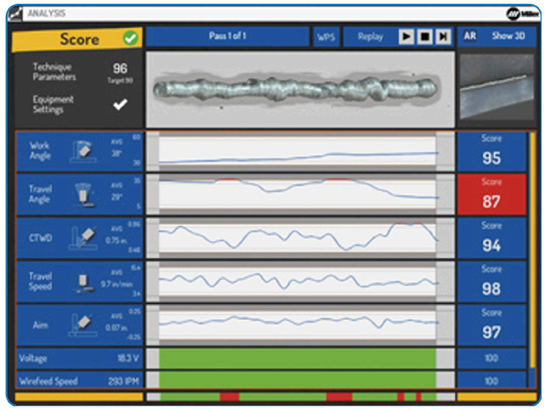
Purpose

- To examine how students' confidence and knowledge align with their actual welding performance on an augmented welding simulator

Methods

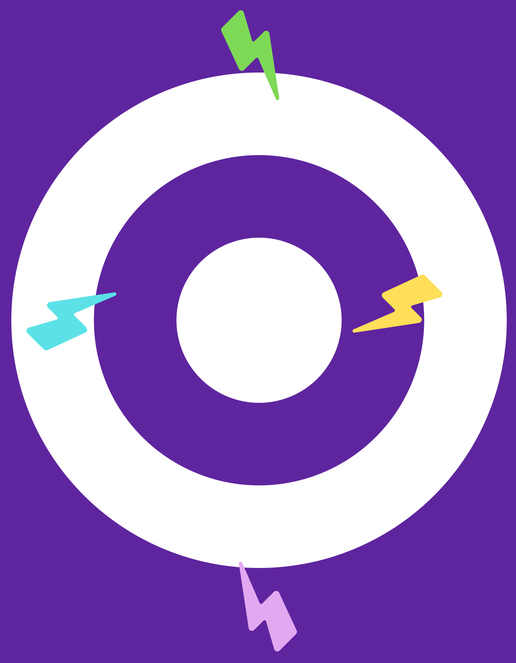
- Fifty students from Fundamentals of Agricultural Technology at Stephen F. Austin State University completed an optional lab using the Miller AugmentedArc simulator
- Students performed two GMAW welds on a 4" T-joint under identical settings
  - Beginner mode, ¼" plate, .035 wire, 75/25 mix, 1 pass, drag, no manipulation
- The simulator produced numeric scores
  - CTWD, travel speed, work/travel angle, and aim.
- Students reported both pass scores, process used, and self-rated experience (None–Very High)
- Average simulator scores were compared descriptively to explore links between confidence and skill
  - Experience Levels, Knowledge Accuracy, and Performance Outcomes





Results

N = 50 | M = 75.32 | SD = 17.39



Experience

None (n = 32)
M = 72.86 | SD = 19.12

Below-Average (n = 10)
M = 84.55 | SD = 9.85

Average (n = 6)
M = 70.83 | SD = 14.11

Above Average (n = 2)
M = 82.00 | SD = 0.50

Knowledge

Correct (n = 20)
M = 77.35 | SD = 19.40

n = 9 | M = 72.06 | SD = 14.70
n = 8 | M = 84.19 | SD = 10.49
n = 2 | M = 71.75 | SD = 8.75
n = 1 | M = 81.50 | SD = 0.00

Incorrect (n = 30)
M = 73.97 | SD = 13.57

n = 23 | M = 73.17 | SD = 20.58
n = 2 | M = 86.00 | SD = 6.50
n = 4 | M = 70.38 | SD = 16.12
n = 1 | M = 82.50 | SD = 0.00

Discussion/Conclusion

- Some groups performed better than expected, while others struggled despite confidence
  - The largest group showed moderate outcomes overall
- Confidence can help or hinder learning depending on how accurately it reflects true skill
- Results showed to be consistent with Bandura's self-efficacy theory,
  - Students who rated themselves modestly may have been more focused and attentive to feedback
- Overconfidence and inexperience appeared to create barriers to effective performance
- While limited to one group, these findings offer valuable insight into how SFA can enhance AR welding integration
- Ultimately, this "Trial" shows that measuring both confidence and skill can help educators design more effective, reflective learning experiences in agricultural mechanics

James "JD" Kelley | Justin Womack | Garrett T. Hancock