Cognitive Learning: Hands-On vs. Theoretical

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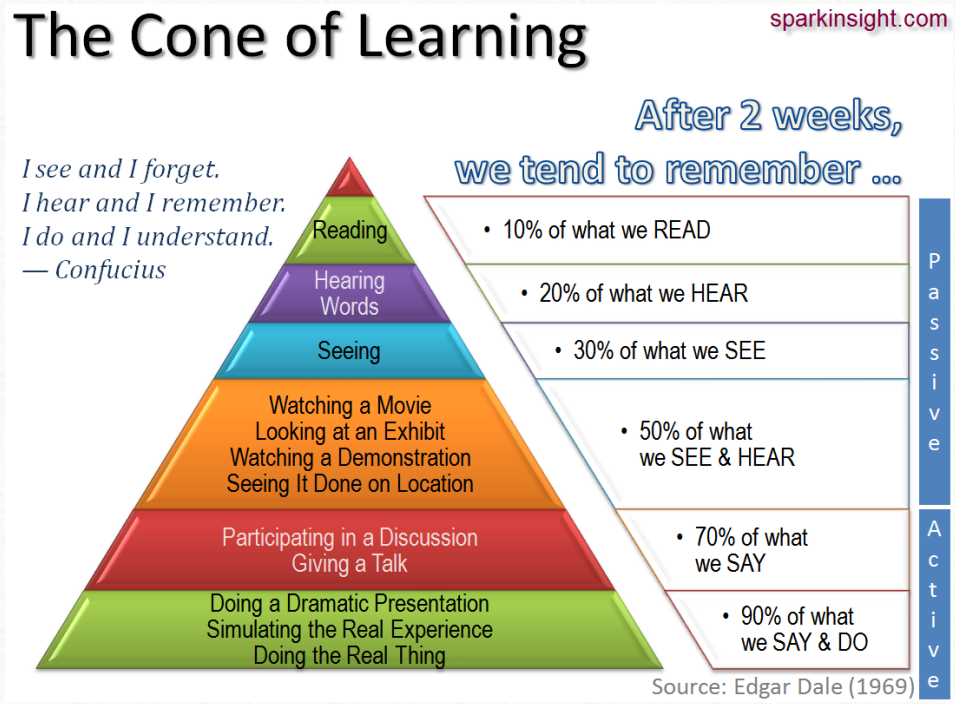
Literature Review

- We often teach the theory of how something works in lecture and test the students over it.
- Student's have no hands-on learning.

Literature Review



Literature Review

- Thomas Lord, revisited this theory in 2007 and applied it to his non-science majors, discovered that the more active the students were involved in the lesson the more successful they were in learning the information (Lord, Nov 2007).

Literature Review

- Why VR in welding?
- Anxiety/Fear
- Confidence prior to actual

Literature Review

- Fear is the number one reason that students do not try and participate in welding classes or classes that require students to weld (Manson, 2014).

Literature Review

- In a welding environment, safety of one's self can cause others to trigger heightened anxiety levels.
- The majority of the triggers can be the potential for electrical shock, compressed gas bottles, pollution inhalation, fire, explosion, and arc radiation (Cary, 2005) (Jeffus, 2012).

Literature Review

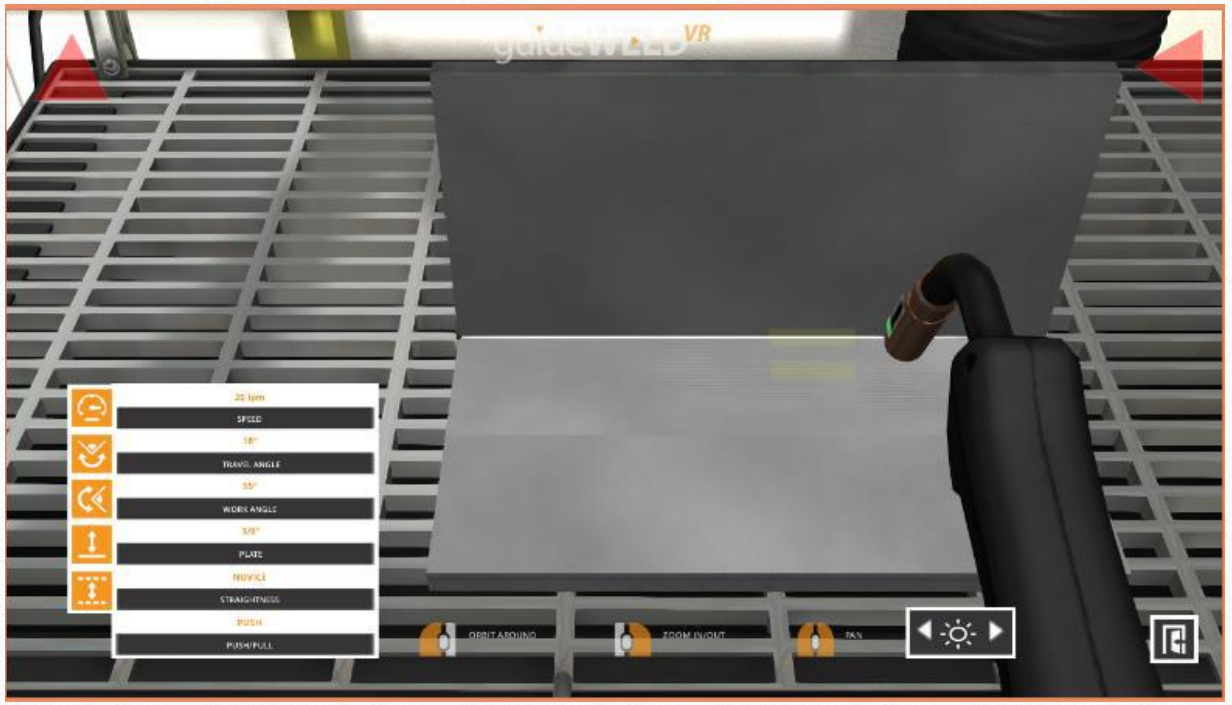
- The use of VR simulators has helped increase the awareness of welding to the younger gamer generation (Postlethwaite, 2012).

Introduction To VR

- Realityworks Guideweld is a product designed to use virtual reality as a teaching aid for educational programs that do not have the capabilities to do actual welding.

Introduction to VR

Introduction To VR



Objectives

- Evaluate students' capabilities of welding using actual hands-on welding vs. the Realityworks Guideweld virtual reality welding machine.
- Evaluate students' fear/anxiety and confidence in welding using different methods of teaching.

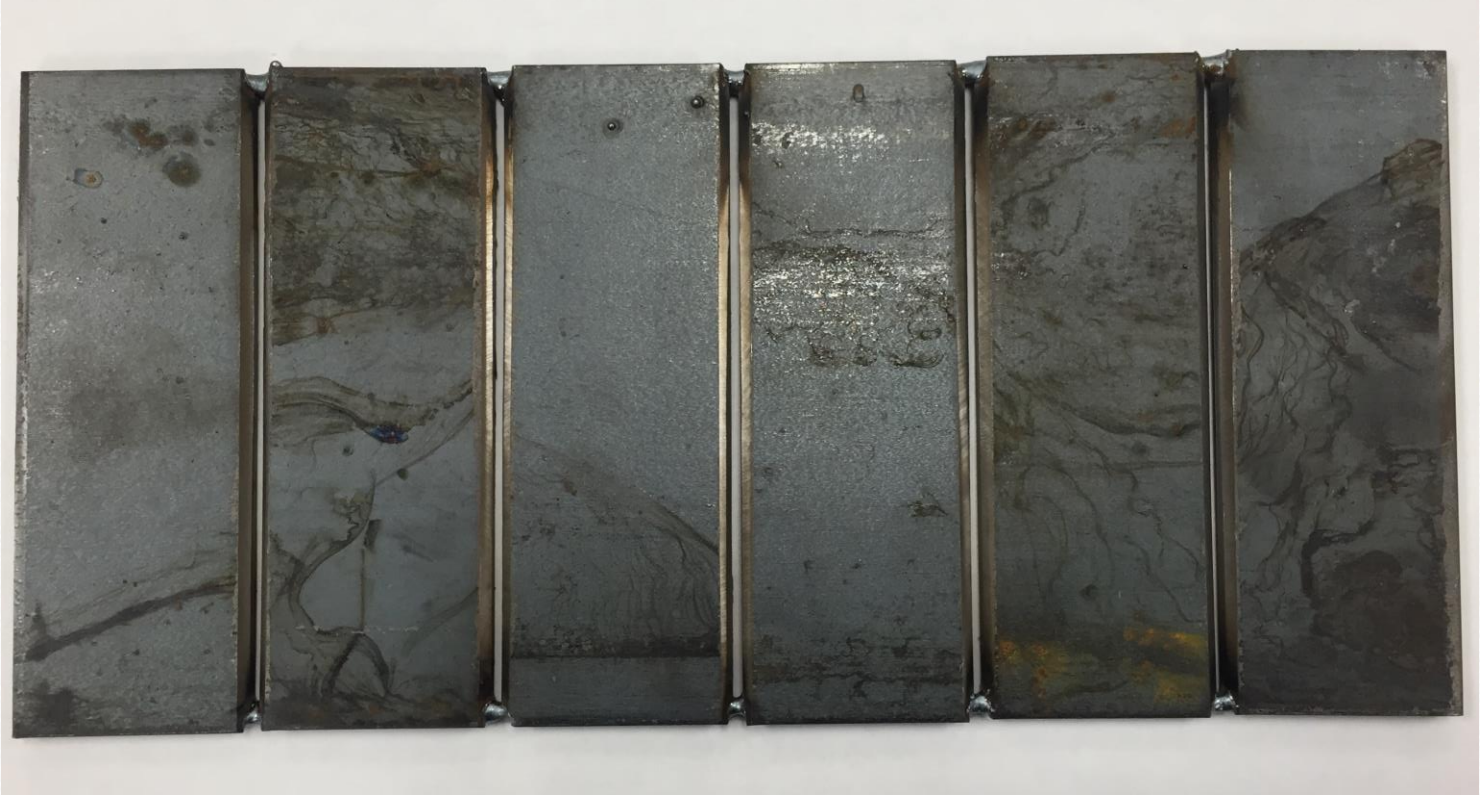
Materials and Methods

- Twenty-nine Students enrolled in the Introduction to Agricultural Mechanization and Engineering (AGRI 2303) classes, and whom had little to no experience in performing Gas Metal Arc Welding (GMAW), were randomly selected to participate in this study.
- Taught theory of GMAW only.
- Randomly drew numbers to distinguish groups.

Materials and Methods

- The groups were labeled as follows:
- 1-10 GMAW with assistance.
- 11-20 GMAW without assistance.
- 21-30 Virtual reality with assistance.
- 31-40 Virtual reality without assistance.

Materials and Methods



Materials and Methods

- Surveys were given before group determination
- After group designation
- After practice welds
- After AWS Test Weld.

Materials and Methods

- The American Welding Society Test Weld was a single pass flat grooved butt weld on ¼” plate (technically referred to as a 1G weld).
- The plates were pre manufactured and given a spacing of 3/32” gap at the root.

Materials and Methods

Materials and Methods

- We used the Realityworks WPS as directions and specification in a manner appropriate for American Welding Society testing and certification.

Results

- The results were evaluated for hands-on welding vs. the Realityworks Guideweld virtual reality machine by using the AWS final test weld.
- The student's fear/anxiety and confidence levels in different methods of teaching were evaluated by the four different surveys that were given and collected.
- All statistics were evaluated using IBM SPSS and Microsoft Excel.

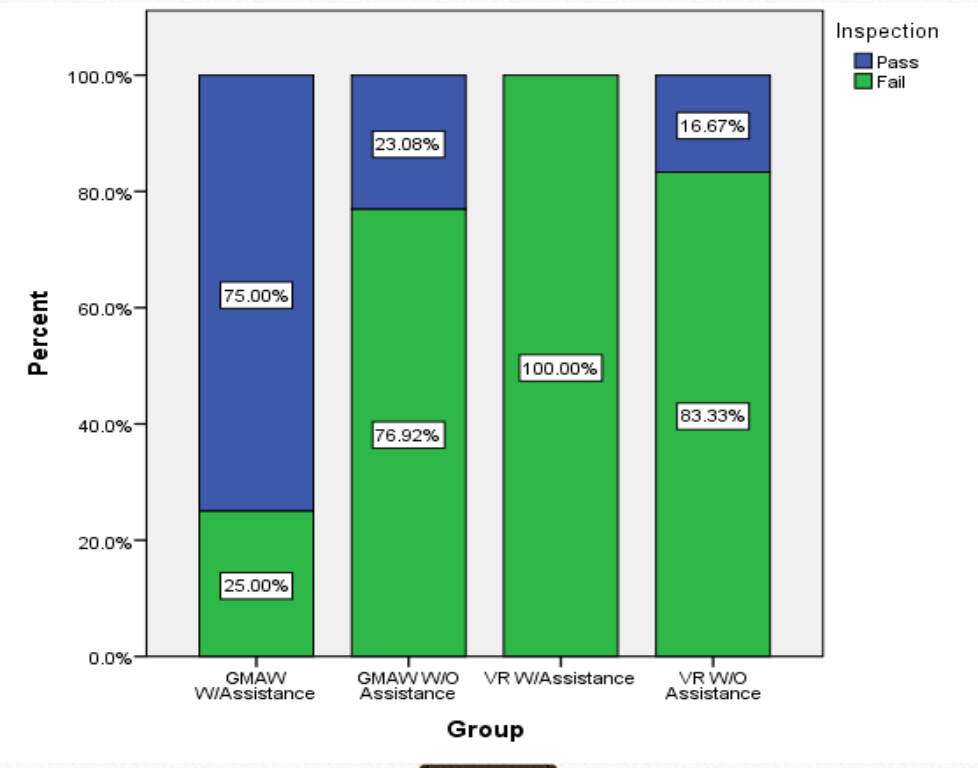
Results

- Having only five practice welds with GMAW or the VR no one passed using the complete AWS D1.1code for visual inspection of groove welds (4.9.1)
- All failed in code due to incomplete penetration throughout the grooved weld.

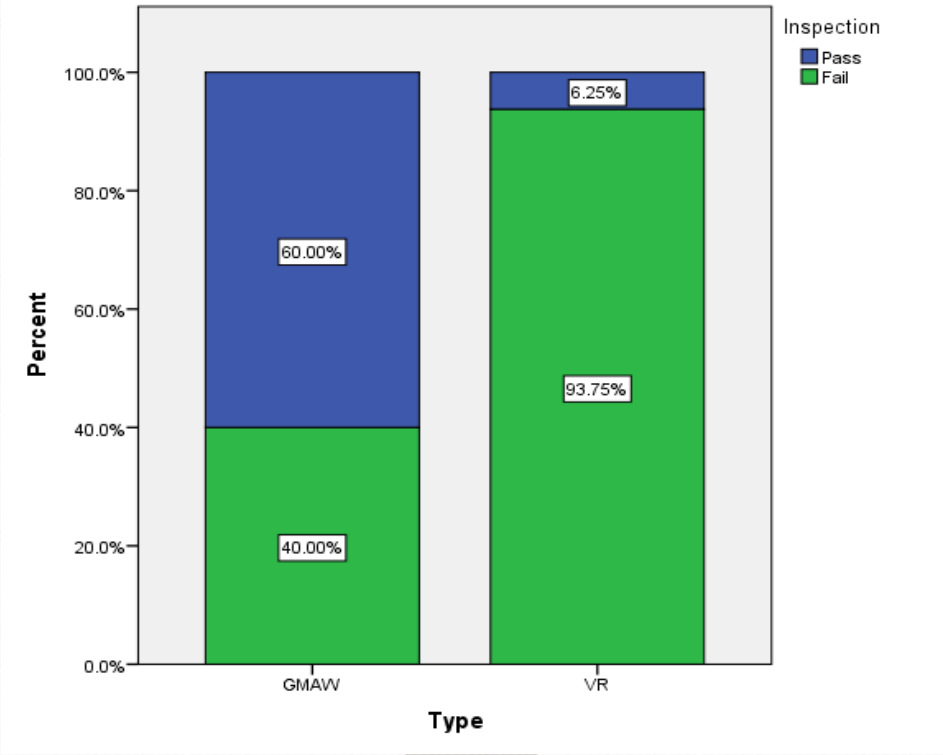
Results

- However if eliminating the criteria 5 and 6 which involve root penetration there were much higher passing results.
- John Husfield an AWS inspector # CWI 11070038 inspected all of the AWS welds. He omitted ½ inch on each end of the weld for the tacking of the premade pieces.

Results


Inspection
Pass
Fail
Percent
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
75.00%
25.00%
23.08%
76.92%
100.00%
16.67%
83.33%
GMAW W/Assistance
GMAW W/O Assistance
VR W/Assistance
VR W/O Assistance
Group

Results


Inspection
Pass
Fail
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Percent
60.00%
40.00%
6.25%
93.75%
GMAW
VR
Type

Results

- Student surveys were conducted during the research to help evaluate their fear and confidence levels during their learning process.
- The first questions of anxiety and confidence were evaluated before they found what groups that they would be separated into.
- The anxiety levels and confidence levels showed no significant difference before they were separated into groups.

Results

- The anxiety levels after they found out which group they would be in, either hands-on or VR, VR had a much lower anxiety level going into their practice pieces than the hands-on groups.
- The confidence levels after they found out what groups they were in was not significantly different between the groups.

Results

- VR still remained to have a lower anxiety level than the hands-on groups going into the AWS test weld.
- Yet, the hands-on groups had a higher confidence level going into the AWS test weld.

Results

- After the students finished their AWS test weld, they were given their final survey to rate their overall anxiety and confidence levels. Hands-On groups had a higher confidence rating and a lower anxiety to the VR group.

Conclusion

- There are many tests and quizzes in the VR programing that allow the students to work and move on at their own desired pace.
- VR saves in consumed materials and resources.

Conclusion

- This study did end up showing that the VR groups had a lower anxiety level than that of the GMAW groups, Yet the GMAW groups were much more confident in their welding after the study was finished.
- The question that comes to play is whether virtual reality welders actually produce authentic skills applicable in the welding industry.
- VR can help produce authentic skills, but lacks the real world ability to make a proper GMAW pass.

Recommendations

- That hands-on learning in a real life environment will still teach and train students how to do a certain task at a faster and more proficient rate.
- VR has come a long way, yet getting used to the software and transitioning over to a real environment is still a hard task for students to master.

Recommendations

- More time and more effort will result in higher safety and less materials being wasted, but more time will be needed and time is money.
- With VR the students have a lower anxiety rate due to no safety precautions needed.
- The students feel more comfortable in the classroom learning how to weld using VR and they see it as playing video games in class.

Questions?

Survey 1 Questions

- On a scale of 1-10 (1 being the least amount and 10 being the highest amount), how much prior experience do you have with Gas Metal Arc Welding?
- On a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your confidence with Gas Metal Arc Welding?

Survey 1 Questions

- On a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your anxiety/fear with Gas Metal Arc Welding?
- On a scale of 1-10 (1 being the least amount and 10 being the highest amount), how much formal instruction (i.e. high school or college) have you had with Gas Metal Arc Welding?

Survey 1 Questions

- What is your gender? Male or Female (circle appropriate response)

Survey 2 Questions

- Now knowing what group you are in, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your confidence with Gas Metal Arc Welding?
- Now knowing what group you are in, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your anxiety/fear with Gas Metal Arc Welding?

Survey 3 Questions

- Having performed your five welds, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your confidence with Gas Metal Arc Welding going into your final American Welding Society test weld?
- Having performed your five welds, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your anxiety/fear Gas Metal Arc Welding going into your final American Welding Society test weld?

Survey 4 Questions

- Having completed your American Welding Society Test weld, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your confidence with Gas Metal Arc Welding?
- Having completed your American Welding Society Test weld, on a scale of 1-10 (1 being the least amount and 10 being the highest amount), how would you rate your anxiety/fear with Gas Metal Arc Welding?