

Educator in the *Manufacturing* Workplace



2014

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M. Michael Andjelkovich

Niles McKinley High School
Business/Technology Grades 9-12

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BOC Water Hydraulics



My Takeaways from the Experience:

- A combination of interest, natural ability/talent, training, experience, commitment, and dedication are keys to being successful in highly-skilled manufacturing.
- A career in manufacturing is a high-tier opportunity for quality individuals.
- Issues with adult employees are relevant to issues high school students have: tardiness, honesty, dealing with others, drug-testing, communication, flexibility.



John Burr: Mechanical Designer for BOC Water Hydraulics

"We have been happy to assist the education community whenever possible and this is no exception. We are happy to have our educator Mike Andjelkovich with us these 32 hours and have enjoyed showing him the in's and out's of manufacturing at BOC. Unlike our educators from last year, Mike had no prior knowledge of what kind of work we did, so it was fun to see his reaction to some of the things we take for granted. I hope he enjoyed the experience. Mike got to see several other events here as well, including having Oh Wow summer manufacturing institute here for a morning and also our monthly safety training. The goal to educate the educator was met as I'm sure he can attest to now knowing about what CNC machining looks like as well as flow and inventory management. Thank you for the opportunity to be involved."

M. Michael Andjelkovich
Niles McKinley High School
Business/Technology Grades 9-12

BOC Water Hydraulics, Inc.
12024 Salem-Warren Rd. P.O. Box 1028
Salem, OH 44460

Contact Person: Mr. John Burr, Engineer

Title of Lesson Plan: A Highly-Skilled Manufacturing Career - Career Development Unit
(Personal Finance Class)

What's the Connection: The students will immerse themselves in a manufacturing career by researching 3 skilled trades and comparing each one.

Objectives of the Lesson Plan

- The students will access information regarding specific careers in manufacturing including: work activities, skills and knowledge needed, abilities, average salary, projected yearly openings, education and training
- The students will develop a table in a Microsoft Word document containing the information for 3 manufacturing careers of their choice
- The students will engage in a blog discussion with classmates and instructor regarding their findings

Core Competencies:

National Business Education Standards – Career Development

- Self-Awareness: assess personal skills, abilities, and aptitudes and personal strengths and weaknesses as they relate to career exploration and development
- Career Research: Utilize career resources to develop a career information database
- Career Strategy: Apply knowledge gained from individual assessment to a comprehensive set of goals and an individual career plan

Skills Being Utilized:

- Computer skills: accessing software: web browser and word processing program, researching information on a website, recording data into a table, saving files for future reference, blogging a discussion with classmates and instructor as facilitator
- Thinking skills: develop strategies to obtain skills needed for at least 3 manufacturing occupations, compare skills and job tasks of 3 occupations, identify job outlook for each occupation

Recommended Teaching Time:

Two class periods – 50 minutes each (assuming students are familiar with using Word software)

Materials:

- Computer lab classroom
- LCD Projector
- Manufacturing PowerPoint presentation
- Handout/instruction sheet
- Blog questions set and uploaded

Body/Lesson/Activity:

1. Open lesson with Manufacturing PowerPoint presentation
 - a. Discuss experience there and takeaways, the need for skilled workers in our region, the opportunities that skilled workers have
 - b. Discuss how BOC employees got to where they are: education, training, skills needed, experience
 - c. Answer questions students have about experience and/or manufacturing
2. Access ohiomeansjobs.com website link from PowerPoint slide
3. Pass out Manufacturing Career Development Activity handout
4. Follow the instructions sheet to access details on obtaining information on manufacturing careers.
5. Guide and assist students through:
 - a. Opening and saving Word Document
 - b. Inserting table
 - c. Labeling columns and rows
 - d. Entering data into table
6. Upon completion of the table, students are to save and print document

Conclusion:

Students are to Access edublogs site, log on to our class blog, and engage in a discussion with classmates by responding to the following two higher level thinking questions and commenting on at least two other classmates posts:

- a. In what ways would a career in manufacturing fit into your future plans both in school and after high school graduation?
- b. How would you describe the comeback of manufacturing into our region and how does that affect everyone living in our area?

Evaluation:

The assessment of this lesson is the participation and engagement of the conclusion activity. The point of the lesson will be achieved if students put forth thought and effort into their answers to the questions and comments to their classmates. As the instructor, I will comment on student responses to further engage student thinking.

Points will be allocated for completion of the following 3 items:

- Website research
- Word Document
- Blogging activity

Robert Barella

New Castle Junior/Senior High School
Autistic Support
Grade 7-12

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Lark Enterprises



- Take Aways:
1. The goal of Lark Enterprises is not only production but to develop life skills, coping skills, personal adjustment skills, and working skills. It's not all about just production.
 2. When giving someone with Autism a paper of instructions to read, use beige or pastel colored paper, rather than bright white paper. Black print on bright white paper can upset people with Autism.
 3. People with disabilities are eligible for \$30,000 of waiver services through the Medicaid Home & Community Based Waiver Program. A student may qualify upon graduation.



Lark Enterprises, Inc.

"The Educator in the Manufacturing Workplace Program has been mutually beneficial to the teacher and the staff at Lark. Bob has acquired information that can assist his students in making informed choices regarding services and employment. They will have a better understanding about the skills they need both hands-on and soft skills to work at Lark or another manufacturing environment. Lark has learned more about the transitional program at the New Castle High School." Dr. Susan Lautenbacher, CEO

Robert Rarella

New Castle Junior/Senior High School
Autistic Support Grades 7-12

Lark Enterprises, Inc.
315 Green Ridge Dr., Suite A-1
New Castle, PA 16105
Deb Ledden, Administrative Services Director

Title: Lark Enterprises Work Stations

Connections: The students will practice the same or similar jobs used at Lark Enterprises.

Objective: The students will improve dexterity and measuring skills and increase their knowledge and understanding of products made at Lark.

Skills Utilized: shirt folding, hook and suction cup building, using screw driver, cutting material to length, measuring, organizing

Recommended Teaching Time: 50 minutes

Materials: Station 1: shirt folding board, T-Shirts
Station 2: hook, suction cups
Station 3: screw driver, screws
Station 4: ruler, scissors, material
Station 5: magnetic clips
Station 6: wire, outlet, switches
Station 7: fun station

Activity: Students will travel to each station, spending approximately 7 minutes at each.

Station 1: Students will use folding board to fold T-Shirts
Station 2: Students will attach a hook to a suction cup.
Station 3: Students will tighten nuts and bolts with a screwdriver.
Station 4: Students will use a ruler to measure and cut a string or ribbon to length.
Station 5: Student will attach magnets to clips
Station 6: Student will connect wires from a switch to an outlet and vice versa
Station 7: Student will work on an activity of choice.

Conclusion: Students will explain in one paragraph which activity they enjoyed the most and why.

Evaluation: The teacher will count how many pieces each student correctly produces and will record data on a class chart to show growth every Friday.

Melissa M. Bartholomew

Warren G. Harding High School
Transition to Work Coordinator
Grades 9-12

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Gasser Chair



The 3 most impactful lessons I learned during my experience:

- Employees must have understanding of basic math skills such as measurement, adding, subtracting, problem solving, and number matching.
- Communication skills are imperative to producing quality products.
- As educators, we can help to instill basic work values through positive community opportunities, classroom speakers, and transition courses which can help students who may not have a certain path, arrive at a starting point.



Melissa M. Bartholomew
Warren G. Harding High School
Transition to Work Coordinator
9-12

Gasser Chair
2547 Logan Avenue
Youngstown, OH 44505
Joy Busko-Supply Chain Manager
Bryan Gasser-Director of Manufacturing & Engineering

Title: Problem Solving in the Manufacturing Workplace (taught in either Resource Math or Transition classes)

What's the Connection: Our students, the same as most I imagine, are forever asking why they have to learn certain things. They would like to know how they are going to use these skills once they are in the real world. This lesson will give the students practical knowledge of the entry level skills they would need in order to pass the pre-test prior to being hired at Gasser Chair or similar manufacturing environments. This lesson will also give them much needed practice on evaluating all the information in front of them prior to beginning each problem.

Common Core Objective:

The students will reason quantitatively and use units to solve problems by making sense of problems and persevering in solving them.

Skills Being Utilized: critical thinking, critiquing the reasoning of others, problem solving, math calculations, math reasoning, following directions, evaluation of information presented, working cooperatively in a small group, multi-step problems, mental math without calculators

Recommended Teaching Time: Two 45 minute class periods. One day to model the problems and work as a group and the next day to review the homework and work in small groups on more problems cooperatively and share out their processes.

Materials:

- Elmo
- White Board
- Pencils/Paper
- Problem Solving Work mats
- Mixed Word Problems practice worksheet-use over 2 days
- Mixed Word Problems homework sheet-can be split into 2 days
- Gasser real application problems

Body/Lesson/Activity:

Part 1-DO NOW (warm-up journal activity)

“When you have a problem to solve, what steps so you take to come to a solution?”

Once students have finished with this journal warm up, we have a class discussion about their conclusions. After all ideas are shared and discussed, talk about the real-life problem of getting qualified entry-level people to fill company positions. Ask “Is this a problem a company would want to have?” If not, what can we do as educators and students to help eradicate that problem?

Part 2-Model a word problem from the classroom problems. Ask out to the students what we know from the problem, what we need to find out, and what operation/s will help us to solve the problem. After completing this problem, show them the problem solving work mat then use it on the Elmo for the next problem. Have students copy the example on their own work mat. Continue working on these problems, asking for volunteers to explain to the class how they came up with their answers. Model at least one of the Gasser question before the end of the class. Assign some problems for homework.

Part 3 (on day 2) - DO NOW-Students will answer in journal what the steps were in the problem solving work mat. Review homework and ask if there are any problems that anyone is unsure of then model for the class.

Part 4-Break students into groups of 3 then assign at least 5 practice problems to work out together. Students will use the problem solving work mats and will be called upon to work out selected problems for the class. Once those are finished do 1 or 2 more of the Gasser examples for the class, asking the students to supply teacher with the information when called upon. Assign the remaining Gasser problems for in class work or if not finished by the end of class for homework.

Conclusion: Students will have an understanding of the basic skills necessary to work in the manufacturing community. They will know that the first step in having a rewarding career is getting their foot in the door. Once they are employed they need to show initiative in what they are doing and willingness to learn new jobs so they can move up in any company. Each day there will be a class discussion on how the problem solving steps used in these math calculations can translate into real life situations.

Evaluation: Informal assessments will occur daily on an observational basis offering intervention and enrichment for students who may need more individual help in order to retain the information being taught. Multi-step problems will be included on the summative assessment at the end of the unit.

Joyce Beitel

Lakeside High School

Japanese

Grades 9-12

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Wheeler Manufacturing



The important items I learned from this experience are:

- Every job is important; no person or step in the process is more/less important than any other.
- Everyone takes pride in their work. Quality Control is the responsibility of each worker; the reputation of the company depends on people who are proud of what they do and create quality products that show that pride.
- Creativity and collaboration are important skills. Everyone is constantly looking for new ways to create a product, to streamline the process, or to invent a new tool to work with new products in the industry. In order to be a company that will still be thriving in the future, they must look forward at what new products they can invent to keep up with the industry. Every worker is important in this area, as they may have ideas for new tools and products to make.



Wheeler Manufacturing

Yoshihiko Miyagawa, Executive Director

"We felt that this was a very positive experience, not only for Mrs. Beitel, but for the employees of the company. We learned from each other. It gave the Wheeler Employees the opportunity to share what we felt was important to our specific jobs. This would be shared with the students to help understand what it takes in different types of jobs. As the working climate of today's workforce is constantly changing, this program is well worth the time. The educator can be constantly updated her knowledge to share with the future workforce. We enjoyed Mrs. Beitel. She was very positive and eager to learn about our operation and eager to take it back to her students. Yoshihiko Miyagawa"

Joyce Beitel
Lakeside High School
Japanese I - IV; Grades 9-12

Wheeler Manufacturing Division of Rex International U.S.A., Inc.
Jefferson Road, Ashtabula, Ohio 44004
Yoshihiko Miyagawa, Executive Director

Title of Lesson: Global Competency Skills and Your Career

Connection: How can learning a foreign language give you the skills you will need for a career?

World Languages Standards: Cultures 1j: Identify global competency skills, relate them to possible career pathways and demonstrate how having global competency skills enables people to build collaborative relationships with others.

Cultures 1k: Develop global competency skills for use in college, career and beyond by engaging in collaborative activities online and/or in person with members of diverse communities at home and in the Japanese culture.

Skills being Utilized: Critical Thinking; Investigation; Communication; Collaboration; Japanese Language and Communication Skills.

Eligible Content: This lesson is suitable for all levels of Japanese Language classes. The final presentation prepared by the students will contain an appropriate level of Japanese for the class the student is enrolled in. This lesson can easily be adapted for students of any foreign language. The final presentation will include information in the foreign language.

Recommended Teaching Time: 5 to 10 days, depending on the amount of class time needed for collaboration and presentations. More time may be needed if students are communicating with students in Japan or with workers at a company.

Materials: Computers/tablets/internet for research and email; presentations can be on poster board or using Power Point or another medium for the presentation; Global Competency Skills spreadsheet/handout (email joyce.beitel@neomin.org for a copy of this worksheet); Websites for information on Japanese invested companies in Ohio:

<http://jobs-ohio.com/images/ohio-international-corporate-investment.pdf>

<http://jobs-ohio.com/international/>

http://jobs-ohio.com/images/SF_Foreign_Direct_Investment.pdf

<http://www.detroit.us.emb-japan.go.jp/pdf/en/pe/Report--2013%20Ohio%20JDI%20Survey%20Fact%20Sheet.pdf>

<http://www.vectrened.com/cms/assets/ed/PDF/Vectren-Ohio-FDI-Map.pdf>

Lesson/Activities:

Day One: Divide students into groups to work on this project. Students will need to work with members of different cultural backgrounds for this project, so divide the groups accordingly. Explain the project: to identify global competency skills and to do research on Japanese invested companies in the US and especially in Ohio; to engage collaboratively with members of diverse communities.

Pass out the Global Competency Skills worksheet. Discuss the World Languages Standards and have students rewrite them in their own words. Discuss “Global Competency Skills” and have students brainstorm what they think these skills are and why they are important. Fill in the chart with information from the group.

Have students discuss and list Japanese invested companies they know of. When students do internet research they will look at what companies are in Ohio and choose a company to focus on for their presentation.

Students will also want to discuss possibilities for engaging with members of diverse communities on this project. Can they email members of the company they are researching? Can they email Japanese students to discuss global competency skills? Students should brainstorm a list of questions/discussion topics to ask when emailing/communicating with others.

Day Two: Students will spend time in the computer lab doing research on global competency skills. As students do their research, they will complete the worksheet on global competency skills. Students will then do research on the Japanese companies and decide which company they will do their presentation on. Students may also begin to communicate with others.

Day Three: Students will work collaboratively to put together their presentation on the company they have done research on. In particular, students will highlight the global competency skills needed to work at the company they are researching. Presentations will be in Japanese. The amount of Japanese in the presentation depends on the Japanese skill level of the class. For example, Japanese I presentations will only have basic information and titles in Japanese. Japanese IV presentations will be written/spoken completely in Japanese. (This step may take more than one day, especially if students are emailing/communicating with others.)

Day Four: Presentations by groups.

Conclusion: The goals of this lesson are for students to identify global competency skills and to develop these skills by engaging collaboratively with members of diverse communities. Students should research ways to do this: can they email with members of the country they are researching? Can students email with Japanese students on this topic?

Evaluation: Presentation Rubric will be used for evaluation; This rubric can be found at: http://education.ohio.gov/getattachment/Topics/Academic-Content-Standards/Foreign-Language/Ohio-Foreign-Language-Model-Assessment-Project/Appendix_1.pdf.aspx

Steve Bennett

Mahoning County Career & Technical Center
Information Technology - Programming
Grade 11 & 12

Sponsored by

America Makes

(National Additive Manufacturing Innovation Institute)



"Technology is creating new types of jobs in the workplace. Jobs will require self-study and access to information from a variety of resources." Steve Bennett



"This has been an excellent experience for both the educator and America Makes. While one week offers limited opportunities for gaining in depth knowledge, the fact that this week coincided with our annual Youth Education Camp enabled the Educator to experience the full additive manufacturing knowledge process. We would certainly consider hosting another Educator in our Workplace next year, and we anticipate that the Educator will be able to take these learnings back to the classroom."

Michael Hripko , Deputy Director

Steve Bennett
Mahoning County Career & Technical Center
Information Technology - Programming
Grade 11 & 12

America Makes
236 Boardman Street
Youngstown, Ohio 44503
Mr. Michael Hripko
Deputy Director
Workforce and Educational Outreach

Title of the Lesson Plan: The changing landscape of future employment opportunities in manufacturing.

Connection: Technology is creating new types of jobs in the workplace. Jobs will require self-study and access to information from a variety of resources.

Objective: Outcome 1.1. Employability Skills

Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competency 1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.

Competency 1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.

Student Skills: Critical Thinking and Problem Solving skills are needed to evaluate future jobs in our society.

Teaching time: This can be used as a stand alone or in conjunction with investigating employment opportunities. Time for the class is 55 minutes.

Materials: Computers, access to the internet, access to OCIS (<http://ocis.ode.state.oh.us>) (requires password), <http://www.careeronestop.org>, Assigned the class account for a blog.

Lesson: Start the discussion by asking what type of careers the students have been thinking about. Have each student voice their idea. Write the jobs on the board. Responses could be web page designer, webmaster, network administrator, technician, programmer, game designer, graphics artist, software support, database manager, animator, and others.

Next ask the students if they have ever considered jobs in the manufacturing area? All of the above are roles that Information Technology uses in business including manufacturing. Explain there has been a change on how manufacturing occurs. Instead

of a support to the company, there are new jobs that permit you to become part of the process for manufacturing items. This is called additive manufacturing.

Play the video <http://www.pbs.org/america-revealed/teachers/lesson-plan/2/>
Estimated time (5 minutes)

Discuss the video and talk about what type of skills are required in the video. Some of the answers will be designer, machinist, salesman, entrepreneur, journeyman, operator, and others. With additive manufacturing you need to add some different types of occupations. Make a list: apprentice, CAD drafter, CAD Technician, CNC Programmer, CNC Machinist, CNC Mill Operator, CNC Operator, Materials Engineer, Design Engineer, and quality control supervisor.

Use OCIS or CareerOneStop and discover the types of jobs in manufacturing. Have the students go out to your blog and respond to the question "How has the use of additive manufacturing changed the potential types of jobs you would be able to master?" Compare current skills with what you think would be required in a manufacturing job.

Have the students get into teams of two. Research two jobs in manufacturing and find out the education required, salary, work conditions, and if it is growing or is static. The students will have about 20 minutes. Next have the teams report out on their findings. They need to answer the questions: what job did you pick, why did you pick this occupation, what is the salary, what are the working conditions, what education do you need?

Conclusion: Have the students get into teams of two and watch the following video on creating a part using Additive Manufacturing.

https://www.youtube.com/watch?v=8aghzpO_UZE
Estimated time (4:26 Minutes)

As a team, discuss what types of jobs will be needed in the future. Read the article regarding the jobs that did not exist 10 years ago.

<http://www.forbes.com/sites/meghancasserly/2012/05/11/10-jobs-that-didnt-exist-10-years-ago/>

Have your team brainstorm a new job. Create a job description for the new job. What do you think the world will be like in 10 years? Give a title to the new job. What type of education would a person need, what is the salary and work conditions, should this require a license or certification? Post your job on the Blog, describe the job and the requirements for the job. As the group's report, have the other groups respond to other students jobs. Respond to three new jobs. Why would this be a job you would like?

Evaluation: The students will be evaluated by the responses to the questions. Responses will need to reflect a thoughtful reflection to the response. All answers must be in complete sentences without any grammatical errors. Students are evaluated during the times they are working with teammates by the teacher.

Rebecca Caruso
Austintown Fitch High School
Science
Grades 9-12

Sponsored by

JMC Steel Group - Wheatland Tube

"My experience at Wheatland Tube was most definitely a positive experience that I will not forget.

Everyone I spoke with stressed the importance of a strong work ethic. I was continuously told that students need to be willing to work hard. Even a career that does not require a college degree requires a willingness to learn. Individuals with a strong work ethic are willing to work hard in every aspect of their lives, and this shows in the manufacturing workplace."



"Wheatland Tube JMC Steel Group without exception looked forward to the opportunity to have teachers intensively learning about what we do, skills we need, and enjoying hands on experience in manufacturing. Wheatland Tube JMC Steel Group believe that teachers are the key to bringing relevancy of the real world into the classroom application experience with meaning for the students and an understanding of new kids of careers available in manufacturing.

We thank Rebecca for taking time out of her free summer and we hope that we can again have the privilege of hosting teachers next year."

Rhonda Dehaarte, Human Resources Manager

Rebecca Caruso
Austintown Fitch High School
Science -- Grades 9 -12

Wheatland Tube – JMC Steel Group
1 Council Ave. Wheatland, PA
Rhonda Dehaarte, HR Manager

Title of Lesson Plan: Lifelong Job Safety Begins in the Science Lab

The Connection: Wheatland Tube employees need to be aware of the possible hazards in the workplace and need to follow proper safety protocol including the use of personal protective equipment (PPE). Safety is equally important within the science classroom.

Objective of the Lesson: “During the years of grades 9 through 12, all students must use the following scientific processes with appropriate *laboratory safety techniques* to construct their knowledge and understanding in all science content areas” (Ohio Revised Science Standards and Model Curriculum High School)

This lesson will help students to identify hazards in the science lab, employ proper safety protocol and understand the need for PPE.

Skills being Utilized: critical thinking, verbal and written communication, cooperation, computer technology, creative design and presentation skills.

Recommended Teaching Time: 1 week (5- 50 minute periods)

Materials: “What do They Have in Common?” photo montage, “Identifying Safe Lab Practices” worksheet, Lab Safety Protocols & Contracts, computers and internet access, iPods

Body/Lesson/Activity:

Day 1:

- Group discussion: “What do they have in common?” · Pictures of professions requiring the use of PPE
- Small group: “Science Safety” packet followed by whole group discussion
- Group discussion: Reviewing lab safety protocols, PPE rules, safety equipment use & location (department tour) and safety contracts
- YouTube video: Lab Safety (Renee Diamond, NSTA Listserve)

Day 2:

- Signed safety contracts collected.
- Formative assessment: question & answer safety review
- Group Discussion: Student Safety Projects – students will work in pairs to create a mini safety lesson utilizing PowerPoint, Prezi or video (student choice). Projects must include at least 5 lab safety rules, audio, and visual elements. Students will have the use of class computers or iPods. Two periods will be allotted to create projects. Rubrics will be provided. Projects will be presented in class on Day 4 and 5.
- Group work: projects

Day 3:

- Group work: projects

Day 4:

- Student Presentations

Day 5:

- Student Presentations
- Safety Quiz

Conclusion:

Although the safety quiz brings a close to the formal safety unit, safety will be addressed with every lab activity. Safety protocol will be closely monitored by the instructor during each lab. Hopefully this recurring emphasis on safe practice will encourage the development of long term “safety habits”.

Evaluation:

Informal (formative) evaluation will include questioning and observation

Formal (summative) evaluation will include project rubric and safety quiz

Angela Cochran

Girard High School
Guidance Counselor
Grades 9-12

Sponsored by

Taylor Winfield Technologies



"I will connect my experience in the manufacturing workplace and educate my seniors on the vast career opportunities available in the manufacturing industry."

Take-Aways

- *Important skills*
 - Ability to speak & communicate
 - Interaction with people
 - Be part of a solution
 - Team player/fit into a puzzle
 - Work ethic
 - Absenteeism not tolerated
 - STEM



Frank Deley, Vice President of Operations

"Our main goal was to explain how our company works from beginning to end. Also what type of individuals we are looking for to join our company. Explaining to the educator who is actually a guidance counselor all the soft and hard attributes these individuals need to work here. We emphasized the need for mathematics and sciences at many different levels."

Angela Cochran
Girard High School
Guidance Counselor: Grades 9-12

Taylor-Winfield Technologies, Inc
3200 Innovation Place
Youngstown, Ohio 44509
Frank Deley, Vice-President of Operations

Title of the Lesson Plan: Exploring the Manufacturing Industry

What's the Connection: I will connect my experience in the manufacturing workplace and educate my seniors on the vast career opportunities available in the manufacturing industry.

Objective of the Lesson Plan: As a Guidance Counselor to high school seniors one of my favorite things to do is to go into our Senior Projects Classes and guide them on Post-Secondary options. The students will practice research skills by investigating various careers in manufacturing.

Skills Being Utilized/Eligible Content: Students will understand and appreciate the importance of careers in manufacturing. Students will gain knowledge on what careers are available in the manufacturing industry.

Reading and Writing Standards for Literacy in Technical Subjects

Gather relevant information from multiple digital and print sources; access the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism.

Draw evidence from informational texts to support analysis reflection, and research.

Conduct short research project to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

Recommended Teaching Time: 1 class period (45 minutes)

Materials:

Computers
Assignment Handout

Body/Lesson/Activity:

1. Show class a short video introducing the manufacturing industry.

2. Distribute assignment handout.
 - Students will choose 2 careers found in the manufacturing workplace
 - Students will research and answer the following questions about each career
 - Job title
 - Job description
 - Training/skills/education needed
 - Job outlook
 - Salary benefits

Conclusion: Each student will then chose one career and present their findings to the class.

Evaluation: Each student will be evaluated and graded on their completion of the assignment and their final presentation.

Karen Cordova

Boardman High School
Physical Science
Grade 9

Sponsored by

Applied Systems & Technology Transfer, LLC (INVENTOR cloud)

My three takeaways from this experience:

- Innovation, creativity, and design thinking can be taught across the curriculum in schools.
- Students need the opportunity to use modern manufacturing technology.
- Additive manufacturing (3D printing) will revolutionize manufacturing and the economy



"Any time teachers can experience manufacturing first hand, they can bring that knowledge and understanding back to their students. Through programs like this, we can teach our students the importance of manufacturing to our future, our economy and our quality. This program makes it possible for manufacturers and educators can learn from each other and develop crucial, lasting partnerships."

Joseph Jeswald, Education Consultant

**Karen Cordova
Boardman High School
Physical Science
Grade 9**

**INVENTOR cloud
Applied Systems & Technology Transfer, LLC
241 West Federal Street, Suite 508
Youngstown, Ohio 44503
Joseph Jeswald, Education Consultant**

TITLE OF LESSON PLAN: Which 3-D Printed Wheels are the Fastest?

OBJECTIVE OF THE LESSON: Students will use CAD to design, a 3-D printer to print, and the classroom floor to test five sets of wheels for maximum speed of a balloon-powered plastic bottle car.

SKILLS BEING UTILIZED: CAD, 3-D printing, English to metric conversion, teamwork, problem solving, Newton's Laws, speed and acceleration calculations, averages

RECOMMENDED TEACHING TIME: Five 50-minute periods

MATERIALS: 18-20 ounce empty plastic beverage bottle, 8-10" long piece of 1/8" dowel rod cut in half for the front and rear axles (shish kabob skewers also work nicely), masking and transparent tape, scissors, 9 or 11" balloons, bendy straws, stopwatch, calculator. CAD and 3-D printer, along with live technical support, can be accessed through INVENTOR cloud if your school has an account with them.

BODY/LESSON/ACTIVITY:

1. Explain to students that they must design the fastest possible wheels for a bottle car. Brainstorm what features of wheels might increase speed (diameter, thickness, etc.)
2. Explain to students that they must test one wheel feature at a time to determine its impact on speed.
3. With a partner, students will design their first two sets of four wheels for one wheel feature (such as diameter) using a CAD program such as 1,2,3 D. (This can be downloaded for free onto a computer, tablet, or iphone.) All wheels in both sets will have the same thickness, such as 1/8", but one set will have a different diameter than the other. Students should vary the diameter by at least 1 inch. Remind students to also include a 3/16" hole in the center of their wheels to accommodate the axle. Instruct students to save their drawings.
4. Teach or review with students how to convert inches into centimeters or millimeters, whichever your CAD program uses. Remind students that 1 inch = 2.54 cm.
5. Have students print both sets of wheels.
6. While wheels are printing, students will construct the body of their bottle car: Holding the bottle sideways, poke holes in the front and back for the axles. Feed the dowel

rods through. Cut the bendy straw in half. Tape the open end of the balloon around one end of the straw, being sure it is air-tight. Tape the straw to the top of the bottle so that the bent end is easy to reach to be blown through.

7. Students will mark a start and finish line 3 to 5 meters apart on the floor with masking tape. Have students record their distance.
8. Slip 3-D printed wheels onto axles and time how long it takes each set to carry the car the required distance. Time 3 trials for each set of wheels to find the average time.
9. Have students use their average times to calculate speed. Which set of wheels gave the car a faster speed? Why?
10. Now have the students use CAD to design their second two sets of wheels, this time using their fastest diameter but now varying the thickness (or whatever design feature they haven't already tested). Wheels should be a minimum of 1/8" but a maximum of 1" thick. Students should vary the thickness by at least 3/8".
11. Students will print both sets of wheels.
12. Students will test their different thickness wheels by timing how long it takes for each set to carry the car the required distance. Time 3 trials for each set to find the average time.
13. Have students use their average time to calculate speed. Which set of wheels gave the car a faster speed? Why? Have students describe the design of the fastest wheels possible.
14. Students will design one last set of wheels to give their car its maximum speed. Have students predict how much faster they think these wheels will make their car.
15. Students will print and test their final wheel design.
16. EXTENSIONS:
 - a. Newton's three laws can be applied to the car. For the 1st and 3rd laws, ask students to draw a force diagram of their car. Why must the balloon be inflated? How does the car move forward? For the 2nd law, have students use their best set of wheels but vary the mass of the car by adding beans or other small objects to the inside of the bottle. How does mass affect the speed and acceleration of the car assuming the force of the air in the balloon is constant?
 - b. The concepts of aerodynamics and drag as well as CNC mill use can be incorporated by altering the body of the car. Have students make and test two types of car body from wood -- one in the shape of a rectangle, one they design to be more streamline. This car will be too heavy to be balloon-propelled so have students test by starting the cars on an incline.

CONCLUSION: This lesson demonstrates that math, science, technology, and manufacturing are all inter-related. It further demonstrates the importance of teamwork in design.

STUDENT EVALUATION: Students will turn in their CAD designs, testing data (track distance, times, speed calculations), and a written summary of their design process explaining how they determined which wheel features make the fastest bottle cars.

Susan Decker

Grove City Area High School
Mathematics
Grades 9 – 12

Sponsored by

Pine Instrument Company



Several things stood out for me.

- First, both shops were very clean and quiet, especially the electrical shop. The machine shop was much quieter than I expected, with only one part being somewhat noisy.
- Also, many employees remarked about having to convert from the metric system to our customary system and vice-versa. I will include that when I teach conversions instead of just focusing on conversions within one system.
- Finally, even those employees who say they only use the very basic math at work said math is important for the problem solving skills, for knowing when a calculation is wrong and being able to trouble shoot to find a solution to a problem."



"We believe the Educator in the Workplace Program to be very beneficial to all involved (students, teachers and Pine staff). PINE staff enjoyed preparing for Sue's visit and enjoyed presenting PINE to her. Sue was a delight to have at Pine. Her exuberance for teaching and dynamic personality made our contributions to the Program easy. We also think it was helpful that Sue is a teacher at Grove City High School. Not only did she know some PINE employees and/or family members, I think the students she teaches and talks to about her experiences may relate more so to a company in their community. PINE would volunteer again to participate in the program and would recommend participation to other manufacturing companies as well. Thank you for giving PINE the opportunity to serve."

Robin Vaughn
HR Manager

Susan Decker

Grove City Area High School

Mathematics Grades 9 – 12

PINE Instrument Company

101 Industrial Drive

Grove City, PA 16127

Robin Vaughn, Human Resources

Title: Gyration within Industrial Machines

Connection: A component of an industrial machine must gyrate at a fixed angle. This motion is similar to that of a circular pendulum. Think of a tire suspended from a tree, swinging in a circle rather than back and forth. The volume traced by the rope's motion is a right circular cone. The angle of gyration is defined as the angle between the rope and vertical, or half the cone's vertex angle. If this angle is less than 2 degrees, the true vertical height and slant height of the cone are close enough to be used interchangeably.

Objective: TSW will measure a circular object (representing the base of a cone) and linear object (representing the vertical or height of the cone) and determine the angle of gyration of these objects forming a right circular cone.

Skills Being Utilized: Trigonometry (\tan^{-1}), Measurement (using a ruler), Vocabulary of cones (base, vertex, height, slant height)

Recommended Teaching Time: 1 class period (43 min)

Materials: Circular lids of various sizes, linear objects such as pencils, pipe cleaners, tape, rulers and scientific calculators

Body/Lesson/Activity: Distribute 3 different sized lids and 2 different pencils and a pipe cleaner to students working in groups of 2 or 3. Have them place the eraser end of the ruler in the center of the circular lid and tape it to the lid (it should be vertical). Make a loop at the one end of the pipe cleaner and attach it to the top of the pencil (it should freely move around the pencil). This will simulate the gyration of the component of the machine. Students then will measure the diameter of the lid and the height of the pencil and calculate the angle of gyration (the angle between the pencil and pipe cleaner). They will complete this for 2 other lids and then switch pencils and complete the process again. They will include sketches and show their calculations for all 6 samples.

Conclusion: Once the students have compared their angles of gyrations, have the groups choose one lid and determine the height of the vertical (pencil) that would be needed to have a 2 degree or less angle of gyration. Have the students write about their observations. Did they get the results they expected? Can they summarize their findings?

Evaluation: The students have succeeded if they can complete a sample problem such as:

A technician must confirm her industrial machine operates at a prescribed angle of gyration. She uses a device that measures horizontal deflection of the moving component as 0.570 inches. This is the cone's base. Her measurement is made 13.325 inches below the pivot point (vertex of the cone). What is the angle of gyration?



Tonya Frost
South Range Middle School
Science
Grade 8

Sponsored by

Butech Bliss



What's the connection?

The students will be able to understand the connection between building a paper roller coaster in the classroom and the process of manufacturing in the workplace.



Ryan Hough, Human Resource Manager

"It is important to nurture relationships with key community stakeholders; not the least of which are the area's educational institutions. We feel that by hosting a teacher in our workplace we are in essence educating them on our organization and the opportunities that we have to offer. After all, the junior high students of today are the workforce of tomorrow. Butech is happy to help impart knowledge to those who are charged with guiding and educating the young people of our community."

Tonya Frost

South Range Middle School

8th Grade Science

**BUTECH
BLISS**

We Build Things. Better.

550 South Ellsworth Avenue, Salem, Ohio 44460

Ryan Hough, 330-337-0000

Building an Amusement Park Roller Coaster

What's the connection?

The students will be able to understand the connection between building a paper roller coaster in the classroom and the process of manufacturing in the workplace.

Objectives of the Lesson Plan:

The overriding objective of this lesson plan is to understand the existing opportunities in the manufacturing work place. Student will have the chance to roll play current real life careers from design to quality control.

Skills Being Utilized/Eligible Content:

The students will develop problem solving skills using logic and reasoning to design and construct a functioning paper roller coaster given a set amount of constraints. The students will also be expected to use measuring skill and tools to follow guidelines. They will also be expected to calculate the speed and distance there vehicle will travel.

Recommended Teaching Time:

The recommended teaching time is quite lengthy. I would suggest using this lesson for an enrichment type situation or a year end cumulative project.

Week 1 – Rules, Roles, and Design Process

Week 2 – Parts assembly, Frame work

Week 3 – Coaster assembly, welding, production control, final test run

Week 4 – Quality control check, Customer (teacher) Satisfaction

Materials:

Paper coaster supplies,

Foam board,

Clear tape,

Scissors

Body/Lesson/Activity:

Each student will be placed into groups and assigned a role that will be comparable to a profession in the manufacturing workplace. Depending on the size of the class the roles can be doubled up or remain individual jobs. The main idea is to continually reinforce the opportunities in the manufacturing workplace by emphasizing the importance of each role and how important one is to the other. Each group will have the following individual rolls: Engineer/Design, Sales/Marketing, Machine shop workers, Welders, Assembly, and Quality Control.

Conclusion/Evaluation:

The conclusion and evaluation will be guided by a rubric based on the product outcome.

Assessment will be both formative and summative. A written essay comparing the different manufacturing roles will conclude the lesson along with a classroom discussion focusing on what we learned throughout the project.

Stephanie Greathouse

Southington Middle School
Science
Grades 6-8

Sponsored by

Howland Machine Corporation



"My experience at HMC was incredible. Prior to visiting HMC I had an outdated idea of what manufacturing was all about, had no idea what many skilled tradesmen actually did, and had never shared the option of manufacturing with my students as a viable career path.

The first thing that stood out during this experience is that critical thinking and problem solving are a must in the daily life of a machinist.

Their need for sharp math skills was evident as they deciphered blueprints to make cuts on a large piece of steel, with precision, sometimes to a 100th of an inch which is about the thickness of three pieces of paper.

I was pleasantly surprised that the work environment was relatively clean and quiet".



"It was a pleasure meeting an educator that is so excited about the future of her students. I look forward to the partnership with educators that will share the many opportunities that manufacturing can offer to students who do not want to attend college, but still maintain a comfortable lifestyle. The more educated our teachers are about current day manufacturing the better they will be able to share that knowledge with their students, our prospective employees. I welcome teachers and their students to visit Howland Machine Corporation to find out more about the manufacturing environment."

Bruce V. Dewey, President Howland Machine Corporation



Stephanie Greathouse
Southington Middle School
Science Grades 6-8
Stephanie.Greathouse@neomin.org

Howland Machine Corporation
947 Summit Avenue
Niles, OH 44446
Bruce Dewey, President

Small Measurements Activity

In this lesson students will be given a shelled peanut very similar to others in the classroom and will be asked to use only their observation skills and precise measurements to identify their peanut when mixed in a bag with the group.

What's the Connection? Machinists measurements need to be precise and in science results can be distorted if measurements are not precise. Students will practice making precise measurements.

Lesson Objective: Students will make careful observations and will make precise measurements to distinguish between several very similar objects. *This lesson should be used after lessons on how to read a fractional rule and identifying types of measuring tools.*

Recommended Teaching Time: 45 - 90 minutes depending on discussion detail

Materials Needed: Metric/US Standard Rulers or Tape Measures, Calculators, Shelled Peanuts (Be sure to check for student Allergies) - Calipers and Micrometers are optional

Activity Procedure:

1. Instruct students to make no marks on the peanut and tell them they will be trying to identify their peanut by making a minimum of five careful observations. Observations should be written down in their science notebooks.
2. Ask students to measure and record the maximum length of each peanut. This is not as trivial as it may seem. The maximum length may lie along a diagonal and there will be parallax problems, depending on where the student places the ruler with respect to the peanut. Students will need to measure multiple points to determine maximum length.



3. Students will quickly realize that they need to choose a measuring tool to help them closely observe the peanut. Provide tape measures and rulers for student measuring. (For students who finish early have them also measure with calipers and micrometers if available.)
4. Students will record their answer as a fraction. They will then need to convert the fractions to decimals. Let students decide how many decimal places they should record and thus how precise their observations should be. This variance will later create discussion points about the importance of precision and accuracy.
5. Collect the peanuts. When collecting, the teacher writes a secret number (only the teacher knows this number) on each of the peanuts. This will ensure the actual peanuts can be identified.



6. Choose one peanut to measure as a whole class. The teacher measures for the class, reinforcing how to measure precisely and have students write down YES if they think this is their peanut. If more than one student claims the peanut discuss problems and possible solutions to the measuring and testing methods.
7. Allow students an opportunity to use all their observations to identify their peanut. This may take some time as students will be measuring many peanuts to find theirs.

Conclusion: Discuss with students how accurate and precise measurements are needed by machinists in skilled trades jobs. Ask students to identify other professions and as well as everyday uses for these same skills.

Evaluation: Following the conclusion of the peanut activity, students will be given a written assessment to evaluate the effectiveness of the lesson.

Differentiation - Measuring Resources: <http://www.funbrain.com/measure/index.html>



Educators and Manufacturers Partnering for Success

Student notes and assessment documents are available via email.

Jim Hamm

Neshannock Township Jr-Sr High School

Civics – Grade 9

POD/Economics – Grade 12

Sponsored by

Silgan PCS



“Working with so many types of employees opened my eyes to all of the occupations within the manufacturing field. My experience at Silgan will not just impact a couple of lessons here and there in my senior Economics courses but will be referred to on a near daily basis when discussing careers and occupation.”



“It was a pleasure to have Jim Hamm visit our facility. Jim was inquisitive and frequently commented on how he plans to use his new knowledge and understanding of the workplace in his classroom presentations.”

Susan Anderson – Human Resource/EHS Manager

Jim Hamm

Neshannock Township Jr-Sr High School

Economics-12th

Silgan PCS

185 Northgate Circle

New Castle, PA 16105

Susan Anderson-HR/FHS Manager

Title of Lesson

Careers in Manufacturing

Connection

From my experience at Silgan, I have a greater awareness of the different occupations in the manufacturing workplace. I want my students to examine these careers.

Objective

Students will analyze and examine a variety of manufacturing positions available from local newspapers and careerbuilder.com.

Skills

PA Core Standards for Reading in History and Social Studies
PA Core Standards for Writing in History and Social Studies
Computer-MS Word
Research-Internet—occupations and companies
Presentation-poster

Recommended Teaching Time

Six periods

Materials

Job ads from local newspapers
Computers
Poster board, scissors, glue, etc
Paper and pencils

Body/Lesson/Activity

Day 1-lecture/discussion/handouts on manufacturing
teacher will show several Youtube videos on manufacturing

Day 2-students will choose a position from a local newspaper or careerbuilder.com
using computers, students will research the position-requirements, abbreviations, and
acronyms
students will write a short summary of the position in their own words

Day 3-using computers, students will research the company that placed the ad
students will look for location, products, number of employees, and other basic
information
students will also research any other information about the company in newspapers,
magazines, or online

Day 4-students will be given a chance for questions
teacher will distribute rubric
teacher will demonstrate/model expectations for poster/presentation
posters will give information about the position and the company
students will have 3-4 days to complete poster/presentation on their own time

Days 5 and 6-students will present posters to class

Evaluation

The students will be assessed on their poster and presentation. The objective of the
poster/presentation will be to persuade the rest of the class to apply for that position with
the company.

Conclusion

By the end of this unit, students have been exposed to many, depending on class size,
types of occupations available in the manufacturing sector of the economy.

Mary Hardin

Chaney STEM/VPA
School Counselor
Grades 9 – 12

Sponsored by

Dearing Compressor

My Takeaways:

- Manufacturing is alive and well in the Mahoning Valley
- There are many opportunities for students who have completed some technical training, such as welding, pipe fitting, precision machining, mechanical skills, etc.
- This experience impressed upon me the importance of the so called soft skills



I believe this is a great experience to give the Educators some “real world” examples of careers in manufacturing to discuss with their students.

Bob Christoff – Human Resources Manager



Mary Hardin
Chaney STEM/VPA
Career Guidance
Grades 9 – 12

Sponsored by
Dearing Compressor

TITLE OF LESSON PLAN:

Opportunities and the Skills Needed in the Manufacturing Workplace

OBJECTIVES:

- 1.) Students will gain knowledge about skilled trades.
- 2.) Students will better understand the importance of soft skills utilized in the manufacturing workplace.

SKILLS BEING UTILIZED:

- 1.) Using the computer to do research about a particular skilled trade
- 2.) Reading comprehension
- 3.) Condensing information onto note cards
- 4.) Public speaking

RECOMMENDED TEACHING TIME:

--Three or four days

MATERIALS:

- 1.) Computer lab
- 2.) 3 x 5 cards
- 3.) Pen or pencil
- 4.) White board and markers
- 5.) Informative materials that I gathered about the various trades.

BODY/LESSON/ACTIVITIES:

- 1.) I will introduce the lesson by sharing with the class my experience at Dearing. I will describe what I saw and was told, the types of jobs there, typical educational and work experiences of the employees, and the soft skills that were emphasized.
- 2.) I will ask the students to share what they know about the skilled trades. We will also discuss what soft skills are and why they are important.
- 3.) I will put suggested skilled trades on the board.

CONCLUSION:

- 1.) Pamphlets and various materials that I gathered will be made available at the end of the lesson. This will include contact information.
- 2.) Students will have the opportunity to schedule individual time with me to further discuss their interests.

STUDENT EVALUATION

--Students will choose a skilled trade and prepare a 3 to 5 minute speech about that particular trade to share with their classmates. The class and I will give verbal feedback and I will give additional feedback to the students in writing.

Adrienne Hetmanski

Austintown Middle School
Math and Science
Grade 7

Sponsored by

Specialty Fab

"My experience at Specialty Fab was very interesting and rewarding. I was amazed to find out that Specialty Fab has supplied steel structures for Heinz Field, bridge joints for the Oakland San Francisco Bay Bridge as well as bridges in China. They also build frames for compression drills used for Natural Gas drilling."



"It was a pleasure having Adrienn Hetmanski visit us. She was very professional and I think that she has a firm grasp on the idea that there are great opportunities available for the children who choose a career in manufacturing. I believe she intends to expose the children to options other than college and explain the need for skilled workers not only to the children but also the parents."

David Hughes

Founder, Owner, President

Adrienne Hetmanski
Austintown Middle School
7th grade Science

Specialty Fab, Inc.
11950 South Avenue
North Lima, OH 44452
330 549-1004
David Hughes, Founder, Owner, and President

Title: Energy In the Workplace

Connection: Students will understand the real world applications of science concepts they have learned in class.

Objective: Students will discuss how molecules are affected by changing temperatures.

Students will observe how heat is used for metal bending.

Students will identify the type of energy transfer involved in heat bending.

Skills:

P.S.3 Energy can be transferred through a variety of ways.

Recommended Teaching Time: 1 class period (approx. 50 minutes)

Materials: A metal bar

Bunsen burners

Ice Water

Safety glasses

Stand to hold the metal bar

Student worksheet

Lesson/Body/Activity: This lesson will be done as a class demonstration. Students are given a lab demonstration worksheet to write predictions, answer questions, and record information.

Students observe the metal bar with Bunsen burners placed two inches from each end. Students write a prediction of what will happen when heat is applied. The teacher applies heat to each end of the bar. Once students notice the bar bending, the heat is removed. Students compare their prediction to the outcome. Students answer questions with a partner as to why the bar began to bend. Discussion follows which will identify that the molecules in the bar were moving faster and expand so the bar began to bend.

Students look at the bar to see if they notice any change since heat was removed. The bar begins to slowly move back to its original position. This may or may not be noticeable to the students. Students write a prediction of what will happen if the bar is cooled? Carefully place the metal bar in ice water and allow students to observe that the bar bends back the other way. Students write on their worksheet why this occurred. Students then answer questions related to the type of heat and energy transfer that occurred. Heating of the bar was through conduction and radiation while thermal energy was changed to kinetic energy.

Conclusion: Teacher and students will discuss scientific concepts demonstrated as well as real world applications. (Ex: why sidewalks are made with spaces between the sections, why doors are sometimes hard to open in the summer, why bridges are built with expansion joints)

Evaluation: Exit cards will be filled out by the students with a few questions pertaining to the content of the lab.

Extensions:

- Students identify the type of energy transfer occurring during different steps of fabrication.
- Students calculate the kinetic and potential energy of items in a fabrication plant.
- Students research how bi-metal strips are used in thermostats on furnaces and air conditioners to control the temperature. (When the temperature in a room reaches a certain temperature, the bi-metal strip will bend enough to close a circuit and turn on the furnace or air conditioner)

Huck Hughes

Columbiana County Career and Technical Center
Welding
Grades 11 and 12

Sponsored by

RBS Manufacturing

My 3 Takeaways:

- In today's job market students need to see how much goes into running a business
- Diversity of skills: Math, English, History, Welding
- How to prepare my students for today's job market goes beyond hard skill set. The soft skill set is a great addition to their training.



"With your time being limited with the kids, it was great to see you subject them to many different areas of the trade. These skilled trades are so different from shop to shop; your training will allow them to better fit in multiple different areas. As an employer I can adjust some of my processes to allow your students to fit better in our workforce. "

Richard Severs

Vice President, Owner



HUCK HUGHES
COLUMBIANA COUNTY CAREER AND TECH CENTER
WELDING
GRADES 11 AND 12

RBS MANUFACTURING
145 EAST MARTIN STREET
EAST PALENSTINE OHIO 44413
VICE PRESIDENT – RICK SEVERS Jr.

LESSON PLAN
HOW A COMPANY OPERATES

Objective

To prepare students for the transition from high school to industry by *garnering* understanding of how businesses operate and using this information to assist making a smooth transition into their future career. This project is a cross-curricular unit. \

Financial Literacy:

- o Students will look at all financials and how you would figure out all of the financials associated with running a business.
 - o Students will understand benefit packages.- (wages,vacations,insurances)
 - o Students will gain a complete knowledge of how companies estimate projects with all the above items factored in.
 - o Students will write up an estimate and make sure operational costs are covered and set up a budget.
- Literacy:
- o Students will understand writing and how it applies to running a business effectively

- o Students will look at writing business documents necessary in running a business (quotes, estimates, etc)
 - o Students write descriptions of the products for advertising.
 - o Students will practice speaking skills.
 - o Students will develop speaking/communication skills appropriate for the workplace.
- Welding and Materials Joining:
 - o Students will understand creating a blueprint
 - o Students will understand creating a prototype
 - o Students will understand customer relations and marketing of their project.
 - o Students will utilize the different equipment in weld lab to create prototype.

1. Students will be separated into groups to establish a mock company. They will be expected to run everything exactly the way a business owner would have to do things when creating a start-up business.

2. Each student is given a role in their company: i.e. president, sales leader

3. Students create a company name and then design a project that they believe will have positive sales in our area. This would require research of the market and the economic area in which they will be selling.

4. Students will design a product, create a blueprint, and create an estimate for the project using additional costs:

Materials

Manpower

Shop costs

5. Students to fabricate a prototype of their designs in weld lab

6. Students will collaborate with the interactive media class to create an infomercial for their product to be broadcast at lunch.

7. The items created will be produced per orders taken and all proceeds will go towards winter coats and supplies for the welding materials joining career path

8. Proceeds from the grant will go towards supplies for students' prototypes

9. As part of the project, students will be required to research items such as:

- Market for project: <http://www.sba.gov/content/do-your-market-research>
- Costs of similar items that may be available from outside sources
- How to create a legitimate business: <http://www.sba.gov/content/follow-these-steps-starting-business>.
- Uses of product and population they will be marketing to.

10. Students to write a paper outlining the project and the learning experience of the projects. making sure that they reflect on all aspects of the project and the what they have learned from the process of how a company operates .

Pam Lubich
Chaney STEM/VPA Campus
STEM Coordinator

Sponsored by

Thomas Steel Strip – Tata Steel Plating



"I had a wonderful experience at Thomas Strip and would encourage all educators to take advantage of opportunities like this.



"For Thomas Steel it is nice to see the Educators and Manufacturing concerns in the Mahoning Valley working together to develop a pathway for the future of our youth and communities."

Patricia Mohney

Director Human Resources

Pam Lubich
Chaney STEM/VPA Campus
STEM Coordinator

Thomas Steel Strip – Tata Steel Plating
2518 West Market Street
Warren, Ohio 44485

Title of the Lesson Plan: Is a Manufacturing Career Right For You?

What's the Connection?: The manufacturing sector has long had trouble finding skilled applicants for its jobs and at the same time we have unemployment. Part of the reason for this may be that students have never considered manufacturing as a career.

Objective: The object of this lesson is to introduce early high school students to careers in the manufacturing industry and to develop teamwork, research and presentation skills.

Skills Being Utilized/Eligible Content:

CCSS.ELA-LITERACY.W.9-10.7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CCSS.ELA-LITERACY.W.9-10.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-LITERACY.SL.9-10.4

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

CCSS.ELA-LITERACY.SL.9-10.5

Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Recommended Teaching Time: approx 5 class periods

Materials: computers/laptops/tablets, posterboard, markers

Body/Lesson/Activity:

Teacher will introduce manufacturing careers using a variety of resources.

- www.iexploremanufacturingcareers.com
- <http://www.careerme.org/>
- <http://www.manufacturingiscool.com/>

Students will work in pairs. Each pair will choose a manufacturing career to research. Teacher will make available a list and assure that no 2 groups research the same career. Careers to include Welding/Welding Engineer, CNC Machine Operators, Engineering Technicians, CAD Operator, Skilled Assemblers etc. Students will create a presentation to share their research. Presentation should include duties of the job, training required, salary, job outlook. Presentation can be in a variety of formats: PowerPoint, video, poster etc.

Conclusion:

Students will present their research.

Evaluation:

Presentations will be evaluated with a rubric with an emphasis on the quality of research and presentation.

Rubric Examples:

- http://bie.org/object/document/9_12_presentation_rubric_ccss_aligned
www.scsc.k12.in.us/SMS/.../ELEMENT%20PROJECT%20RUBRIC.doc
<http://www.ppmhcharterschool.org/ourpages/auto/2010/1/5/34171780/Presentation%20Rubric.pdf>

Charles McErlane
Commodore Perry School District
Substitute Teacher

Sponsored by

IlSCO Extrusions



"My experience at IlSCO Extrusion Inc. was a positive experience that provided valuable insight into the manufacturing world."



*"Making products that are
useful and needed is
extremely rewarding."*

*John Thigpen, General
Manager*

"The mentality that working in a plant or in the manufacturing field is less than working in any other fields needs to be reshaped. People need to understand that manufacturing is a dynamic field worthy of the best and brightest our schools have to offer."

Howard Swartz, Engineering Manager

Charles McClrline
Commodore Perry High School
All Grade/Subject Substitute

Ilco Extrusions Inc
93 Werner Road
Greenville, PA 16125-9434
Mr. Gary Jones, Operations Manager
GJones@Ilco.com
(724) 589-5888

TITLE:

Understanding Fractions and the Amount they Represent

WHAT IS THE CONNECTION:

Having a solid grasp on fractions leads to fewer mistakes in the extrusion process. Less mistakes leads to better production and better production results in a satisfied customer.

OBJECTIVE OF THE LESSON PLAN:

1. Students will construct a tan gram puzzle and determine the fractional parts of the tan gram.
2. Students will compare the value of fractions to determine the larger fraction.

SKILLS BEING UTILIZED

1. Understanding of numbers and operations
2. Understanding of various ways of representing numbers
3. Relationships between numbers and number systems
4. Analyze various characteristics and properties of two and three dimensional geometric shape
5. Develop mathematical discussion points as they relate to geometric shapes
6. Describe special relationships using coordinate geometry and other representational systems
7. Apply transformation and use symmetry to assist in analyzing mathematical situations
8. Use spatial reasoning as well as geometric modeling to solve problems

RECOMMENDED TEACHING TIME:

45-60 minutes

MATERIALS:

- 1 piece of construction paper per student (6 inches by 6 inches)
- 1 pair scissors per student

BODY/LESSON/ACTIVITY

Pass out the construction paper and scissors to each of the students. Have the students follow the oral directions being provided. Be certain to ensure that all students are on the same step of the process before proceeding.

1. Fold the large square in half in a diagonal manner. Cut paper along the fold. You should now have 2 congruent triangles.
2. Take one of your triangles and fold it in half so that it forms two triangles. (save these two pieces)
3. Take the large triangle that is left and fold it so the point of the triangle touches the midpoint of the base of the triangle. Cut the triangle that is formed from the fold.

4. The remaining shape forms a trapezoid. Fold the trapezoid so that the long base and the shorter top edge meet.
5. Unfold the top half of the paper to the middle of the original top edge.
6. Unfold from the original top edge down to the opposite side original bottom edge.
7. The shape now has three folds. Cut on the folds and save the four pieces. (2 triangles, 1 square, 1 parallelogram).

Questions

1. Name the 7 shapes that have been formed. Use geometric terms to describe each of the shapes formed.
2. Are any of the shapes congruent?

Have the students put the tan gram pieces together so that they form the original shape they started with. Now have the students find the fractional value of the tan gram. Students may assume the original value is 1.

EVALUATION

1. Students will name the seven shapes that have been formed
 1. 1 Square: all sides congruent, four right angles, opposite sides are parallel
 2. 2 large Congruent Isosceles Triangles, 3 sided figure, base angles are equal, both legs are congruent
 3. 1 Parallelogram, opposite sides are congruent and parallel
 4. 2 small Congruent Isosceles Triangles, three sided figure, base angles are equal, both legs are congruent
 5. 1 medium sized Isosceles triangle, three sided figure, base angles are equal, both legs are congruent
2. Are any of the shapes congruent?
 1. 2 large Isosceles Triangles
 2. 2 small Isosceles Triangles

Elaine Meals

United Local High School
Calculus, Pre-Calculus, Advanced Geometry
Grades 9-12

Sponsored by

General Motors – Lordstown Complex



"I was able to see many areas for math and computer science applications that I will be able to take back to my students. Students enjoy learning when it is connected to real life. My top three takeaways from this experience would be to enhance my real world classroom instruction to include additional spreadsheet capabilities (Excel), statistics/data analysis, and problem solving techniques."

"It was a pleasure to have Elaine Meals shadow our GM team at Lordstown as she developed a better understanding of the application of math in the manufacturing workplace."

Darren Ford

Engineering Group Manager – Cruze



Elaine Meals
United Local High School
Calculus, Pre-Calculus, Advanced Geometry – Grades 9-12

Lesson Plan Title: Customer Satisfaction Statistical Survey

Lesson Objectives:

- Develop a statistical customer satisfaction survey
- Collect and summarize statistical data with an excel spreadsheet
- Use data to make informed judgments and recommendations for improvement

Skills Utilized:

- Excel – spreadsheet capabilities
- Common Core Statistics and Probability Cluster: *Make inferences and justify Conclusions from sample surveys, experiments, and observational studies*
(Standards: 9-12.IC. 3, 9-12.IC. 4, 9-12.IC.5, 9-12.IC.6)

Recommended Teaching Time:

- Approximately five class periods for teaching time and group work

Materials:

- Laptops with Microsoft Excel

Body/Lesson/Activity:

Day 1 & 2:

- Give students an overall understanding of the need to constantly evaluate customer satisfaction of a manufactured product (ex. GM analyzes customer satisfaction data of the cars they produce). Instruct students on how to analyze quality data using excel spreadsheets.
- Walk through an example with the students using a hypothetical customer satisfaction survey about the school cafeteria. Showcase the excel capabilities to summarize and graph the results in several ways.
- Have students utilize this data to define what areas should be analyzed to improve cafeteria customer satisfaction.
- Have students break up into groups of 3-4. Have them come up with a “real life” school example where customer satisfaction data will help them to make decisions on where they can improve a product or service. Have students come

up with 10 questions that they can use to obtain information to measure the customer satisfaction levels. Students should quantify each response (for example 1, 2, 3, 4, or 5 with 1 being low satisfaction and 5 being high satisfaction).

- Students should divide up the responsibility to survey their peers, making sure that a diverse population is being considered.
- Provide each group with a rubric which will be used to evaluate their performance.

Day 3:

- Groups will enter all survey data and summarize their findings using tables and graphs in excel.
- Students should sort and analyze the data using “Pareto’s principle” as a guide to determine the highest priority issues that will improve customer satisfaction.
- Each group should come up with several recommendations which can be supported by their findings to improve customer satisfaction.

Day 4:

- On the third day, student groups will present their findings to the class.
- Class members will perform a peer review of each groups’ performance using the pre-established rubric. Students will quantify each response (for example 1, 2, 3, 4, or 5 with 1 being low satisfaction and 5 being high satisfaction).

Student Evaluation - Day 5:

- Each group will receive the feedback from their peers. They will summarize this data in a spreadsheet and use these results to critique their own work. Each group will then summarize what they would do differently if they were given this project to do a second time. Additional bonus points will be given for each group’s ability to learn from their mistakes.

Conclusion:

- At General Motors, the quality control department is continually monitoring customer satisfaction data in order to improve their product. With so much data to monitor and prioritize, companies like General Motors are continually utilizing spreadsheet type programs to aid them in defining and prioritizing their improvement projects. In this lesson, students will be given a real world customer satisfaction project to analyze and make recommendations. They will also use this same process to evaluate and critique their own project work.

Robert Olesky

Trumbull County Career & Technical Center
Welding & Employability
Grades 11 -12

Sponsored by

Starr Manufacturing

My three takeaways from my four days at Starr were:

- Communication
- Collaboration
- Attention to Detail



Dale Foerster

Vice President

"We as a team and without exception have looked forward to the opportunity to have teachers intensively learning about what we do, skills we need, and enjoying hands-on experience in operations and in helping us to actually produce some of our product while they learn.

We believe that teachers are the key to bringing relevancy of the real world into the classroom and into helping to translate required curricula into real-world, applicable experiences with meaning for the students – and with an understanding of the new kinds of careers available in manufacturing and the kinds of skills needed."

Lesson Plan

Applications and Interviews

Overview

Description: Students will practice completing a job application and participate in a mock interview.

Objective

The students will:

- Examine the "Dos and Don'ts" of completing a job application
- Exhibit appropriate behavior during a mock job interview

Materials

Job Application (PDF) from *Spell Well! 50 Quick, Fun-Filled Ways to Help Kids of All Learning Styles Masters Their Spelling Words* and/or a variety of job applications from various local businesses.

Career Portfolios and Resumes from Lesson One

Writing paper/pencils

Chart paper

Transparency of a job application

Overhead Projector

Interview Questions

Set Up and Prepare

Copy the Job Application printable for each student and/or collect a variety of job applications from various local businesses. Each Student should have two blank applications.

Divide the class into groups of four students each.

If you wish, send home a note informing parents that students will be involved in mock job interviews on a specified date, encouraging each to dress appropriately during that class period.

On chart paper or transparency, write the following journal prompts for Part I:

- Describe five ideas, accomplishments, strengths, skills, or personal qualities that you think would best "sell" yourself to an employer.
- What are your personal skills and abilities, and how do they relate to a particular job? Write about specific examples of how you have used them.
- What are your weaknesses, and what steps are you taking to improve them?
- Describe your ideal work environment, which may include the kinds of companies and their philosophies, physical environment, types of people with who you work, amount of supervision, and types of responsibilities.
- Describe your educational background. How is it relevant to your desired job?

Write the following Job Acquisition Descriptions on chart paper for Part II.

A. JOB AVAILABLE: Typist

EXPERIENCE: Office assistant at local high school

SKILLS: Typing, 60 wpm

EDUCATION: Business certificate

B. JOB AVAILABLE: Sales/Inventory Clerk
EXPERIENCE: Wal-Mart cashier and stock person
SKILLS: Good communicator, cash register operator
EDUCATION: High School Diploma

C. JOB AVAILABLE: Mechanic trainee
EXPERIENCE: Mechanic for Reliable Auto
SKILLS: Capable of completely overhauling or rebuilding most car engines
EDUCATION: Certificate in Auto Mechanics

Directions

PART I - APPLICATIONS

Step 1: Introduce this lesson by handing each student the Job Application Printable as they walk into the classroom. Instruct them to complete the application as though they were applying for a job right now. If they have a job, they may use that as a reference. If not, ask them to think about where they would like to work. Encourage them to use the information from their resumes and career portfolios to help them.

Step 2: Collect the applications. Ask students to assemble in their small groups. Redistribute the applications randomly, asking each team to critique them. The team should generate a list of positive aspects and suggestions for improvement for each application.

Step 3: Upon completion, ask each team to share their lists. Generate a discussion of common errors and ways to improve. Using the transparency, model a complete application. Make sure students understand the following list of "dos and don'ts."

DO

- Read the form thoroughly so that you put relevant information in appropriate sections
- Follow the instructions accurately (e.g. ink color, continuation sheets, block capitals)
- Answer the questions with evidence from your experience which demonstrates you
- Know what job involves
- Keep a copy of your form so that you can use it to prepare for an interview or complete other forms
- Write using active words and I/Me statements
- Put a positive emphasis on your experiences

DON'T

- Leave any sections blank
- Write illegibly or cross things out
- Fail to research the employer and the type of work for which you are applying
- Leave gaps in your employment/study record
- Misspell words

Step 4: Explain that a standard application form is an opportunity for students to promote their

Lisa Perry
Youngstown City Schools
English
Grades 9-10

Sponsored By

Specialty Fab, Inc

"I signed up for this experience with trepidation. How was I going to relate 32 hours of experience in a steel fabrication shop to my secondary English classes? I love a challenge but after my first day on the job I was pleasantly surprised to find out that the challenge was not going to be making my lesson relative, it was going to be choosing which skill I wanted to focus on to create my lesson."

I thoroughly enjoyed this class. My mind was full of ideas and extensions to this lesson and this venture into the manufacturing world. I learned a lot."



Specialty Fab

"We are proud to have our public educators in our workplace. We feel that we are opening new learning paths for the educator but we also learn a great deal from the educator in our workplace. This is a great opportunity for both groups of manufacturing and education systems to keep in touch with, to learn from, and to build a long lasting relationship."

David Hughes

Founder, Owner, President

Lisa Perry
East High School
English Grades 9-10

Specialty Fab

Dave Hughes,

Owner

11960 South Ave.

North Lima, OH 44452

Title:

Connection: The students will practice writing instructions on how to make a paper airplane. They will also practice making a paper airplane from seeing a visual step by step without written instructions. This is a basic simulation to the blue prints and written modifications and revisions that appear on a blue print work order for each station of the fabrication shop.

Objective: Apply knowledge of transitional words, active and passive language to create a set of instructions.

Skills: Reading comprehension, grammar and vocabulary usage, collaboration and communication.

Teaching Time: Two 90 minute blocks

Materials: Internet access, copies of visual instructions see

Choose the number of designs per group.

paper/pen or computer access for composing and rulers.

Copies of "How to Catch River Crabs" see

<http://grammar.about.com/od/essayassignments/a/rivercrabsessay.htm>

Lesson: Day1

- Introduce lesson by reviewing and practicing using transitional words and active and passive vocabulary.
- List on Sign paper/Hang on the wall for reference
- Separate students into groups of 4
- Have students read a copy of How to Catch River Crabs and answer the questions about the essay.
- Go over answers and findings taking turns asking each group

- Give a brief explanation of the next lesson.
- Each group is to create a business name (explain that their business will be making airplanes)
- Design a Logo
- Instruct each group to assign each member a job for the following days assignment.

Day 2

- Students will be asked to get into their groups
- Have them display their business name and logo in front of their group
- Hand out copies of visual instructions to one of the airplanes
- Each group is instructed to create a set of written instructions for making the airplane
- When groups are done writing instruct them to switch directions with the other groups
- Each group is then instructed to follow the directions to make the plane.

Conclusion:

This lesson will enable students to understand the importance of communication through written instruction and the use of precise language for application in the work force.

Evaluation: The students will self assess each other according to participation in each group. There will also be a grade assessed for group written instructions. A rubric will be designed for written expectations.

Extensions:

- **Challenge each plane in a race**
- **Use mathematics to determine angles**
- **Have students build something by using specific materials supplied by teacher and write directions to see if it can be duplicated by following student written directions**

Beth Queen

Poland Seminary High School
Biology, Anatomy & Physiology, AP Biology
Grades 9-12

Sponsored by

Brilex Industries



My experience at Brilex was wonderful. The concepts and applications that I was exposed to are priceless. I will be able to take so much of what I experienced back into Poland's science department and better prepare students for future education and employment."

"Increasingly, teachers and employers must work together to ensure that teaching and learning are both relevant and focused on the competitive job market graduates are entering.

As teachers gain more industry-based experiences and better understand the modern workplace, they're better equipped to bring the world of work into the classroom.

In a short period of time it was evident that Beth Queen's enthusiasm and passion for education made the interaction process between Brilex employees and herself a valuable exchange of information."

Frank Ingrao
Director of Continuous Improvement and Quality
Systems



BETH QUEEN
POLAND SEMINARY HIGH SCHOOL
HUMAN ANATOMY & PHYSIOLOGY (11-12)

BRILEX INDUSTRIES, INC.
1201 CRESCENT ST.
YOUNGSTOWN, OHIO 44501
FRANK INGRAO~ DIRECTOR OF CONTINUOUS IMPROVEMENT &
QUALITY SYSTEMS

TITLE: *MODELING & MANUFACTURING OF THE (impaired) HUMAN KNEE*

CONNECTION: Students will model the manufacturing process from estimating through shipping. Product is scaled & 3D printed human knee with chosen impairment.

OBJECTIVE/SKILLS/CONTENT: Students will work in teams to plan, create, and analyze product: will study & analyze anatomy of knee/leg physiology, use Excel spreadsheets, Gantt charts, 3D printer (ODE Learning Standard- Biology- Science Inquiry & Application): *"Use technology and mathematics to improve investigations and communications" and "Recognize and analyze explanations and models"*

TEACHING TIME: ~ three 52 minute periods

MATERIALS: Computer & software (Excel, etc), 3D printer, filament, & software, anatomy text &/or internet access; job descriptions

LESSON/ACTIVITY: Students will be in process of studying human bones & bone markings; Class size ~ 30

- Students places into 3 groups of ~10 by instructor
- Students self-assign 1-2 people within each group for each assigned job title (Estimator, Project Manager/Scheduler, Quality Control Manager, Fabricator, Machinist/Assembler, Inspector/Shipping manager)
- Students will study the anatomy & physiology of the healthy human knee (bone, muscle & connective tissue form & function)

- Students will review job descriptions, plan & execute the 3D printing of a fractured/arthritis/osteoporotic human knee (one 3D file provided as an option)
- Finished product parts will be labeled (bones, muscles, connective tissues)
- Excel spreadsheet to be used to calculate at least cost of materials and labor
- Gantt chart to be used for planning/ progress checks
- GrabCAD to be used for Bill of Materials
- Finished project with summary & analysis to be submitted to customer (instructor) for payment (grading)

CONCLUSION: Submission of final product and analysis (comparison of impaired knee to healthy knee, job summary by position, addendum noting possible improvement techniques)

EVALUATION: Self- evaluation (40 pts) and instructor evaluation (60 pts)

Self evaluation: Each student will score each group 1-10 pts for completed project based on assigned parameters (finished product quality & analysis quality). Scores for each group will be averaged and used in 40 pt total. 30 pt score to be assigned by Project Manager & Quality Controller for each group member, remaining positions agree upon 30 pt score for PM/QC. As assisted/approved by instructor

Instructor evaluation: Each group is scored by rubric. 10 pts each for the following: anatomical correctness, use of spreadsheet/chart, use of 3D printer, product quality, job efficiency (team approach), and job analysis (comparison of impaired knee to healthy knee, procedure summary, addendum)

-5 extra points available for presenting job summary with 5 SOP's included (standard operating procedures)

Diann Ruozzo

Farrell, Hermitage, Keystone, Sharon & Sharpville School Districts
Career Awareness Program
Grades 7-10

Sponsored by

Berner International Corporation



"After being at Berner for 4 days, I have "proof" of how math, reading, grammar, etc. related to manufacturing. It was really interesting to see all the ways these skills are used by each of the positions in manufacturing."

"Diann Ruozzo was extremely interested in what we do at Berner International. I do believe it provided her with a good background of what is expected of employees in the workplace. Hopefully, this knowledge will help her convey to her students the importance of learning what is being taught."

Mark McNulty
Chief Financial Officer
Berner International Corporation



Diann Ruozzo
Farrell, Hermitage, Keystone, Sharon, & Sharpsville School Districts
Career Awareness—Grades 7 – 10

Berner International Corporation
111 Progress Ave. New Castle, PA 16101
Georgia Berner – Owner/CEO
Mark McNulty – Chief Financial Officer
Caitlin Bobanick – HR Generalist

Lesson Title: What skills are employers looking for in their employees?

Connection: Helping students realize certain hard and soft skills are needed to maintain a job

Objectives: (taken from Academic Standards for Career Education and Work)

- 13.1.11 – Complete two assessments (interest inventory, Wonderlic [sample], and personality)
- 13.2.11 – Complete a job application; demonstrate workplace skills (includes attitude, punctuality, attendance, communication, commitment, dependability, reliability, initiative, time management, teamwork, technical, literacy, math, computer, and getting along with others)

Skills Being Utilized/Eligible Content: Relevance of hard and soft skills; job search and hiring process; how to fill out an application properly

Recommended Teaching Time: Two periods—one to show power point and talk about hard and soft skills, relating my experience in the manufacturing workplace, and the hiring process and the second to actually give them an interest inventory, a sample Wonderlic test, a personality survey, and fill out an application

Materials: Power Point, Interest Inventory, Wonderlic Test (sample), and Application

Body: Discuss and view power point about manufacturing and my experience at Berner. During second period, have students complete Inventory, Wonderlic, and Application.

Conclusion: Sum up definition of hard and soft skills and why they are important to have them; discuss things that interested them in manufacturing at Berner

Evaluation: Students will write a paragraph about the importance of hard and soft skills in the workplace. They will also be able to list a variety of hard and soft skills. Students will also explain what the job search, application, and hiring process involves.



Richard Scarsella
Choffin Career & Technical Center
Vocational Coordinator
Grades 11-12

Sponsored by

KTSDI LLC

"The Themes of collaboration, cross-training, and communication were very evident. These "soft skills" are needed in today's workplace."



"Richard Scarsella, our Educator in the Manufacturing Workplace, was very interested in our company culture. He was able to spend time with each department and observe our basic processes. In closing this has been a positive experience and we would welcome the opportunity to participate in future programs."

Vickie Soroka, Project Manager



Richard S. Scarsella
Choffin Career & Technical Center, Youngstown, Ohio
Vocational Education, Grades 11-12

KTSDI
801 E. Middletown Road
Youngstown, Ohio 44452

Lesson Plan Title: What are *soft skills* in the workplace?

Connection: Students of today need *soft skills'* competencies to become the workers of tomorrow.

Lesson Plan Objective: Students will explore/identify/explain/compare/contrast what *soft skills* are and why they are important for employment.

Skills Used: Computer skills, Investigative skills, and Analysis skills.

Recommended Teaching Time: One class period, no less than forty-five minutes.

Materials: Computer access, Poster materials, Markers, Tape.

Body/Lesson/Activity:

- 1) Students will be grouped in groups of four, with a reporter and recorder determined.
- 2) Students will be instructed to use the computer to explore what the phrase *soft skills* means and to make notes on the same. Students will be told to differentiate *soft skills* from *hard skills*.
- 3) Students will list examples of *soft skills* on the posters, using markers.
- 4) Groups will tape their posters around the room.
- 5) Students will compare and contrast notes from each group, while reporters report findings.
- 6) Students will be instructed to prioritize six necessary *soft skills* for general employment.
- 7) Each group will give their reasons for their selections.
- 8) Students will note similarities and differences in their selections.

Vocabulary: *Soft skills, Hard skills, Teamwork, Communication, Flexibility, Patience, Time Management, Self-Motivation, Positive Attitude, Work Ethic, Dependability, Critical Thinking, Creativity, Emotional Intelligence.*

Conclusion: Posters will stay posted around the classroom. Students will be encouraged to self-reflect on what "soft skills" they now possess and on what "soft skills" they need to develop for employment.

Evaluation/Assessment: A Pre-test and Post-test, either teacher-made or industry/government sponsored, will be utilized. They do not need to be administered on the day of the lesson.

Resources:

Career Builder Survey, Harris Poll, February 10, 2014 – March 4, 2014.
Soft Skills to Pay the Bills, United States Department of Labor, 2014 edition.

Tiffanee M. Seames

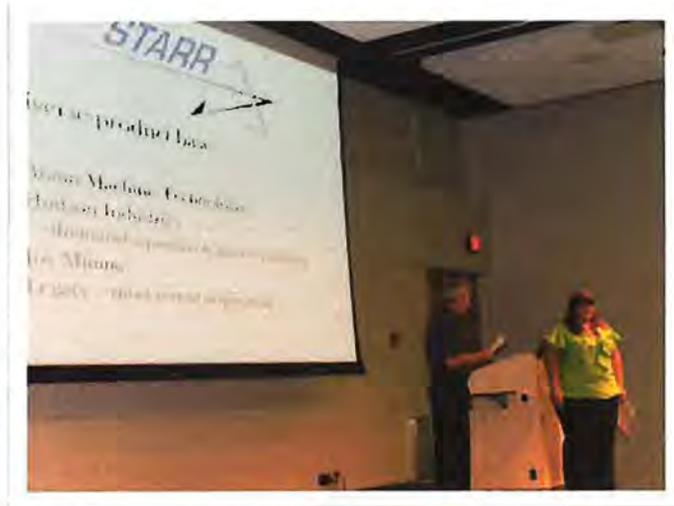
Ashtabula County Technical and Career Campus

English

Grade 10

Sponsored by

Starr Manufacturing



"The key part of my week at Starr Manufacturing was the opportunity to experience a Real World Scenario and to identify the aspects that are parallel to my classroom."

"We believe that once again we have been blessed with outstanding teachers who have gone beyond requirements and made this pilot program a success we know will happen their enthusiasm and expressed desire to share their experiences and new knowledge with their students and fellow teachers, administrators and counselors."

Dale Foerster
Vice President, Starr Manufacturing



Starr Manufacturing **4175 Warren-Sharon Road** **Warren, OH 44473-9524** **Dale Foerster, VP**

Title: Procedural Technical Writing

What's the Connection: Within Starr Manufacturing, each work order is accompanied by a traveler. The traveler accompanies the work order and is the procedure for each division to follow. The directions on the traveler are based on terminology that would be found in each specific division. The employees are responsible for reading, comprehending and following the travelers step by step. The traveler is a tangible representation of the instructions for each division and employee who plays a role in developing the product from beginning to end.

Objective: The objective of this lesson is for students to competently impart and exchange information regarding a specific use of tools and materials to create a useful final product. The students will need to communicate knowledge, skills and processes to follow to their peers. Each student will use their knowledge of their own skills and abilities to determine the value and validity of the information exchanged, as well as interact with their peers in order to clarify any miscommunication identified.

Skills being utilized/eligible content:

- ☆ Ability to understand and analyze explicit and inferential ideas
- ☆ Determine the meanings of technical terminology
- ☆ Analyze the cumulative impact and effectiveness of specific terminology
- ☆ Analyze various formats of procedural technical writing, including print, video demonstrations, etc.
- ☆ Evaluate and assess what is relevant and sufficient
- ☆ Write explanatory texts to examine and convey complex ideas, context & information
- ☆ Introduce and organize complex ideas, concepts, and information
- ☆ Use precise language and domain specific vocabulary
- ☆ Establish and maintain a formal style and objective tone
- ☆ Produce clear and coherent writing
- ☆ Use technology to produce, publish, and update writing product
- ☆ Initiate and participate effectively in a range of collaborative discussions
- ☆ Integrate multiple sources of information
- ☆ Evaluate a writer's organization and communicate verbally with the writer
- ☆ Demonstrate a command of the conventions of standard English grammar
- ☆ Apply knowledge of language to understand how it functions in different contexts

Recommended Teaching Time: 240 minutes of classroom time split up over the course of 8 days.

Materials: Various instructional documents (simple to complex texts)

 Procedure writing example from Starr Manufacturing

 Instructional videos (school tube), Powerpoint on Technical Writing

 Pen, Paper, Highlighters, Computers, Internet access

Body/Lesson/Activity:

View and take notes from the PowerPoint on Technical Writing. Brainstorm in pairs (two brains are better than one) the types of technical writing they are familiar (give a few minutes). Remind students to go as far back in their life as they can remember and recall more materials which could be considered technical writing (a few more minutes). Discuss how “procedural” works into technical writers. Students will then get up and go to write on the board the types of procedural technical writing they may come across in the future.

Discuss what their use of procedural technical writing will be in the future. How can they use it today? (Apply to their career lab and how the ELA Standards affect PTW). Discuss objectives of lesson – final product assignment.

Read and analyze various instructional documents. Watch instructional videos. Discuss key words, organization, text complexity, speed of procedure, relevance, impact, effectiveness, etc. (Quality Assurance)

Provide procedural writing example from Starr Manufacturing (XYZ Manufacturing). Read individually, analyze, highlight key aspects, content or organizational traits that are recognized. Compare and contrast both procedures (SOP vs QMP), define use vs. usefulness.

Students designate final product (on contract form) and produce a pre-writing activity of their choice.

Students read and analyze peers pre-writing activity, determine positives and negatives (QA). Make adjustments to pre-writing.

Using computers, designate a template, set up heading (following written directions given by teacher – Microsoft Word (tables and such).

Create a procedural technical writing document specifying the building of a useful final product (doghouse, bunk beds, swing set, etc).

Conclusion: Students will share their procedural technical writing packets. We will also give the packets to the students’ Career Discovery Program instructor to address any issues in the procedural technical writing packets.

Evaluation:

Notes	+, /, or -
Two Brains are Better	+, /, or - (self-evaluation)
Get Up & Go	+, /, or -
QA	+, /, or - (self-evaluation)
Contract	_____ /10 points
Pre-Writing Activity	_____ /20 points
QA (others)	_____ /30 points
Checkpoints	_____ /30 points
Final Rubric	_____ /100 points (4 point rubric, 6 traits)

Kara Sertick

East Youngstown City Schools

Math

Grades 7 -8

Sponsored by

Dearing Compressors

"On July 7th through the 10th, I spend thirty-two hours in the manufacturing workplace. I had no idea what to expect with this. What I saw was absolutely amazing. Dearing manufacturers custom built units for natural gas compressors. This has been an excellent learning program for me to share with my students. There was so much I did not know anything about. I got to experience these things firsthand. I will tell my students what great opportunities wait in the trades if they invest knowledge into themselves."



"We appreciated the enthusiasm that Kara Sertick brought to this exercise! It seems that she got a lot out of this experience that she will share with her students."

Bob Christoff

Human Resource Manager

Kara Sertick (Pages 3 and 4)
East- Youngstown City Schools
Math- 7th & 8th Grade
Dearing Compressor and Pump
3974 Simon Rd. Youngstown, Ohio 44512
Robert Christoff/HR

Ratios and Proportions in the Manufacturing Workplace

Connection- Ratios and proportions are used everyday in the manufacturing workplace.

Objective of the Lesson Plan-

Mathematics Model Curriculum

Domain: Ratios and Proportional Relationships

Cluster: Analyze proportional relationships and use them to solve real-world and mathematical problems.

Standards:

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

2c. Represent proportional relationships by equations.

Skills Being Utilized: Students will utilize their skills of setting up proportions. This will include common algebra skills such as setting up algebraic equations and solving for a variable.

Recommended Teaching Time: This can be taught in a ninety minute block period, and should be reviewed later to reinforce skills.

Materials: Students will use paper, pencils, and they can work in partners if needed.

Activity:

Problem #1: A bottle scrubber at Dearing Compressor has a diameter of three feet. Sticking out of the scrubber is a pipe that measures 1.5 feet in diameter. Dearing Compressor needs another bottle scrubber that is 3 times bigger in diameter than the original scrubber. How big in diameter does the new pipe have to be in order to match the proportions of the previous scrubber?

Problem #2: A pipe sales company recently made a sale that consisted of five PVC tubes for twenty dollars. If Dearing Compressor wants to purchase 15 PVC pipe tubes, how much would their total cost be?

Conclusion: Students will present work on the elmo to share with the class.

Evaluation: Work will be collected to grade for credit (worth 5 points). No credit will be given for no effort on work shown.

Adam Shankle

Springfield Local Intermediate School
Social Studies
Grade 7-8

Sponsored by

Specialty Metal Products

My three takeaways:

- Many of the jobs that I had thought were good for general labor are actually very specialized and require a lot of extensive training.
- My students can make a livable wage working in the manufacturing workplace and it is a good opportunity for students that are not considering college.
- This experience helped me realize how deeply connected many businesses are in the world today.



"In addition to the educator getting firsthand training and specific information on what skills students might require, our employees can appreciate their capabilities and how valuable they are to the company. This is a mutually advantageous program and we were pleased to be associated with this program."

Tanya McClafferty
Vice President

Adam Shankle
Springfield Local Intermediate
7th and 8th Grade Social Studies

Specialty Metal Products
85 Garfield St
West Middlesex PA, 16159
Tanya McLafferty Vice President

Comparing the Silk Road to Business Today

Subject

Ancient World History

Topic

Silk Road Economics Compared to Modern Economics

Connections

For this lesson I looked at the economics side of the business and how all the members of the business affect the economic outcomes and also looked at the interconnectivity of the process at Specialty Metal Products and other businesses not only in our valley but also around the world as this company has many international clients. Although there are many connections to mathematics and engineering in the manufacturing workplace, there is also a strong economics background because the demand for their product is what enables them to employ the people that they have on staff, and problems in other parts of the world can greatly affect their production.

Objectives

- Students should understand the way that businesses and people are interconnected in an economic system.
- Students should be able to compare and contrast the economics of the ancient world and the modern world

Skills Being Used

Students will be using their reading comprehension skills and their ability to compare and contrast the ancient world with the modern.

This lesson will cover the economics side of the ancient world and study the global market which made up the ancient world and makes up the market today.

Procedure

- In the prior day of class students will have read the article “The Silk Route; 7,000 Miles of History”, dealing with the journey of goods on the Silk Road.
- A short review of the summaries from the prior day will be used at the beginning of the class in order to refresh their memories on the subject.
- Class will begin with a short discussion asking questions to the students including:
 - o Why was it worthwhile for people to attempt this journey?
 - o How could problems in one part of the route hurt people that are trading all over the Silk Road?
 - o How does this compare to today?
- Class will then take part in an interactive presentation showing them pictures and descriptions of the trade processes of the ancient world and today.
 - o This PowerPoint will help students to see the similarities and differences between the modern day and the past.
- Students will then be given an overview of the process of operations that I observed at Specialty Metals in order to show the students how people produce goods that are desired by many people and businesses.
 - o This will also help students to realize why events in other parts of the world can affect jobs and the economy in the US just as it would have in ancient times
- Students will be asked to compare and contrast the activities of modern businesses and the people in the ancient world.

Materials

Items needed for this lesson:

- Copy of “The Silk Route; 7,000 Miles of History”
- PowerPoint dealing with comparing the Silk Road and the modern economy
- Pieces acquired during my experience at Specialty Metal Products

Estimated Time Needed

50 minutes, 1 class period, may extend based on discussion in class.

Conclusion

This lesson should show the students how many of the businesses in the modern and ancient world were and are so closely connected and it will help to show them how they would help as part of the manufacturing businesses in our area. This will help the students to understand how economies and problems in other parts of the world can affect life here in the US, just as problems in Asia could have, and did, lead to problems in Medieval Europe. The experience gained at Specialty Metal Products will be key after being able to talk to management personnel about supply and demand problems that they face in the modern market.

Assessment

Students will be asked to create and turn in a T-Chart detailing the similarities and differences between the market today and in the ancient world. This will require students to look back at the presentation and discussion from the class in order to complete this task, and also to draw conclusions from the information given to them in class, thus testing their comprehension and historical skills.

Kristen Sturm

Maplewood Middle School
School Counselor
Grades 5-8

Sponsored by

Sharon Tube



“Overall my experience helped me develop not only a clear understanding of what is involved in the manufacturing industry, but I also learned to appreciate how essential each position is to the success of the company.”



“The Educator in the Manufacturing Workplace was an excellent experience. This gave the JMC Steel-Sharon Tube the opportunity to promote our industry, business and careers. Working with Kristin Sturm allowed us to provide insight on recruitment, employee relations, and employee communication. Each department was provided the chance to promote their occupation while providing business impact. Sharon Tube is eager to network with the educational arena now and in the future to impact our future workforce (students).”

Denise Carissimo

Human Resource Manager

Kristen Sturm
Maplewood Middle School
School Counselor
Grades 5-8 (Lesson plan is appropriate for 8th grade students)

Title of Lesson Plan

The Manufacturing World: Do You Have the Skills?

What's the Connection?

As a school counselor, part of my job is to expose my students to career fields and opportunities. I typically teach a career unit using a career program, formally called the Ohio Career Information System (OCIS), so students can match jobs based on their interests and research what those jobs entail. This can include, but is not limited to: required education, job prospects, a description of the job's duties, opportunities for advancement, annual salary, and budgeting a lifestyle based on income. This unit will allow students to not only research positions associated with manufacturing, it will also give students a chance to develop a clear understanding of different career choices that they may not have otherwise considered. Additionally, it will help students understand why math, science, and computer skills are essential in today's job market.

Objective(s) of Lesson Plan

The students will define job positions associated with the manufacturing industry.

The students will explain how the position(s) they've researched are essential to manufacturing and running a business.

Skills Being Utilized/Eligible Content

Computer skills, researching, interpersonal skills, communication skills, public speaking

Recommended Teaching Time

4-5 days in 84 minute blocks

Materials

Computer, paper, pencil, pre/post assessment, worksheet, markers, poster board

Body/Lesson/Activity

Day One: The first day will consist of the class becoming acclimated with the career information system. During this time, they participate in creating a personal portfolio, completing short assessments, and class discussion of those assessments. However, before they log on to their computers, they will take a multiple choice pre-assessment that will assess their knowledge of careers associated with the manufacturing industry and responsibilities associated with that career.

Day two: I will spend the first 20-30 minutes sharing my experience at Sharon Tube. It will consist of an overview of the company, its different positions, and future of the manufacturing industry, and what this future can mean for my students. They will be able to ask questions during this time. Once the discussion is over, we will start our project.

Students will have taken the EXPLORE test months (typically two) prior to this lesson. This test not only consists of an academic section, it also has an interest inventory and career component. Students' interests are evaluated, and their evaluations appear on a "World of Work Map". This map consists of four main sections: Working with Data, Working with Things, Working with Ideas, and Working with People. Students will be separated into small groups based on the category in which they've qualified. I will distribute cards with job titles on them that will match their categories. The positions/job categories that will be researched are as follows: Human Resources, Safety, Sales, Customer Service, Laborer, Plant Supervisor, Quality Control, Maintenance, and Supply Chain. For example, a "Working with People" group may receive a card that says "Human Resources" or "Customer Service Representative". Also, a "Working with Things" group may receive a card that says "Laborer" or "Maintenance". Additionally, a "Working with Ideas" group may receive a "Quality Control" card, and a "Working with Data" group may receive a "Supply Chain" or "Safety" card. Once a group has received their card, they will begin to research the position using the career information system. Although some of the positions can be

broad, it is up to the students to determine how the positions apply to manufacturing based on discussion. I will also be around to give ideas and input; I do not expect them to be experts on the positions. As they're researching, they'll be given worksheets that pose a series of questions about their research. These questions include, but may not be limited to: What does this position entail? How is it important? What kind of education is needed for this position? What qualities should a person have in order to be successful in this position? How does it need to work with the other departments? How does it use math? How does it use science? Would the company be able to run without this position? Why or why not? How does it use computer skills? How does it use interpersonal skills? How might this position fall into more than one of our four categories? Once the questions have been answered, the students will write a one page reflection about anything new they've learned, what they found surprising, their likes and dislikes about what they've learned, and whether or not they would consider the position.

Day Three: Students will continue to work in groups

Conclusion

Day Four (and five if needed): Students will give 10-15 minute presentations about their findings. They should use Microsoft PowerPoint and/or a trifold poster board. Class discussion will ensue. Students will submit their completed worksheets (one per group). Presentations will be graded based on a rubric. Students will take a post-assessment to test their knowledge gained from the project.

Evaluation

The students will be given a pre-assessment at the beginning of the lesson to show prior knowledge of different positions within a manufacturing business and their duties. The students will take the same assessment at the conclusion of the unit to compare the knowledge and see how much they've learned. Additionally, students will be evaluated on the completion of the activity and quality of the activity using a rubric.

Tawny Tharp

South Range School District

Math

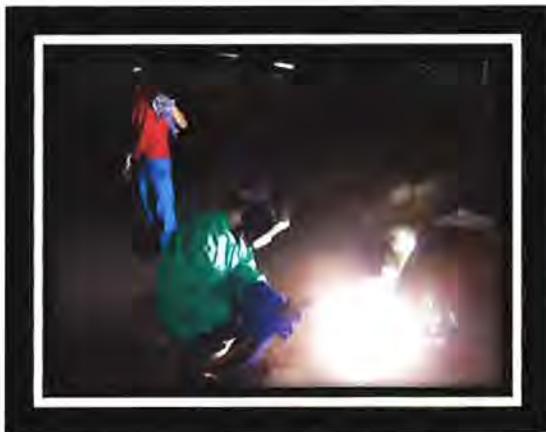
Grade 3

Sponsored by

Columbiana Boiler Company



I feel so thankful to have had this opportunity this summer to be an Educator in the Manufacturing Workplace. I LOVED having the chance to witness firsthand how amazing a profession manufacturing is. I adore the wonderful and dedicated staff at the Columbiana Boiler Company. Thank you for pairing me with such a generous, hardworking, and proud group of individuals!



THEY LET ME WELD!

"This was the first year for the Columbiana Boiler Company to host an educator and we are very pleased with how the program works. Our educator was enthusiastic and eager to learn how we operate. It is nice to know that this experience will be taken back to the classroom and incorporated into the curriculum. This was a great experience for us and we hope for her as well."

Maggie Rummel
Office/Safety Manager
Columbiana Boiler Company

Tawny Tharp
South Range School District
Math / Grade 3

Columbiana Boiler Company
200 Railroad Street, Columbiana, Ohio 44408
Maggie Rummel / Safety Director



Title of the Lesson Plan: Measuring Kettles

What's the Connection: Students will be part of the "Quality Control" department at the Columbiana Boiler Company and will need to use their careful measuring skills to make sure the Kettle they made is correct for the order that was placed.



Objective of the Lesson Plan – Core Competencies: Students will relate their school experience to what working in a job will be like. Quality work is vital in school and out. A kettle is a large rectangular prism that is open on top to use for the galvanizing and dipping of metals. Kettles are constructed out of large pieces of steel that are welded together and undergo multiple safety tests that must meet required safety codes. Third graders will create their own kettle (using a rectangular prism "blueprint") that must be formed correctly in order to meet the order specifications. Students will accurately create and measure the length and width of a "Kettle" to the nearest $\frac{1}{2}$ to $\frac{1}{4}$ of an inch.

Skills Being Utilized/Eligible Content: Grade 3 Math: Measurement and Data: Represent and Interpret Data, 4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch.

Recommended Teaching Time: Two – 45 minute classes

Materials: Rectangular prism templates (kettle blueprints) of different sizes (enough for whole class to make one), glue, scissors

Body/Lesson/Activity: Students will discuss how the work they do in the classroom is preparing them for the jobs/professions they will someday hold. Students will observe a PowerPoint of pictures of from the Columbiana Boiler Company (CBC) and get to hear about their teacher's experiences there. Students will observe and learn what a Kettle is and how they are used. Students will pretend that they have JUST been hired by the CBC and have their first orders. China needs eight kettles measuring 9" long and 4 $\frac{1}{2}$ " wide. Venezuela needs 6 kettles measuring 8 $\frac{1}{4}$ " long and 5" wide and Germany needs 7 kettles measuring 7" long and 4 $\frac{3}{4}$ " wide. Unfortunately, things got a little mixed up in the ordering process so even though we have the "blueprints" for the kettles they are all mixed together and each student will

need to do some investigating and measuring to see which order their Kettle will go with. Each child will receive a blueprint for a rectangular prism. Students will proceed to cut and glue together their rectangular Prism "Kettle". When completed students will measure the length of the longest side and the width of their Kettle. Students will record their dimensions on Worksheet A. Students will find the remaining students who will help complete their order.

CHINA'S KETTLES

9" long
4 ½" wide

Needs 8 Kettles

VENEZUELA'S KETTLES

8 ¼" long
5" wide

Needs 6 Kettles

GERMANY'S KETTLES

7" long
4 ¾" wide

Needs 7 Kettles

Conclusion: Once completed with the task, students will have their Kettle receive final measuring check from an inspector "outside" of the CBC (their classroom teacher, or a group of expert classroom measurers) to make sure accuracy has been met. Students will discuss if anyone's kettle did not meet the dimension needs. Students will brainstorm what happens in the real work force when something does not meet the specifications for an order. Students will write a reflection on the lesson and how they felt they did in getting their product ready accurately.

Evaluation: Students will turn in their "Worksheet A" slips with their reflection. Teacher will use the each student's worksheet, observations, discussions and student reflections to determine who has an understanding of measurement and work ethic.

Possible Lesson Extensions:

1. Students complete this same activity using different kettle blueprints and measure the length and width dimensions using the Metric System.
2. Students complete the same activity but are required to measure exact length, width, and height.
3. Students compare to see if a cylinder "Ton Container" or a Rectangular Prism "Kettle" that have the same length and width dimensions would hold the same amount of volume.

Carlo Trafficante
Austintown Fitch High School
Applied Math/Trig and Pre-Calculus/AP Calculus
Grades 11-12

Sponsored By

Ajax TOCCO Magnethermic



“What I heard from every team member, the characteristics necessary to be successful in the manufacturing workplace include: communication skills, a willingness to learn new skills, a tremendous work ethic, trouble-shooting skills, being dependable, collaborating, listening, precision and attention to detail, flexibility, self-motivation, being open-minded and respecting others and your employer. As educators, teaching our students the importance of these characteristics is just as, or arguably more important than our content.”



“I found the Educator in the Workplace program to be worthwhile and interesting. It is nice to see that school administrators are interested in the skills their students need to possess and that they included manufacturing in the discussion of this important idea. ”

Gregg Richey

EHS Manager

Carlo Trafficante

Austintown Fitch High School

Mathematics: Grades 11-12

Ajax TOCCO Magnethermic

1745 Overland Ave. N.E., Warren, Ohio 44483

Gregg Richley, Plant Engineer & Health and Safety Manager

Title of the Lesson: Manufacturing a cylindrical can to minimize cost

What's the connection: The students will use trouble shooting skills to determine the dimensions of a cylinder given a specific volume that will minimize the cost of producing the can. Once the correct dimensions are determined by the students, they will use a blueprint to create the cylinder out of poster board using the specifications determined by the employer. Students will need to be precise in their computations and measurements when creating the cylinder.

Objectives/Learning Targets/Alignment to Standards: Geometry – Modeling with Geometry

G-MG.3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Skills Being Utilized/Eligible Content: Mathematical Practices addressed in this activity include; Making sense of problems and persevere in solving them, Reasoning abstractly and quantitatively, and Attending to precision. Students will need to be able to work with formulas (volume and surface area of a cylinder), work with spreadsheets, add fractions and decimals, convert between fractions and decimals, use trigonometry (law of sines or right triangle trig), and explain their reasoning and logic so that anyone with a similar background can follow their logic.

Recommended Teaching Time: Two 50-minute class periods.

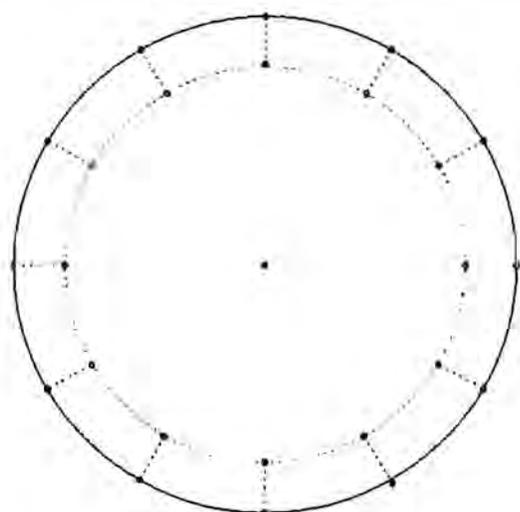
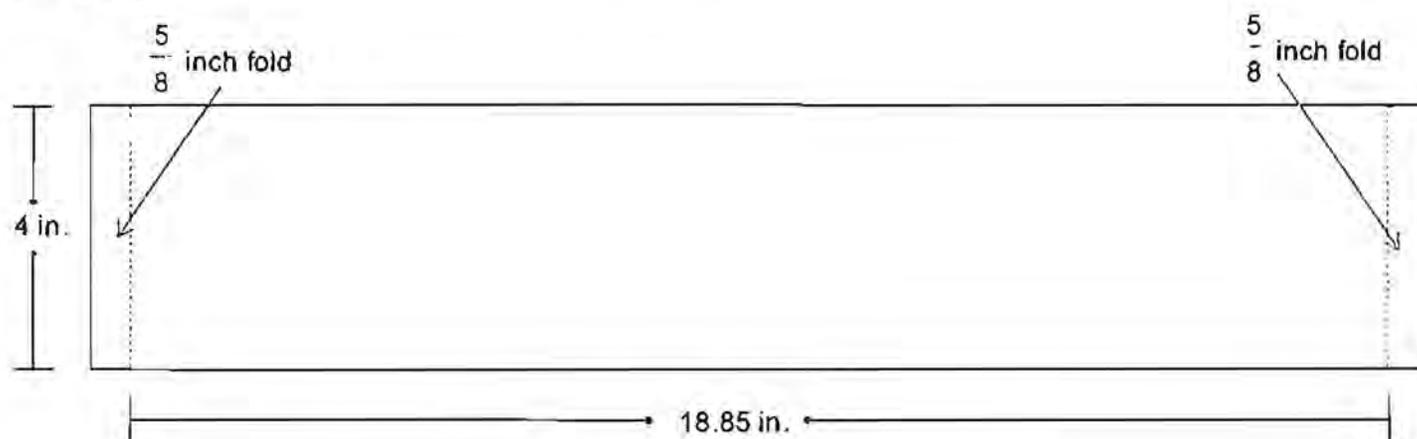
Materials: Access to computer software spreadsheet program (Google Docs), inches ruler with 16ths of an inch clearly marked, scissors, scientific calculator, tape, paper clips, and poster board. NO PROTRACTORS ALLOWED.

Body/Lesson/Activity: Put students in groups of 3 and pose this scenario to each group. Your employer has asked your team to design a cylindrical container for a bulk size powdered baby food product that will hold 36π cubic inches (approximately 113 cubic inches) of product using whole numbers only for the radius and where the *radius* ≥ 1 inch and *height* ≥ 1 inch. However, there is one stipulation. You are asked to make the most cost effective can that will hold the amount stated. Determine the dimensions of this can (radius and height) meeting all the specifications. Using a spreadsheet, determine the dimensions of all possible cans and use the spreadsheet to confirm that each will give us the indicated volume. Then determine the dimensions of the can that will be most cost effective. Explain why your can will be most cost effective. After you have convinced the teacher that your group has found the dimensions of the can that will be most cost effective, you will be given a blueprint of the can. Read the blueprint and use poster board to create the cylinder to the employer's specifications outlined on the blueprint.

Conclusion: At the conclusion of the lesson, each group should share the 'road blocks' they encountered along the way and what they did to overcome them. Also, class discussion should also revolve around: the importance for a company to minimize cost of production, the importance of being precise and satisfying the employer's needs, how making mistakes can be costly in the manufacturing world, the importance of collaborating with others, and the fundamental math skills needed to successfully complete the project.

Evaluation: The role of the teacher will be as a facilitator for each group. Formative assessment opportunities should be utilized throughout the lesson/activity while observing student strategies and listening to group discussions. In the end, the spreadsheet will be assessed by the teacher to verify that students considered all possibilities and correctly calculated the volume and surface area for each outcome. In addition, the final product will be assessed. That is, the cylindrical can they produced with the exact employer specifications. Each group will also be responsible for submitting a paper clearly explaining what they did along the way, how they did it, and why they did it. Their submission should be very detailed so that anyone with a similar background can follow their logic.

Blueprint:



radius of caps is 3 in. with a $\frac{3}{4}$ in. fold-over
each cut in the fold-over is separated by 30°
2 caps needed

Jamie Vande Steeg

Maplewood Middle School

Mathematics

Grade 8

Sponsored by

Roll Forming Corporation



"I learned many things about manufacturing during my time at RFC, but the three lessons that will impact my future students are measurement, conversions and computer skills. My experience at RFC has further enabled me to prepare my students with the skills needed to be successful in a manufacturing workplace."

"We have exposed our instructor to every aspect of our manufacturing process, from the front office to the plant floor. We hope that the educator's experience will enable them to provide real life scenarios to the classroom environment and help their students understand how their new knowledge will be applied in the future.

Alex Moyer, P.E.
Engineering Manager



**Jamie Vande Steeg
Maplewood Middle School
8th Grade Mathematics**

**Roll Forming Corporation
250 MLK Jr. Boulevard
Farrell, PA 16121**

Alec Moyer, P.E. Engineering Manager

Title of the Lesson Plan: Measuring Tolerance

What's the Connection?

At RFC, I was most inspired by the work of the Quality Control group. When a new item is rolling it is the responsibility of the mill workers and Quality Control to ensure the dimensions of each piece are within the tolerance given by the customer. The shapes, angles, widths, and lengths of the first piece are inspected to the scale drawing. Each part is given the greatest range of variation that will work for the customer. If the measurements are not within the tolerance, then it is the responsibility of the mill worker or engineers to fix the problem so the product meets the specifications. To measure all of the different shapes, angles, lengths, and widths the team at RFC uses tape measures, squares, micrometers, and measuring equipment. These measurements RFC uses are in English yet many customers use Metric, therefore converting is an essential skill.

Objective of the Lesson Plan- Core Competencies

The students will measure using different tools. They will convert their measurements to an appropriate form (English or Metric and decimal or fraction form). Finally, they will check their accuracy with the given tolerance.

Skills Being Utilized/Eligible Content

The skills utilized in the lesson are English to Metric conversions, Metric to English conversions, fraction to decimal conversions, decimal to fraction conversions, measurement skills, application of the Pythagorean Theorem, numerical tolerance, problem solving skills, and teamwork.

Recommended Teaching Time: 1 hour 30 minutes

Materials: Tape measures, rulers, micrometers, bolts, washers, etc.

Body/Lesson/Activity

Prior to this lesson students should know how to convert from fractions to decimals without a calculator. They should also know how to convert from Metric to English and how to apply the Pythagorean Theorem. Conversion factors may be given to assist students (1 in = 2.54 cm and 1 m = 39.37 in). Discuss with the students what is going to be measured in the classroom and give them a quick reminder of how to use all of the measuring tools.

Students will be in pairs for this lesson. Each partner will measure different items in the classroom like the length and width of chalkboard and items brought in like bolts, washers, etc. They will measure with tape measures, rulers, and micrometers. Each person should measure and record their personal measurement. Each group should begin on a different item and circulate throughout the room so only one pair is measuring the same item at a time. Remind students to label their measurements with appropriate units.

In addition to measuring lengths, widths, and diameters, students should also measure angles. To have the students verify if the angle formed between two objects is 90 degrees they will measure three line segments that would create a triangle. For example, if you want them to verify if the angle between the wall and the floor is 90 degrees, place a point on the wall, corner, and floor and have the students measure the lengths of all three segments.

Once the students have completed measuring give them a sheet with the tolerances of each item. These tolerances should be in different units than they originally measured. For example, if they measured the length of the chalkboard in inches you may give them a range in centimeters. The tolerances should also be in different forms like fractions or decimals. Each measurement should be converted properly and checked by the students. In order to verify the 90 degree angle measurement, students will need to place their line segment measurements into the Pythagorean Theorem and verify if it works or not.

Once students have converted their measurements they need to check to see if they fall into the permitted range. If not, they need to figure out if they made a mistake in measuring or converting. This gives time to reflect, discuss, and problem solve with their partners.

Conclusion

This lesson should demonstrate the importance of measuring and converting in the manufacturing workplace. It also shows how measuring is an estimation which is why a range of measurement may work for a given item. Finally, it allows students to build soft skills like teamwork and communication.

Evaluation

Students will be evaluated on their measurements and conversions. Since this is a review lesson, students will be assessed on the percentage of measurements converted correctly and in the appropriate tolerance range.

Eric P. Wenger

Sharon Middle-High School
Mathematics
Middle-High School

Sponsored by

Joy Cone



"Each person I interacted with gave me the following "focus factors": details, attendance, communication, attitude, and reliability. On another note, as I was introduced as "a math teacher from Sharon" many said math was not a high priority – it was a given."



"Our educator was well prepared for the experience, asked relevant questions of our employees, and was very personable during his stay. The knowledge that Eric has gained by seeing the process from end-to-end has given him a new perspective on how to prepare his students for life after high school and he has gained valuable information on skills gaps that he can now address in his classroom."

Colleen Chamberlain
Director of Human Resources

Eric P. Wenger
Sharon Middle-High School
Mathematics – High School

Joy Cone Co.
3435 Larmor Road – Hermitage, Pennsylvania 16148
Ms. Colleen Chamberlain, Director of Human Resources

The Lesson Plan

Title: Can you spend the least amount?

Connections: All manufacturing business need to move raw materials into the facility and deliver the finished product out to their customers. This exercise will give students a brief overview of the complexity associated with this “traffic” within the business environment.

Core Competencies: Overall, the student will be exposed to

- (a) communication via spreadsheet design and development
- (b) communication via published schedule of delivery routes, dates, and times
- (c) understanding the basic rules associated with professional truck driving
- (d) using Internet resources as a tool both in research and as a point of reference (i.e.: pricing, availability, travel disruptions)

Eligible Content: Each student will be assessed on

- (a) spreadsheet (Excel, Google Docs) in design, development, and accuracy
- (b) Word Processing (Word, Google Docs) demonstrating attention to details in scheduling the “run”
- (c) Internet Browser (Explorer, Firefox, Chrome) demonstrating ability to navigate to various sites, read for understanding, extract pertinent information, and assimilate the data pieces into a coherent plan

Time Length: 40 minutes per day for five (5) days

Materials:

- Introductory prompt
- Computer with Internet connection at a minimum
- Microsoft Office installed if desired otherwise Google Docs will be a suitable replacement

Lesson Components: The students’ task involved scheduling a truck route for picking up necessary raw materials to come back to the physical plant and on the same truck route, deliver the finished goods to the customer. The most efficient route is desired.

The teacher can use many scenarios. For this example, the delivery of generic corn flake cereal will be discussed. The company lists many ingredients, but for this exercise, the student is responsible for delivery of the corn flake product, acquiring the materials raw corn, sugar, and diesel fuel.

The students will research the basic rules imposed on commercial truck driving (hours behind the wheel, hours on truck-related duties [loading/unloading], resting time). They will find the current pricing of corn and sugar using real time information via the Internet. Sites like CNN, Google, and Yahoo contain many links to research these pricings. Using a search engine, the students will need to find the amount of fuel needed to move the truck through the various stops and cost associated. As there may be multiple options for a delivery route, care in the organization of the data as the spreadsheet is developed is essential.

For the actual locations for the route, many options are available. For weaker students, the teacher can limit the number of locations. In other words, the teacher can stipulate the delivery of corn flakes and the pick-up of the raw materials occurs within the same towns. For the more advanced thinker, the teacher can tailor the scenario to involve multiple locations, necessary detours, or place restrictions on the delivery side (i.e.: delivery on during night hours or pick-up only during midnight to 6:00am). This complicates the data elements enough to make the challenge more intriguing to find the optimal solution path.

The final product required of the students will be:

- (1) A delivery schedule for the truck driver that includes road route directions, stop locations with times, description of the type of stop (deliver corn flakes, collect sugar, ...)
- (2) A detailed spreadsheet detailing the possible routes and the costs associated with each schema
- (3) A "works cited" page, of sorts, to document where the information was pulled in their research.

Evaluation: The final product for each student (or student group) will vary greatly. The emphasis shall focus on reliability, readability, and organization of the schedule and the cost analysis. The students will be encouraged to explain their thought processes as the project develops.

Depending on the level of difficulty placed into the scenario by the teacher, other components can be assessed for accuracy. For example, was a map included in the route planning for the driver, how much fuel is needed for certain parts of the trip, or can you plan the route missing many toll roads.

Kathryn M. Woodford

Joseph Badger High School
Geometry, Pre-Calculus, Calculus
Grades 9-12

Sponsored by

Graham Stamping Company

My three takeaways:

- Jim, an employee on the shopfloor who commonly trains new hires, stated that a lot of new hires do not know how to use or read a tape measure. I am interested in getting some of my students to use a tape measure instead of a ruler this year in class.
- The most common form of communication is by email for recording purposes. It hit me that some students may not know how to properly write an appropriate/formal email or communicate intelligently. I would like to get students to submit work electronically throughout the year.
- The metric to English measurement conversions are calculated (mainly approximated) mentally. I did not realize how often conversions took place!



"Katie's presence has been well received here at the Graham Stamping Company. All employees have enjoyed the experience and interaction. I am confident in stating that Katie has received an educated insight to the manufacturing workplace in order to enlighten and inform her students on the value of mathematics in the real world."

Tony DeMarco
General Manager, Quality Manager

Kathryn M. Woodford
Joseph Badger High School
9 – 12 Mathematics

Graham Stamping Company
1700 Broadway Avenue
Hermitage, Pennsylvania 16148
Tony DeMarco, General Manager

Title: How much steel?

Connection/Common Core Standards utilized: Students will be using many of the mathematical practices in the classroom similar to what is seen in the manufacturing workplace. This activity will be a great wrap-up to a discussion over diameter and area and a great introduction to a review of volume.

Reason quantitatively and use units to solve problems.

[CCSS.Math.Content.HSN.Q.A.1](#)

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

[CCSS.Math.Content.HSN.Q.A.2](#)

Define appropriate quantities for the purpose of descriptive modeling.

Apply geometric concepts in modeling situations

[CCSS.Math.Content.HSG.MG.A.2](#)

Apply concepts of density based on area and volume in modeling.

[CCSS.Math.Content.HSG.MG.A.3](#)

Apply geometric methods to solve design problems.

Objective of the Lesson: To encompass a hands-on activity that will practice several concepts students should already be familiar with by the time they reach geometry but may need refreshed (measurement with a ruler, Metric to English conversion, decimal to fraction conversion, area and volume). Students will not only be using practical math skills, but also problem solving skills and teamwork to learn about a new concept (density) that ties into science. It also gives them practice in reading a simple blueprint.

Skills being utilized: Measurement of metric to English and conversions, decimal/fraction conversions, area and volume formulas, using density to find weight and possible costs, problems solving and perseverance skills, and teamwork. There will be many different differentiation stems throughout the lesson.

Recommended teaching time: 2 – 3 days (50 minutes each)

Day 1 will be a lesson over using perimeter, circumference, and area in basic geometry. Day 2 will be devoted to the activity.

Materials: Student worksheet that includes the tasks, print 1 and 2 worksheets, pencil, calculator, compute Compass and graph paper (if visual needed)

Body/Lesson/Activity: As a warm up, students will discuss an OGT review question (2009 #9) from the previous night's homework. This question will get students into the mindset of an object being broken into different shapes.

Next, students will be partnering up to begin the activity (each student is responsible for recording their own work).

The first question of task one in the activity will have students investigate how many sheets of metal are needed to process a job. Each sheet of metal is 48" by 96" and there are three types of circles that need to be cut. 1,500 pieces of 4½", 5", 7" diameter circles need to be made. Students are to record their required information in an organized, logical order (I will not be telling students exactly what needs to be calculated to figure this problem out – I want students to work together to decide what information needs to be calculated on their end to get to the final answer of how many sheets of metal is needed).

Once students have figured out how many sheets of metal are needed, I will have them briefly explain to me their answer and their process to get approval to move forward. This will allow me to guide those who may be headed in the wrong direction, or to challenge those who are moving forward quickly (I may not be looking for exact answers but instead am looking for the correct processes). The next question will have students calculating the total weight of the sheets of metal needed. Here the students will know the thickness of a sheet is 0.285" and will need to make the connection that they need to use the volume and density. Here is where students will research how many pounds per cubic inch are needed to solve this problem. (Hopefully students will come up with a number around 0.2904 lbs.) There are different types of metals that can be used (and even steel) so if come up with a different value I will ask them why they choose this number and where it came from. This will allow different groups to possibly have different answers than others but all still be correct. This will complete task one.

After task one, students will then be given a blue-print of a specific part. This part is also circular but will have the inside cut out. Here is where students will need to work with conversions between metric and English. The question in this task will have students figure out how many pieces can fit inside a shipping box. Again, I will not specifically tell students what calculations need to be made but instead have them work together in figuring out what need to be done to correctly answer this question. Students will be given the information that the box size is 22,140 cubic inches and the washer will have an outside diameter of 55.8 millimeters, inside diameter of 28 millimeters, and thickness of 3 millimeters (be sure to watch the difference in units!). To end, students can figure out how much the pieces weigh inside the box.

An extension task can then be to figure out the area of a part from a detailed given blue print. Or, students can enter their activity information into an Excel worksheet to organize their data in an efficient way that can be used for other similar parts that may be made inside the manufacturing workplace.

Teaching notes:

1. Do not answer student questions until they have a start to a specific task. Let them know that they need to start the question with as much as they know and try something before giving up and asking the teacher.
2. Remedial groups can use graph paper to visualize the sheet of metal and a compass can be used to draw (instead of cut) out the circular pieces.
3. Re-enforce the concept of approximate appropriately, rounding and estimating appropriately, and being sure to label units of measurement throughout.

Conclusion: This lesson should demonstrate to the students that workers in manufacturing need to know a variety of math skills that they will use every day (conversion, blueprint reading, and measurement.) Not only will they be using math skills, but also be aware that problem solving and teamwork skills arise daily.

Student Evaluation: Students are expected to get through task 2. Some remedial students may only get through task 1 and that is acceptable (they may also work outside the classroom if needed). Advanced students should make it to task 3 and find a reasonable place to end their activity if they do not get all the way through this task. Students should be conversing with the teacher throughout the activity to give them a better understanding of what they need to accomplish to finish this activity.

Michael Yauger

New Castle High School

Social Studies

Grade 7

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Spike Mancuso

Human Resource Director/Sec

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Title of Lesson: Increasing Geographical Awareness of Countries Where ITV Products Are Shipped

Connection: Show students through maps, charts, and other worksheets where ITV products are shipped to both internationally and domestically once the products leave the plant

Objectives of the Lesson Plan:

- 1) Understand the themes and elements associated with the study of Geography where ITV products are shipped
- 2) Understand the purpose and uses of maps where ITV products are shipped
- 3) Describe how to use maps, graphs, and charts showing where ITV products are shipped
- 4) Identify the most commonly used geographic terms where ITV products are shipped

Skills Being Utilized/Eligible Content:

- 1) PA Geography Standard 7.1.7A: Explain how common geographic tools are used to organize and interpret information about people, places and environment
- 2) PA Geography Standard 7.1.7B: Explain and locate places and regions as defined by physical and human features

Recommended Teaching Time: 1-2, forty-minute periods

Materials: Student journals and worksheets, world maps, graphs, and charts showing where ITV products are shipped

Lesson:

Objective Question: Where are ITV products shipped both internationally and domestically:

- 1) Students will write this question into their student journals to write initial reflections and reactions for further discussion later
- 2) After initial question response in journal, students will review with instructor various geographical places around the world where ITV products are shipped
- 3) After map and geographical instruction, students will review vocabulary terms associated with geographical maps and charts
- 4) Students will then be given a blank worksheet map to fill in the international and domestic ITV products are shipped to work together in groups of four
- 5) Students will be able to review book, in-class, and instruction materials to fill in geographic worksheets
- 6) Upon completion, teacher will review on map where ITV products are shipped

Assessment:

- 1) Student responses to teacher geographic review questions
- 2) Teacher review of maps students filled out during group and individual discussion
- 3) If needed, teacher review of student journals or map quiz upon completion of lesson

Homework: If needed, teacher will schedule map quiz upon completion of lesson

Conclusion: Teacher will review all assessments and homework as needed for objective completion

Evaluation: Teacher will reflect upon any necessary changes in lesson upon completion

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