

Changing Manufacturing and Welding Perceptions at Northeast Wisconsin Technical College

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Obtaining our grant: “Welding: Wisconsin’s Ultimate Rural STEM Pathway”

- NWTC applied for this grant in Fall 2013 and were awarded the grant in late summer 2014.
- The objectives of the grant:
 - Provide outreach to K12 students, their parents, K12 counselors and K12 teachers about the local opportunities afforded by welding careers
 - Strengthen K12 welding education pipeline, particularly in rural areas
 - Develop and pilot educational materials for Math Trades 1 that can be used in both the high schools (who articulate the course) and NWTC

Projected Outcomes

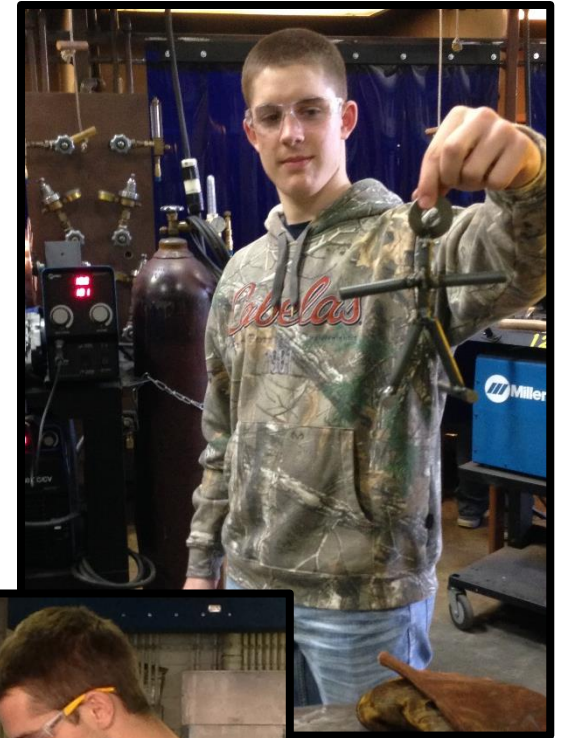
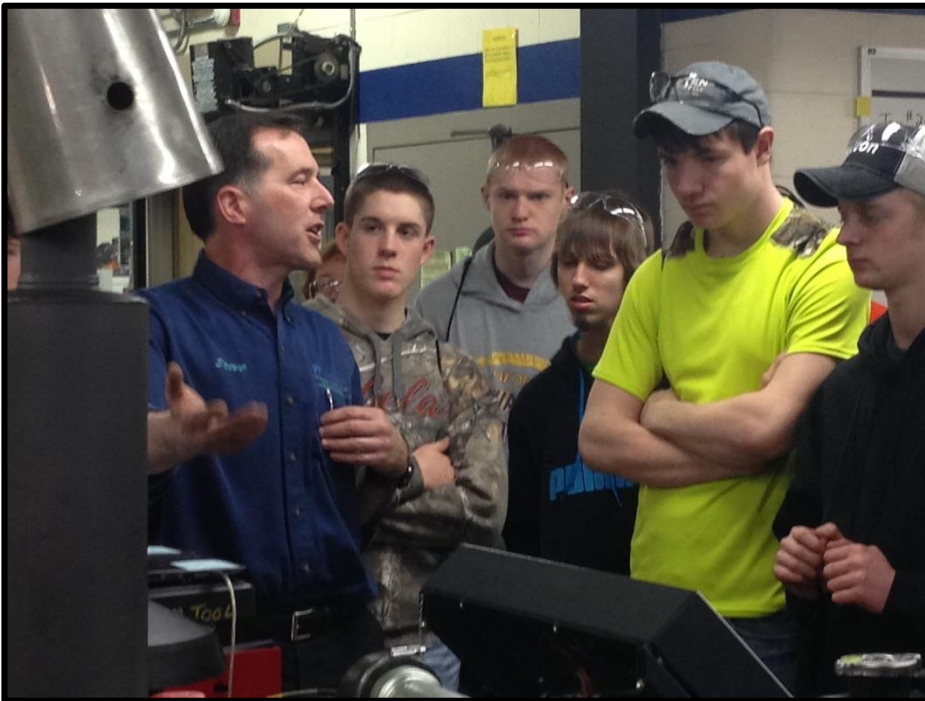
- More employees to fill welding positions in the region to meet industry needs
- Perceptions about welding and the manufacturing industry will improve
- Math instructors will have a better understanding of the manufacturing industry to improve teaching in Math Trades 1 and welding and technical education instructors will have a better understanding of the math concepts taught in Math Trades 1 to relate in their program classes
- Students will have stronger math skills coming out of the welding program
- Pass rates of Math Trades 1 will improve, thus leading to more students graduating

High School Articulation

- Initially three high schools committed to add welding and math NWTC courses to be articulated as dual enrollment for juniors and seniors
- Six more high schools were added to varying degrees for Fall 2016 and several more may be added for Fall 2017

High School Industry Tours

- High school groups (typically sophomores) attend tours that go to a local manufacturer, a Green Bay manufacturer, and NWTC each semester (initial three high schools at this point)
- Students get paired up with an NWTC student to try out welding



Professional Development Opportunities and Training for High School and College Instructors Involved

- Learning Community Meetings – High school math and technical education and NWTC math and welding instructors meet monthly to quarterly to develop curriculum, plan industry tours, and to have overall improved collaboration (for three years of the grant)
- Welding for Non-Welding – High school and NWTC math instructors take a one day welding course taught by the NWTC welding instructors with the help of high school technical education instructors (see flyer next)
 - This may be potentially expanded to other trades areas
- Train the Trainer – Technical education high school instructors take summer courses to be able to teach the welding and other trades area courses in the high schools

Welding for Non-Welders

Spend the day in the welding lab learning first-hand the welding applications and relevance to the Math Trades 1 content.

This one day course provides instructors direct exposure to welding concepts and techniques. Understanding the welding applications creates improved collaboration between Tech Ed and Math teachers, which better serves the students.

Each high school will be given a math kit and curriculum materials for Math Trades 1 to take back to their high school on this day.



7:00 AM - 3:00 PM ~ NWTC (2740 W. Mason Street; Green Bay, WI)

~ All supplies, lunch and a light breakfast will be provided

~ Please wear appropriate attire:

leather shoes (steel toe if available) and long pants/sleeves



Northeast
Wisconsin Technical College

Contextualized Math Curriculum

- The course that welding students take at NWTC is Math Trades 1 which only suffices for technical diplomas (not associates degrees)
- Competencies:
 1. Perform operations involving whole numbers
 2. Perform operations involving fractions and mixed numbers
 3. Perform operations involving decimals
 4. Perform operations involving measurement
 5. Perform operations involving integers
 6. Solve equations
 7. Perform operations involving practical plane geometry
 8. Perform operations involving trigonometry

Videos

- Nine interactive videos showing examples of how welding and manufacturing use math were created at two manufacturing companies and NWTC (3/location)
- Created in conjunction with the Northeast Wisconsin Manufacturing Alliance
- Housed at <http://newmfgalliance.org/educators-students/get-real-math-videos/> and www.nwtc.edu/mathnsf
 - Links to YouTube where the videos can be played
 - Links to pdf Lesson Plans to go with the videos – these lesson plans are geared more towards middle school and high school with common core competencies included

Videos

- See handout of example video handout, example of instructor key, and list of videos
- We will watch/complete the Whole Numbers Video:
https://www.youtube.com/watch?v=6P69vLOe_vA



Activities

- Created during the learning community meetings
- The activities are mostly hands-on and are specific to welding or the manufacturing industry in general and utilize items in a math kit (see next slide)
- See handout of example activity, example of instructor key, and list of activities
- We will do the first part of the first activity for Whole Numbers



Math Kit

Total Cost of the kit - \$380



- Cart to hold materials
- Fraction/Decimal activity parts in storage box – ten of each of the parts below
 - Two angle iron pieces labelled A1 and A2
 - Two rectangular tubing pieces labelled T1 and T2
 - Three flat bar pieces labelled FB1, FB2, and FB3
- Algebra activity parts – ten of each the parts below
 - Two round stock pieces
 - One square stock piece
 - One rectangular stock piece
- Motor stand
- Fuel tank replica
- Tank reducer replica
- Bolt Hole Circle (not pictured)
- 10 combination squares
- 20 pee-wee tape (soft tape measure)
- 4 angle finders (protractor in red plastic envelope)
- 10 compasses
- 1 micrometer
- 1 dial caliper
- 1 kitchen scale
- 1 measuring cup
- 1 funnel
- 10 scissors
- 20 copies of needed Ryerson stock list charts

Data

Fall 2015 Math Trades 1 Pre-Test and Post-Test Data (test out of 68)

	Pre-Test	Post-Test	Difference
High Schools			
Enhanced	27.5	46.3	18.8
Non-Enhanced	26.5	44.4	17.8
NWTC			
Enhanced	25.8	43.9	18.1
Non-Enhanced	23.7	37.8	14.1
Total			
Total Enhanced	26.5	45.0	18.5
Total Control	25.6	42.8	17.2

Rachel Johnson's Classes Pre-Test and Post-Test 2014 vs 2015

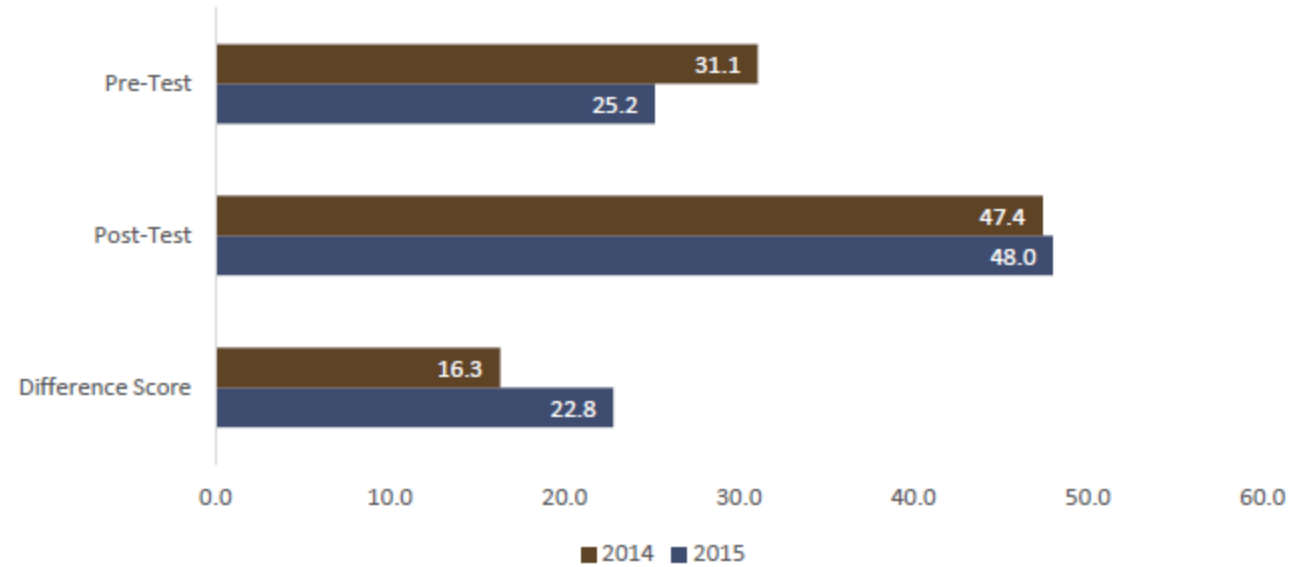


Figure 7. Mean scores for the math test given to students in one instructor's classes towards the beginning and at the end of the Math – 1 Trades course. The tests were out of 67 points.

- Fall 2015: Total Enhanced Welding Sections – 77.8% Course Success
Total Non-enhanced Welding Section – 58.8% Course Success