NACTA Journal

Using Interactive Gaming to Introduce Students to Gas Tungsten Arc Welding (GTAW)

Introduction

The use of educational games has become commonplace in classrooms (de Freitas and Oliver, 2006). There is evidence suggesting that utilizing computer program simulations may be more beneficial than traditional teaching strategies (Vogel et al., 2006). The use of computer programs has led to greater potential for teachers to adapt lessons to facilitate the flow of experiences and teach more complex concepts (de Freitas and Neumann, 2009). Boyd and Murphrey (2002) posited that by utilizing computer-based programs teachers and instructional designers can utilize animation, video, and sound to provide all learners a platform to learn complex concepts.

Educators need to incorporate a variety of instructional delivery methods to maintain students' attention and motivation (Born and Miller, 1999). Furthermore, the use of computer-based programs that include simulations, role-play, and games are vehicles in which students can utilize to reinforce knowledge by putting theory into play (Boyd and Murphrey, 2002). Vogel et al. (2006) indicated that by creating computer programs that reduces a students' time on task and increase cognitive gains will help educators. The use of simulations allows teachers to give students the ability to learn concepts for which the teacher may not have the materials to give actual hands-on learning opportunities.

One area that secondary teacher's in Iowa indicated a low competence to teach was Gas Tungsten Arc Welding (GTAW) (Shultz et al., 2013), more commonly known as Tungsten Inert Gas (TIG) (Jeffus, 2012). While the use of welding simulators has been well documented (Byrd and Anderson, 2012; Clark, 2011) the internet-based game *Tig Welder Premium* is the only virtual reality simulator that introduces theories and application of the TIG welding process.

How it Works

Educators and students can access the internet-based *TIG Welder Premium* game via http://www.tradesgamer.com and is also available as an app for iPhones. The webpage and app allow students to explore TIG welding theory and develop performance skills. There is a set of tutorial videos located on the website that explains how to operate the TIG Welder Premium game. The students will need to watch the videos to know how to operate the simulator correctly. In addition to the TIG welding simulator, nine tutorial videos about TIG, MIG , and arc welding can be found at the bottom of the website. Students can access introductory videos that include other aspects of welding including arc and MIG welding via YouTube videos that run approximately two minutes each.

The game consists of three TIG welds and 15 questions. It should be noted, that prior instruction about TIG welding is not required if the tutorial videos are utilized by the students. When a student starts the game, they must select their filler material to be used. The selections range from thin, normal, and thick filler rod. A selection for heat range must also be made which range from 1400, 1500, and 1600 degrees Celsius. The student will then get to perform a series of three welds. Safety procedures and personal protective equipment are reinforced in the game by requiring the students to lower a welding visor prior to welding or be virtually exposed to arc flash and required to start over. After each weld is performed the student is required to answer five questions pertaining to TIG welding before advancing to the next weld. Once all three welds and 15 question have been completed the welds will be tested. The destructive weld test used is termed *the wall of death* where a wrecking ball is used to test the welds. If the welds fail the wrecking ball will break the welds knocking down the welder. If the welds pass the wrecking ball will not break the welds saving the welder from being knocked down.

Teachers can structure instruction around this game in various ways such as letting students have free roam of the website to learn about TIG welding or incorporate it into classroom instruction. One

limitation to using this website is technology. If educators have a limited number of computers, they will be limited in how they can incorporate the website. If educators are in one to one school incorporation should be easy. There are multiple ways to integrate the game, but researchers recommend that students view a video individually or as a class and discuss the underlying theories ensuring that the students understand the principles of TIG welding. Then allow the students to watch the game tutorial video so that everyone understands how to play the game correctly. A welding contest could be set up within the class to see who can get the highest virtual score as a TIG welder.

Implications

The utilization of the TradesGamer website can help educators introduce students to TIG welding. Please note that we recommend this as a teaching aid, we are not suggesting that this is a replacement to TIG welding. The game can also give non-traditional students the ability to experience welding if they are anxious about the dangers of welding by learning about selecting filler rod, machine adjustment, and correct personal protective equipment. Anderson and Byrd (2012) postulated that with the use of simulations a student's anxiety level may decrease.

Future Plans

The researchers plan to introduce the availability of the website to secondary teachers through the NAAE communities of practice. The researchers plan to introduce the website to pre-service teachers in the Methods of Teaching Agricultural Mechanics course. An evaluation of the website and its usefulness in an agricultural education classroom will also be conducted with pre-service teachers in the Methods of Teaching Agricultural Mechanics course.

Costs/Resources Needed

It is free to utilize the internet website http://www.tradesgamer.com. The resources needed by educators will be the use of computers or tablet that has internet access and can support Adobe flash player. Time will also be needed by the teacher to identify the most appropriate time to incorporate the website into the current curriculum.

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