Careers in Action **TEKStar Lesson Summary**

Lesson Title How Did It Happen, How Does It Work, Can We Build It Too?
Grade Level Fifth Grade
Course Number SC 112.7 **Course Name** Science, Fifth Grade

Keywords

engineer, structure, invention, research, Rube Goldberg, trial and error, stability, dependability, manufacture

SE Course

SC 112.7:5.1 (A)(B), 5.2 (A)(B)(C)(D), 5.3 (A)(B)(D)(E), 5.4 (A)(B) 5.11 (B)

SE Cross Curricular

SS 113.7:5.24 (A)(B)(C)(D)(E), 5.25 (A)(B)(C), 5.26 (A)(B)(C)(D)(E), 5.27 (A)(B)
M 111.17:5.14 (A)(B)(C)(D)
ELA 110.7:5.1 (A)(C), 5.4 (A), 5.5 (A)(B)(D)(E)(F), 5.10 (B), 5.13 (E)(F), 5.15 (A), 5.25 (A)

TAAS

M 1: 8.2 (B)(C)
RE 5: 5.13 (G)
WR1: 8.15 (C)
SC 1: 8.1 (A)(B), 2: 8.5 (A)(B)(C)

TAAS II/TAKS

M 4: 5.11 (A)(B), 6: 5.14 (A)(B)(C)
WR 1: 7.15 (A)(B)(C), 7.18 (H)
SC 1: 5.2 (A)(B)(C)(D)(E), 5.4 (A)
RE 4: 5.10 (H), 5.11 (C)(D)

Lesson Summary

TEKS, TAAS/TAKS, and personal skills valued by educators and employers are taught as students experience the career area of **Industrial and Engineering Technology.**

In this lesson students research "wacky inventions." They experience manufacturing and engineering by constructing a super straw structure. They research and prepare a presentation with visuals to describe an invention past and present, then design and produce their own inventions for the future which are demonstrated at an "Into the Future Fair."

Finally, with the assistance of an engineer mentor, they design and build an elaborate, complicated, and imaginative contraption to complete the simple process of popping a balloon.

Arrangements are made with the Tech Prep Office at (956) 364-4548, Fax (956) 364-5143 or by using Tech Prep Inc.'s website (http://techprepRGV.com) for a speaker, mentor, and/or field trip. These experiences enable students to investigate the actual careers in action.

This lesson was developed in Summer 2000 as part of a Careers in Action project led by Tech Prep of the Rio Grande Valley, Inc., and funded with School-to-Careers grant funding through the Texas Education Agency and the Texas Workforce Commission. Following a pilot project by Tech Prep Support Teams, revisions were made in the Spring of 2002.

This lesson has been endorsed by Mike Allen, President/CEO of McAllen Economic Development Council, MEDC, McAllen, Texas, and by Cesar Maldonado, Vice President of Manufacturing Systems, Assa Abloy Door Group, Harlingen, Texas.

Evidence of Success

The student will discover and apply the process used by engineers to create inventions that solve problems.

The student will be able to invent products and explain the problems and solutions found.

Personalize the Learning

The teacher will write on the chalkboard, "Wacky Inventions*." List a few examples and then ask students to brainstorm additional examples. Examples may include these actual wacky inventions:

- a bird diaper
- tricycle lawnmower
- diaper alarm
- motorcycle airbag
- cricket gun
- pet shower
- fly trap
- pet toilet
- thumb sucking inhibitor

*A great website for additional wacky inventions including pictures can be found at: http://www.totallyabsurd.com/

Read the following book to the class, Mistakes that Worked by Charlotte Fultz. Discuss with students that an inventor is a person who thinks up original ideas or produces a new device, process, etc.

Additional Books include:
The Ben Franklin Book of Easy & Incredible Experiments, by Franklin Institute, ISBN: 0-471-07638-4
Edison Etc. by B.K. Hixson, ISBN: 1-57156-005-X
From Indian Corn to Outer Space, by Ellen H. Showell and Fred M.B. Amram, ISBN: 0-942389-10-7
Girls and Young Women Inventing, by Frances A Karnes and Suzanne M. Beam, ISBN: 0-915793-89-X
Inventing Stuff, by Ed Sobey, ISBN: 0-86651-937-8
Lucky Science, by Royston M. Roberts and Jeanie Roberts,ISBN: 0-471-00954-7
Put a Fan in your Hat!, by Robert Carrow, ISBN: 0-07-011658-X
Steven Caney's Invention Book, by Steven Caney, ISBN: 0-89480-76-0
The Thomas Edison Book of Easy and Incredible Experiments, by The Thomas Alva Edison Foundation, ISBN: 0-471-62090-4
Turn on the Lights from Bed!, by Robert Carrow, ISBN: 0-07-011659-8

Relevance

Technological advancements have been tremendous over the last 50 years. Many students are unaware yet fascinated with "old" inventions. The first telephone looks and works quite differently than a mobile phone today. But in order to plan for the future sometimes they must look at the past and their mistakes to create a better invention. On a much grander scale, inventions not only make our lives easier but provide many types of jobs. Each invention goes through the process of an idea , to drawing, to a model, to an engineer, to a manufacturer, to workers, to the truck driver, to the loader and unloader, to the store owner, to the sales clerk, and on and on. But it all begins with an idea.

TECH PREP of the Rio Grande Valley, Inc.

Know It
Do It
Think It

Activity 1

Careers in Action

TEKStar Activity Summary

Lesson Title Super Straw Structure

Time Frame 50 Minutes

Activity Description

Ask students to define an engineer. (A skilled person who plans, constructs, operates or supervises the construction of machinery, engines, roads, etc.) Explain to students that they will be acting as engineers today and will be designing and building a super straw structure in groups of 3 or 4. Review proper group behavior for this activity because it can get loud! Distribute a package of straws, one pair of scissors, and one roll of tape to each group. Allow the class 30 minutes to discuss, design, and construct their super straw structures. Debrief by discussing the following questions:

1. What is the job of an engineer? (Definition above)
2. Why are engineers needed? (Skilled people are needed to construct building, roads, bridges, etc.)
3. What types of skills must an engineer have? (Creativity, problem solving, making predictions, predicting consequences, working cooperatively, etc.)
4. What types of skills did you experience while creating the super straw structure? (Creativity, problem solving, making predictions, predicting consequences, working cooperatively, etc.)
5. What could your super straw structure be used for?

Students should realize that they experienced some of the same skills of an engineer. Ask what they would need to know/do before manufacturing/producing their straw structure to sell and/or manufacturer.

*Optional Activity: Following this activity, students may have an engineer and/or manufacturer speak to them, view their super straw structures, and discuss his/her job. Ask the speaker to bring actual products with drawings, etc. to share the design and development process from start to finish.

Note: If you live in the Rio Grande Valley and want an engineer to speak to your class, contact the Work-Based Experiences Specialist at the office of Tech Prep of the Rio Grande Valley Inc., in Harlingen, Texas at (956) 364-4548.

Teacher-to-Teacher Notes

The teacher will need to make sure students have ample space for construction. The teacher will need to discuss the rubric to be used for assessment with the students before the project begins. Explain why stability counts 30 percent. Before sharing their projects, have students assess their own work using the rubric.

Objective

The student is expected to work cooperatively to construct a super straw structure by which they will discover and experience the skills necessary for an engineer.

Materials

1 package of straws per group
1 pair of scissors per group
1 roll of tape per group

Technology Utilization

None

SE - Course

SC 112.7: 5.2 (B)(C)

SE - Cross Curricular

M 111.17: 5.14 (B)
SS 113.7: 5.25 (B), 5.26 (C), 5.27 (A)(B)

TAAS

M 1:8.2 (B)(C)

TAAS II/TAKS

M 4:5.11 (A)(B), 6:5.14 (A)(B)(C)
SC 1:5.2 (A)(B)(C)(D)(E), 5.4 (A)

Check for Understanding

The teacher will monitor and guide students as needed.
Students monitor their work using the straw structure rubric. (See Assessment)

Assessment

The teacher may grade students on working cooperatively and on their super straw structure using the following rubric:

Straw Structure Rubric:

30% Working cooperatively
30% Creativity of design
40% Stability of structure

Students write a paragraph explaining the steps used in building the straw structure and relate the process to what an engineer would do.

Learning Styles

Concrete Sequential
Concrete Random
Abstract Random

Multiple Intelligences

Intrapersonal
Verbal/Linguistic
Visual/Spatial
Logical/Mathematical
Interpersonal

Thinking Skills

Dynamic

Accommodations

Adapted Assignment
Instructional Support

Extensions

Depth and Rigor
Complexity

Resource Pages

None

Careers in Action

TEKStar Activity Summary

Lesson Title Inventions Through Time **Time Frame** 90-120 Minutes

Activity Description

1. Students brainstorm what they think might be the best inventions over the last several years. The list might include: mobile phones, electric cars, disc players, etc.

2. Explain that inventors and engineers experience trial and error each time they develop a new idea just as
the class did in building their super straw structure.

3. The teacher will guide a discussion on inventions that have evolved over time. Topics to consider may include the telephone, television, stereo, various transportation modes, etc.

4. Allow students to choose one topic to research for a brief written report to present to the class. Students will gather information describing a product at its conception and how it has evolved to its present form. The report must include the name of the inventor, the manufacturer, how it was manufactured, as well as additional pertinent information. Visual pictures are a must for each presentation and include what the product first originally looked like and then what it looks like today.

5. After research, students will present their report and explain their visual aid. Allow time for students and teacher to ask questions as well as view each other's visual aids.

Teacher-to-Teacher Notes

Some products may have several evolutions and can be presented through more of a flow chart format. Other products may have changed very little and may be presented simply on a divided poster board. Encourage students to bring in the actual products in their past and/or present form.

Students will be graded on their presentation skills. Therefore the teacher may need to present a short mini lesson explaining tone, volume, stance, how and where to hold a report while reading, etc. Be sure a display table, easel, etc. are available to hold materials for presentations.

If not done in Activity 1, bring in local manufacturers and/or engineers to the classroom to describe their jobs to the students. This may be done as a follow up to the students' presentations.

Note: If you live in the Rio Grande Valley and want an engineer to speak to your class, contact the Work-Based Experiences Specialist at the office of Tech Prep of the Rio Grande Valley Inc., in Harlingen, Texas at (956) 364-4548.

Objective

The student is expected to research, create a visual aid, and present information on an invention both past and present.

Materials

Computer research programs
Poster board
Markers
Butcher paper

Technology Utilization

Internet (if desired)

SE - Course

SC 112.7: 5.3 (D)(E)

SE - Cross Curricular

SS 113.7: 5.24 (A)(B)(C)(D)(E), 5.25 (B)(C), 5.26 (A)(B)(C)(D)(E)
ELA 110.7: 5.1 (A)(C), 5.5 (A)(F), 5.10 (B), 5.13 (E)(F), 5.15 (A), 5.25 (A)

TAAS

RE 5: 5.13 (G)
WR 1: 8.15 (C)

TAASII/TAKS

RE 4: 5.10 (H)
WR 1: 7.15 (A)(B)(C)

Check for Understanding

The teacher will monitor and guide students during their research phase and the construction of their visual aid. Remind students to include all of the required information by having students highlight the information in the report.

Assessment

The final written report and the accompanying visual aid may be collected for a grade. Points are also given for their presentation skills.
Ex: 50 points - report content
15 points - visual aid
35 points - presentation skills

Learning Styles

Concrete Sequential
Abstract Sequential
Abstract Random

Multiple Intelligences

Verbal/Linguistic
Visual/Spatial

Thinking Skills

Basic
Engaged

Accommodations

Adapted Assignment
Instructional Support

Extensions

Complexity
Acceleration

Resource Pages

None

Careers in Action

TEKStar Activity Summary

Lesson Title Into The Future Fair **Time Frame** 90-120 Minutes

Activity Description

1. The teacher will ask students to brainstorm inventions they would like to see and/or need in the future. Ex. Shoes that make you jump high enough to slam dunk a basketball, a machine that can make a meal at the push of a button, a car that runs on air, etc. Explain that students will now become inventors themselves.

2. Ask the students to choose one of the ideas from their brainstorming or assign the class the same futuristic invention to construct either with materials or simply drawn on paper. This can be done either in a cooperative group or individually. Whole class assignment examples may include the design of a better mouse trap, a better umbrella, a new type of wheelchair, etc.

3. The teacher will ask students to think about the knowledge and skills that would be required to design and manufacture the invention like those mentioned in earlier activities.

4. Students will conclude with an "Into the Future Fair" where other students from various grade levels view the futuristic inventions and talk with the inventors about what they have learned about inventors, engineering, and technology.

Teacher-to-Teacher Notes

The "Into the Future Fair" may be set up in the classroom or the gym depending on the size of the inventions themselves. A science fair type set up of students rotating to each invention may work best. Allow the students to demonstrate and explain their inventions to other students thus allowing them to practice proper presentation skills. A prize may be awarded to the best invention voted on by students and faculty. Local engineers may be asked to view the students inventions and may also vote for the best invention. Students may even dress futuristically for doing their presentations.

Objective

The student will assume the role of an inventor or engineer and is expected to create a futuristic invention to be presented at an "Into the Future Fair."

Materials

Paper, if inventions are required to be drawn
Area for students to set up their inventions, if required to be constructed

Technology Utilization

Dependent on students' inventions

SE - Course

SC 112.7: 5.2 (A)(B)(C)(D), 5.3 (A)(B)(D)(E), 5.4 (B), 5.11 (B)

SE - Cross Curricular

SS 113.7:5.24 (E), 5.25 (A)(B)(C), 5.26 (B)(C)(D), 5.27 (A)
ELA 110.7:5.5 (A)(B)(D)(F), 5.25 (A)
M 111.17:5.14 (B)(C)(D)

TAAS

SC 2: 8.5 (A)(B)(C)

TAAS II/TAKS

SC 1: 5.2 (A)(B)(C)(D)(E), 5.3 (A)(B)(C)

Check for Understanding

The teacher monitors the students and may need to guide students by questioning to focus on details as they plan/design their inventions.

Assessment

The teacher may grade the final invention based on the following rubric:

1. Does the invention make life easier?
2. Is the invention practical?
3. Is the invention needed?
4. Is the invention an improvement on something of today?

Learning Styles

Concrete Sequential
Abstract Sequential
Concrete Random
Abstract Random

Multiple Intelligences

Intrapersonal
Verbal/Linguistic
Visual/Spatial
Logical/Mathematical

Thinking Skills

Dynamic

Accommodations

Adapted Assignment
Assistive Technology/Materials
Instructional Support

Extensions

Depth and Rigor
Complexity
Acceleration
Performance Option

Resource Pages

None

Careers in Action — TEKStar Activity Summary

Lesson Title Pop that Balloon! **Time Frame** 5 Days of 30 Minutes each

Activity Description

*This activity requires the mentorship of an engineer familiar with the "Engineer in the Classroom" program (See Teacher-to-Teacher Notes #2 to assist in obtaining an engineer for your classroom).

1. The day before this activity, ask that each student bring objects (junk) they no longer need from home. Ex. A broken toy car, straws, toy wheel, a telephone cord, an empty milk jug, etc.

2. The day of the activity, explain to the students that they will be working as a class to build a contraption that is capable of breaking a balloon. The contraption should be as elaborate, complicated, and as imaginative as possible in order to complete the simple process of breaking a balloon.

3. Explain that the contraption will look like one of Rube Goldberg's cartoons. Rube Goldberg was a Pulitzer Prize winning American cartoonist and sculptor (1883-1970) who created extremely intricate diagrams of contraptions designed to do relatively simple tasks (to awaken someone to deliver a paper, etc.). Show students examples from http://www.rube_goldberg (See Gallery C1) or http://www.rube.iscool.net/ to see actual examples of machines built from drawings.

4. List and discuss the following rules for the project:

    1. no sharp objects
    2. no open flames
    3. no dangerous situations
    4. no external power (including humans)
    5. must fit inside a 3 foot by 3 foot area
    6. must break a balloon (using at least 10 steps)
    7. must break the balloon within 10 minutes from start to pop

5. The teacher will have students tape a 3 foot by 3 foot area on the floor or table.

Continued from page 13

6. The engineer will structure his visit(s) to allow time to guide the process of constructing and experimenting at least 30 minutes per visit. Note: The amount of time spent on the project will depend on the engineer's schedule and building a machine that will pop a balloon.

7. The students can keep a daily log and debrief about the problems the class encountered including, what worked, didn't work, how they solved their problem, where and how they got their ideas, etc. Explain that this activity is much like the job of engineers as they look for ways to solve a problem. Of course, engineers always look for the least complicated solution. Everyone knows much simpler ways to pop a balloon.

Teacher-to-Teacher Notes

1. Remind students that they will be experiencing the process of trial and error while constructing. The contraption must be able to pop a balloon each time it is used therefore they must repeat the process to ensure dependability.

2. This activity idea was borrowed from a program called "Engineer In the Classroom." This program involves engineers visiting the classrooms and a national competition.
E-mail: RxatETC@aol.com.

3. Be sure to establish a plan of controlling the students volume during the construction phase.

4. Plan to thank the engineer for his time in some creative manner. Perhaps students can draw a rube cartoon of an outlandish contraption consisting of at least 5 steps to deliver a Thank You note.

5. Students may want to enter the annual Rube Goldberg contest. (For information, go to http://www.rube.iscool.net/)

Objective

The student is expected to work cooperatively to create a complicated contraption that will pop a balloon.

The student is expected to keep a log reporting what works and doesn't work in solving the problems.

Materials

Space for setting up the class project
Rolls of tape to mark the floor/table
Objects brought by students
Several balloons for trial and error

Technology Utilization

Internet (if desired)

SE - Course

SC 112.7: 5.1 (A)(B), 5.2 (A)(B)(C)(D), 5.3 (A), 5.4 (B)

SE - Cross Curricular

ELA 110.7: 5.1 (A), 5.4 (A), 5.5 (E)
M 111.17: 5.14 (A)(B)(C)(D)

TAAS

SC 1:8.1 (A)(B), 2:8.5 (A)(B)(C)

TAAS II/TAKS

SC 1:5.2 (A)(B)(C)(D)(E), 5.3 (A), 5.4 (A), 3:3.6 (A), 5.5 (A)(B)

Check for Understanding

The teacher will monitor students during the construction.

The teacher may ask students what forms of math or science was used during the construction.

The teacher will monitor the notations made by students in their daily logs. Students are reminded that these notes will help them not to make the same mistakes again. Also the notes will be used for writing their final report.

The teacher may ask the students, "What will you tell the manufacturer to help him/her duplicate this product" (ie. to not make the same mistakes you have made).

Assessment

The group's final contraption that will pop a balloon or just the cooperative skills may be graded.

The students will write a report explaining the process used to build the class contraption including examples of trials and errors made and solutions found. They will conclude their report with what they learned about their work as an "Engineer."

Learning Styles

Concrete Sequential
Abstract Sequential
Concrete Random
Abstract Random

Multiple Intelligences

Body/kinesthetic
Intrapersonal
Verbal/Linguistic
Visual/Spatial
Logical/Mathematical
Interpersonal

Thinking Skills

Engaged
Dynamic

Accommodations

Adapted Assignment
Instructional Support

Extensions

Depth and Rigor
Performance Option

Resource Pages

None