

**Heating up Virtual Instruction:  
Teaching Hand Motion Techniques for Virtual Welding Using Hot Glue and Flipgrid**

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### **Introduction**

Motivated by the transition to online or hybrid educational environments, teachers are challenged to take a fresh look at teaching. By adapting to this challenge there is an increasing need to create innovative approaches to teach hands-on lessons (Lunceford, 2020). Cultivating hands-on, practical lessons for online delivery can be challenging for courses, such as agricultural mechanics. Beyond lacking access to appropriate equipment and shop facilities, agricultural mechanics engage tactile learning strategies best refined in laboratory settings. To maintain an interactive classroom, educators must also employ strategies to keep students engaged with the content and peers during their educational experience (Cavinato et al., 2021).

In alignment with Priority 4 of the American Association for Agricultural Education (AAAE) research agenda, instructors teaching agricultural mechanics can adapt lessons to be engaging and meaningful by using materials that are accessible and affordable for most students (Edgar et al., 2016). An effective approach to achieving this is through student participation in Career Development Events (CDEs), which allow students to gain career-related skills that are practiced and demonstrated through competitive events. CDEs provide an opportunity to practice Deweyism—the practice of experiential learning (Garrison, 2016)—by allowing students to make meaning from lessons and apply it to complete a task. The purpose of secondary career technical education (CTE) is to create a skilled, agricultural workforce who consist of consumers who can make informed decisions (Rich, 2020). To address these challenges, agricultural educators must adapt lessons to teach agricultural mechanization skills as numerous employment opportunities are waiting for qualified, skilled students to enter the workforce (Lunceford, 2020). As a result, we investigated the use of various online platforms to increase engagement in a virtual agricultural mechanization skills lesson.

### **How It Works**

Teaching welding in an online environment can showcase avenues to meet students' learning styles. As a result, we created a virtual welding activity to meet the educational needs of students' learning styles—divergent (feel and watch), assimilation (watch and think), convergent (do and think), and accommodation (do and feel; McLeod, 2017). For this activity, students were taught the motions of Gas Metal Arc Welding (GMAW), commonly called Metal Inert Gas (MIG), by using a hot-glue gun in place of a MIG gun in an advanced agricultural education course at New Mexico State University. In this simulation, the hot-glue guns melted glue sticks from the heat collected at the tip due to the flow of electricity. This compares to the MIG gun by the electrical current passing through the welding lead into the MIG gun, into the wire, and onto the metal surface creating penetration and the melting of the wire.

After relating the hot-glue guns process to GMAW, students were guided through welding techniques and weld puddle manipulation. This pilot used a pre-recorded demonstration to model the operation of the hot-glue gun, define a puddle, and establish how to apply welding techniques to manipulate the weld puddle. We also introduced students to welding techniques of manipulating a puddle by using straight push/pull, circles, flick, crescent, and triangular motions. After the recorded demonstration was complete, students completed a bead pad on cardboard to practice each welding technique. While completing their bead pad exercise, students were encouraged to use Flipgrid (Flipgrid, 2021) to record themselves completing the beads. Flipgrid

allows educators to create page in which students can record a video of them completing a task, and then share that video to the page for the class to watch. Once complete, students uploaded their videos to a link specific to the course that we created in Flipgrid.

### **Results to Date**

While this activity had some connectivity challenges, student feedback was extremely positive. The class was engaged and enjoyed the opportunity to apply welding techniques they observed in the video to complete this exercise on their own. Students stated that this type of activity could be incorporated in both synchronous and asynchronous learning environments. Students also acknowledged that watching the pre-recorded video provided a good introduction to welding and allowed students to practice hand motion techniques without the intimidation of electricity, sparks, and fumes in a normal welding exercise. Additionally, students indicated that they enjoyed that the activity presented a hands-on learning opportunity they miss in many courses delivered online.

While most feedback was positive, a few complications arose. When displaying the pre-recorded demonstration video via a shared screen, the audio and visual quality was inconsistent as students had differing connectivity access. This challenge resulted in some students missing key steps needed to run the beads. A few students also had operating difficulties with the glue guns as cheaper products seemed to run inconsistent beads. Some students struggled accessing Flipgrid due to expired software so most positioned their computer cameras where the instructors could observe their hand motion techniques via Zoom.

### **Advice for Future Use**

We discovered this activity is best suited to use as an introduction to welding as it allowed students to obtain hands-on experience of puddle manipulation in a safe, non-intimidating environment. To increase efficiency of group engagement, we recommend using the online educational platform of Nearpod (Nearpod, 2021) in addition to Flipgrid. Nearpod presentations allow students to see the demonstration, hear the demonstration, practice the activity, and then share with a group, which allows students to view their peers' work in real-time. We also recommend introducing and practicing one hand motion technique at a time to help with retention and determination of technique preference. After each student completes the exercise, they should also upload an image of the final product with the class or to the "Collaboration Board" feature in Nearpod. We also recommend encouraging students to replace clear glue sticks with colored glue sticks to help with bead visibility. Finally, we recommend that students and instructors check the quality of the equipment prior to completing the activity. Instructors can also add various features in Flipgrid and Nearpod to aid in making welding online engaging, interactive, and productive.

### **Costs/Resources Needed**

Instructors will need a computer or another device with a camera, a network connection, and access to Zoom or another video conferencing software. For the glue gun activity, instructors will need one hot-glue gun for each student, hot-glue sticks (the amount will vary depending on class size and how much practice students are expected to complete), material to "weld" on such as cardboard or cardstock paper, and access to Flipgrid (or a different educational platform for students to upload their videos). The cost of the hot-glue guns and glue sticks associated with this activity vary but likely range between \$7–\$20 per set.

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