Transportation: Learning on the Move

Developed by: The University of Tennessee, Knoxville
Center For Transportation Research
Funded by: Garrett A. Morgan Transportation and Technology Grant

Contact: Jerry Everett. Ste 309 Conference Bldg, 600 Henley St, Knoxville, TN 37996 (865) 974-8275
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Dr. David Clarke – University of Tennessee
Tammy Enix – University of Tennessee
Dr. Jerry Everett – University of Tennessee
Deanna Flinchum – University of Tennessee
Jeni Folck – Anderson County High School
Donna Poling – Halls Middle School
Dr. Jennifer Richards – University of Tennessee
Kelly Shanton – West Valley Middle School
Lisa Taylor – South Doyle Middle School

Thank you to the 8th grade teams at South Doyle Middle School and Gresham Middle School for pilot testing the curriculum and providing feedback for revisions and improvements:

**South Doyle Middle**
Glinda Blair
Eric Brabson
Lisa Taylor
Tim Watson
Lauren White

**Gresham Middle**
Erin Allen
Michelle Baker
Robin Bell
Jennifer Cochran
Wanda Mash
<table>
<thead>
<tr>
<th>Day</th>
<th>Language Arts</th>
<th>Vocabulary</th>
<th>Math</th>
<th>Science</th>
<th>Social Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOL</td>
<td>Setting the Stage: 10 min</td>
<td>Setting the Stage: 10 min</td>
<td>Setting the Stage: 10 min</td>
<td>Setting the Stage: 10 min</td>
</tr>
<tr>
<td></td>
<td>Objectives</td>
<td>Objectives: 3 min</td>
<td>Objectives: 5 min</td>
<td>Objectives: 5 min</td>
<td>Objectives: 5 min</td>
</tr>
<tr>
<td></td>
<td>Word Splash</td>
<td>Word Matching: 10 min</td>
<td>Airplane Math: 35 min</td>
<td>Children’s Book &amp; Discussion: 35 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semantic Mapping: 25 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tuesday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOL</td>
<td>Review: 10 min</td>
<td>Review: 7 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td>Objectives: 3 min</td>
<td>Contextual: 3 min</td>
<td>Spaghetti Bridge: 45 min</td>
<td>Building Paper Bridges: 45 min</td>
</tr>
<tr>
<td></td>
<td>Supply Chain PPT</td>
<td>Redefinition: 45 min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply Chain Poetry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wednesday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOL</td>
<td>Review: 10 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td>Objectives: 3 min</td>
<td>Journal Entry: 30 min</td>
<td>Finish Bridges: 10 min</td>
<td>Revised Alpha Boxes: 15 min</td>
</tr>
<tr>
<td></td>
<td>Poetry Presentations</td>
<td>Transportation: 35 min</td>
<td></td>
<td>Brainstorming: 10 min</td>
<td>RAFT: 30 min</td>
</tr>
<tr>
<td></td>
<td>Word Splash Essays</td>
<td>Board Game: 35 min</td>
<td></td>
<td>Engineering Process: 25 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thursday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOL</td>
<td>Review: 10 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td>Objectives: 3 min</td>
<td>Journal Entry: 30 min</td>
<td>Finish Bridges: 10 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
<tr>
<td></td>
<td>Theme Park Rides: Background &amp; Setup</td>
<td>Transportation: 35 min</td>
<td></td>
<td>Brainstorming: 10 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
<tr>
<td></td>
<td>Theme Park Rides: Design &amp; Illustration</td>
<td>Board Game: 35 min</td>
<td></td>
<td>Engineering Process: 25 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
<tr>
<td><strong>Friday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOL</td>
<td>Review: 10 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
<td>Review: 5 min</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td>Objectives: 3 min</td>
<td>Journal Entry: 30 min</td>
<td>Finish Bridges: 10 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
<tr>
<td></td>
<td>Theme Park Rides: Presentations</td>
<td>Transportation: 35 min</td>
<td></td>
<td>Brainstorming: 10 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Board Game: 35 min</td>
<td></td>
<td>Engineering Process: 25 min</td>
<td>Future of Transportation: 35 min</td>
</tr>
</tbody>
</table>

**Notes:**
- DOL: Daily Objectives and Learning
- Setting the Stage: Introduction to the day's activities
- Objectives: Specific learning goals
- Modes Cooperative Learning: Group-based learning activities
Language Arts

Summary of Activities:
Setting the Stage
Word Splash
Supply Chain
Graphic Organizer
Supply Chain Poetry
Word Splash
Supply Chain Theme Park Rides

Table of Contents:

Gagne Instructional Design 5
Lesson Plan-Day 1 6
Word Splash Student Handout 8
Lesson Plan-Day 2 9
Supply Chain Graphic Organizer 11
Supply Chain PowerPoint 12
Lesson Plan-Day 3 16
Lesson Plan-Day 4 18
Theme Park Rides Project Guide 20
Lesson Plan-Day 5 21
Lesson Plan-Day 6 23
<table>
<thead>
<tr>
<th>Stage of Instruction</th>
<th>Event</th>
<th>Description</th>
<th>Unit Activity</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Instruction</td>
<td>Gaining Attention</td>
<td>Stimulates readiness to learn and participate. Stimuli like surprises or questions are typically used for this event.</td>
<td>Items From Home</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Informing learners of the objectives</td>
<td>Generates expectancy by helping them understand what they will be learning</td>
<td>Objectives</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Stimulating recall of prior learning</td>
<td>Relating new information to something they already know or have experienced helps learners make sense of the lesson</td>
<td>Word Splash</td>
<td>Day 1</td>
</tr>
<tr>
<td>Instruction</td>
<td>Presenting the stimulus</td>
<td>New information is presented. Strategies like providing examples or presenting vocabulary should be used to present the lesson content to provide more effective instruction</td>
<td>Supply Chain</td>
<td>Day 2</td>
</tr>
<tr>
<td></td>
<td>Providing learning guidance</td>
<td>Helps facilitate the process of long-term information storage</td>
<td>Graphic Organizer</td>
<td>Day 2</td>
</tr>
<tr>
<td></td>
<td>Eliciting performance</td>
<td>Requires the learner to practice the new skill or behavior. The repetition further increases the likelihood of retention of the new information</td>
<td>Poetry</td>
<td>Day 2/Day3</td>
</tr>
<tr>
<td>Post-Instruction</td>
<td>Providing feedback</td>
<td>Assess and further facilitate learning. Typically, activities designed for feedback are for comprehension, not scoring</td>
<td>Poetry</td>
<td>Day 3</td>
</tr>
<tr>
<td></td>
<td>Assessing performance</td>
<td>To evaluate the effectiveness of the instructional events, you must test to see if the expected learning outcomes have been achieved</td>
<td>Word Splash</td>
<td>Day 3</td>
</tr>
<tr>
<td></td>
<td>Enhancing retention and transfer</td>
<td>Helps learners develop expertise by internalizing the new information. Methods for helping learners internalize are paraphrasing, generating examples, creating concept maps or outlines, and repetition</td>
<td>Theme Park Rides</td>
<td>Days 4/5/6</td>
</tr>
</tbody>
</table>
DOL, Setting the Stage, Objectives, Word Splash, Gain Attention, Inform Learners of Objectives, Stimulate Prior Recall

Word Splash

How does transportation impact my daily life?
What roles do different modes of transportation play in moving goods and people?

1. Give examples of the connections that exist between their daily lives and transportation.
2. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.

GLE 0801.2.1
SPI 0801.1.10

1. Identifying Similarities and Differences
2. Nonlinguistic Representation
3. Cues, Questions, and Advance Organizers

Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

transportation is the movement of people or goods from place to place

types of transportation include the following modes: car, motorcycle, train, boat, and airplane

• Allow students 3-5 minutes to correct the sentences individually, then lead a class discussion on the corrections:
  o Transportation is the movement of people or goods from place to place.
  o Types of transportation include the following modes: car, motorcycle, train, boat, and airplane.

Purpose: To capture attention and prepare students to learn and participate.

• Write the following question on the board or overhead: What is the one item at home that you use every day and couldn’t live without? What store did that item come from?
• Ask students to write down their responses to the question. Allow 3-5 minutes for students to do so.

• Ask each student to share their item with the class, record these responses on the board.

• As a class classify these items into three categories: Items made in TN (underline these), Items made outside of TN, but probably in the US (star these), and Items probably made in other countries (circle these).

• Pose the following questions for discussion:
  o How did your item get from where it was made to where you bought it?
  o What modes of transportation do you think were used to transport your item?

Purpose: To help students understand what they are responsible for learning.

Tell students, “Through the course of this unit, we are going to study transportation, its impact on our daily lives, and how different modes of transportation help us move people, goods, and ideas from place to place.”

Purpose: To familiarize students with new words, activate prior knowledge, and provide a guide to the concepts they will learn in this lesson.

• Distribute one copy of the handout “Word Splash” to each student.

• Ask students, “What is the supply chain?”

• Encourage students to share their ideas, then remind them that the supply chain is the network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the production, delivery, and sale of a particular product.

• Ask students to read each word and think about how that word is related to the supply chain.

• Working in pairs or individually, students should then write at least 5 prediction statements describing how they think a word relates to the supply chain. Have them underline words used from the Word Splash.

• Ask students to volunteer to share some of their predictions with the class. Remind students that they will use the words on the Word Splash later in the unit.
Each of the words above relates to the supply chain in some way. Choose five words and predict how each word is related to the supply chain.

Student Predictions:

Now that you’ve learned about the supply chain, use each of the words above in a paragraph that explains the supply chain. Use the back of this page if you need more space. Underline each word from the Word Splash in your paragraph.
Unit Activities: DOL, Supply Chain Presentation, Poetry

Instructional Events: Present the Content, Provide Learner Guidance, Elicit Performance

Materials: Supply Chain PowerPoint, construction paper, markers

Student Handouts: Supply Chain Graphic Organizer

Essential Question: How does transportation impact my daily life?

What roles do different modes of transportation play in moving goods and people?

Procedures

Daily Oral Language (10 minutes)

Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

**most large citys in the united states are design on a grid system straight roads and four way intersections are designed to help traffic move easily**

**older citys in other countrys that were established hundreds of years ago have short narrow roads that can make car travel difficult these streets was designed for people on foot or horseback before cars was invented**

- Allow students 3-5 minutes to correct the sentences individually then lead a class discussion on the corrections:
  - **Most large cities in the United States are designed on a grid system; straight roads and four-way intersections are designed to help traffic move easily.**
  - **Older cities in other countries that were established hundreds of years ago have short, narrow roads that can make car travel difficult. These streets were designed for people on foot or horseback before cars were invented.**

Learning Objectives:

1. Give examples of the connections that exist between their daily lives and transportation.

2. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.

Tennessee Standards:

GLE 0801.2.7

GLS0801.3.1

Marzano's Instructional Strategies

1. Cues, Questions, and Advance Organizers
Yesterday, we looked at different modes of transportation. Who can name one mode? What modes of transportation did you use to get to school this morning? Today, we are going to learn about the supply chain and how goods get from where they were produced to our local stores.

**Purpose:** To provide new information to students and facilitate the transfer of new knowledge to long-term retention and determine what students have learned from the activities in this lesson so far.

- Explain to students that in this presentation, they will learn about the supply chain.
- Distribute a copy of the handout “The Supply Chain Graphic Organizer” to each student. Instruct students to focus on filling in each step of the supply chain as they listen to the presentation.
- Use the PowerPoint presentation “The Supply Chain”.
- As you give the presentation, periodically stop to make sure that students are keeping up on their graphic organizers.

**Purpose:** To allow the learner to practice the new knowledge and assess and facilitate further student learning. The repetition further increases the likelihood of retention of the new information.

- To demonstrate mastery of the supply chain, students will use their new knowledge of the supply chain to write poetry.
- Students can write their poems in one of two formats:
  - They may create an acrostic poem using the word “TRANSPORTATION.”
    - Each letter of the word becomes the first letter of a word or phrase that summarizes what they learned about the supply chain.
  - They may create a Haiku about the supply chain demonstrating what they learned and then have them illustrate the haiku.
    - Haikus are three line poems with the syllable pattern of 5, 7, 5. The lines do not have to rhyme.
- Students should illustrate their poems.
- Students may finish poems for homework. Remind students they will present their poems in class tomorrow.
So, you want to buy a TV?
The Supply Chain

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Step 6:

Step 7:

Step 8:

Step 9:

TV available for purchase

Other Notes:
Following The Supply Chain
Also known as
Getting Stuff From Place To Place

It's NOT as easy as you think...

So you would like to buy a new television and WalMart has one on sale.

Simple enough, right?

HOW does the television GET from the manufacturer in Japan to your local WalMart?

Step 1: The television is loaded into a shipping container. One shipping container can hold hundreds of boxes!

Step 2: Then containers are loaded onto a ship.
Containers are designed to stack securely to each other.

Containers have to be secure for their long trip across the ocean.

Step 3: The containers are shipped across the ocean.

Step 4: When the containers reach a U.S. port, they are unloaded and sorted.

Many containers from Japan arrive in the U.S. at Long Beach, CA.

Step 5: They are then loaded onto trains or trucks.
Train: can move hundreds of containers quickly. These containers could contain hundreds of televisions or other consumer goods.

Step 5: Boxes are unloaded at distribution centers, sorted, and loaded onto individual trucks.

Step 6: Containers are transferred from rail cars to trucks.

Step 7: Most stores operate on the “Just in time” model. That means that they expect goods to arrive just as they are needed. They do not want to store extra goods because it ties up money in products that may not sell for a while.

Step 8: Trucks move all sorts of products to stores.

Step 9: Stores unpack all of the boxes and display items for sale.
Your new television is FINALLY available for purchase!

Did you have ANY idea that getting one item from place to place was THAT complicated??????

Luckily, the supply chain works well most of the time.

Can you list some of the jobs that people have to do properly in order to move goods from place to place?

What happens if even one person along the way doesn’t complete their job?

What can happen to disrupt the supply chain?
Unit Activities:
- DOL, Supply Chain Poetry, Word Splash
- Providing Feedback, Assessing Performance

Instructional Events:
- Word Splash

Materials:

Student Handouts:

Essential Question:
1. How does transportation impact my daily life?
2. What roles do different modes of transportation play in moving goods and people?

Learning Objectives:

Tennessee Standards:
- GLE 0801.2.7
- GLS0801.3.1

Marzano’s Instructional Strategies:
1. Summarizing and Note Taking
2. Nonlinguistic Representation

Procedures

Daily Oral Language (10 minutes)

Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

**Without transportation and trade we would not be able to get chocolate which is made from imported cocoa or coffee which is grown in South America and Africa**

**The United States export send to other countries many different product including soybeans cotton dairy products and machines**

- Allow students 3-5 minutes to correct the sentences individually then lead a class discussion on the corrections:
  - **Without transportation and trade, we would not be able to get chocolate, which is made from imported cocoa, or coffee grown in South America and Africa!**
  - **The United States exports (sends to other countries) many different products including soybeans, cotton, dairy products, and machines.**
Yesterday, we wrote poems about the supply chain. Did any of you talk about the supply chain with your parents yesterday? Today, we are going to present your poems and review what you’ve learned so far.

Purpose: To assess and facilitate further student learning.

- Ask students to share their poems with the class as a means of providing immediate reinforcement of new concepts.
- Display students’ poems and artwork around the room or in the hall.

Purpose: To determine if students are successfully meeting the learning objectives for this lesson.

- Ask students to refer back to the Word Splash predictions they made on Day 1.
- Instruct students to use their new knowledge of the supply chain to use all of the words in the Word Splash to write a paragraph describing the supply chain.
- Ask students to underline each word they use from the Word Splash.
### Learning Objectives:
1. Give examples of the connections that exist between their daily lives and transportation.
2. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.

### Tennessee Standards:
- GLE 0801.7.1
- GLE 0801.7.3

### Marzano's Instructional Strategies
1. Nonlinguistic Representation
2. Cooperative Learning

### Procedures
**Daily Oral Language (10 minutes)**

Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

- **in 1902 in the u.s. there were 17 million horses used for travel and 23,000 cars**
- **people could also travel on railroad passenger trains which offered dining cars and sleeping compartments for overnight trips this type of travel is still available today on amtrak a national rail system**

- Allow students 3-5 minutes to correct the sentences individually then lead a class discussion on the corrections:
  - **In 1902 in the U.S., there were 17 million horses used for travel and 23,000 cars.**
  - **People could also travel on railroad passenger trains which offered dining cars and sleeping compartments for overnight trips. This type of travel is still available today on Amtrak, a national rail system.**
Yesterday, we shared our supply chain poetry. What was the hardest part about writing the poems? Today, we are going to begin working on a new project that will showcase your knowledge of the supply chain.

Purpose: To determine if students are successfully meeting the learning objectives for this lesson.

- Show students some theme park web sites or brochures and notice the descriptive words used to describe rides. Students should keep a list of these words on a sheet of paper.
  - http://www.kidiamondback.com/
- Ask students about the things they see and hear while standing in line at theme parks. Lots of time and money goes into designing a complete package, not just the ride itself! These include the sounds people hear, posters and images on the walls, etc.
- Show students some of the marketing materials used to promote new rides at theme parks. Ask students to begin to make a list of the descriptive words they hear.
- As a class, make a list of these words on the board so students can refer back to these later.
- Assign students to groups of 3-4 and distribute a copy of the Theme Park Rides Project Guide to each student.
- Carefully discuss expectations of the project and how students will be assessed.
- Each group will be responsible for creating a marketing campaign for a new theme park ride that captures some aspect of the supply chain.
- The goal for this project is to have the riders feel as if they are part of the supply chain in some way.
- Students’ goal for this class period is to design the ride. Students should submit their drafts of the ride, including the name, part of the supply chain the ride represents, and a rough sketch of the ride.
Theme Park Rides Project Guide

Your team has been hired to develop a brand new theme park ride that makes your customers feel like they are part of the supply chain. You may design any type of ride you wish: roller coaster, water ride, kiddie ride, etc. As part of this project, you will need to develop marketing materials for your theme park rides. These marketing materials include: a paragraph that promotes the ride through vivid language that will attract customers, decorations for customers to read while waiting in line, any music or sounds that will be playing in line or during the ride, and exhibits or displays that will attract people to your ride, etc.

Your project will be evaluated as follows:

0 2 4 6 8 10 You design a theme park ride that recreates some aspect of the supply chain.

0 2 4 6 8 10 There is a direct relationship between your ride and the supply chain.

0 2 4 6 8 10 You write a descriptive paragraph that describes your theme park ride using vivid language.

0 2 4 6 8 10 Your descriptive paragraph describes the ride in a manner that will attract customers and that is free from spelling and grammar errors.

0 2 4 6 8 10 You create marketing materials to attract customers to your ride. Your materials use rich, descriptive language that paints a mental picture of the experience your ride provides.

0 2 4 6 8 10 You create supplemental materials (posters, exhibits, displays, sounds, etc.) for your customers to enjoy while waiting in line. These materials are directly related to the theme or your ride and the supply chain.

0 2 4 6 8 10 You create appropriate ambience materials to allow your customers to feel like they are part of the supply chain.

0 2 4 6 8 10 All of your materials are free from spelling and grammar errors.

0 2 4 6 8 10 Your materials are neat, easy to read, and demonstrate an appropriate level of effort and creativity.

0 2 4 6 8 10 Each member of your group contributes equally to the final product.

TOTAL: /100 points
1. Give examples of the connections that exist between their daily lives and transportation.

2. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.

GLE 0801.3.1

SPI0801.3.8

1. Nonlinguistic Representation

2. Cooperative Learning

Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

**Henry Ford produced the first popular American car on an assembly line in Michigan. Ford and other manufacturers began to make standard car parts that could be purchased anywhere so drivers could make repairs.**

**As more people bought cars, families traveled outside their communities and businesses such as motels, restaurants, and gas stations were built.**

- Allow students 3-5 minutes to correct the sentences individually then lead a class discussion on the corrections:
  - Henry Ford produced the first popular American car on an assembly line in Michigan. Ford and other manufacturers began to make standard car parts that could be purchased anywhere so that drivers could make their own repairs.
  - As more people bought cars, families traveled outside their communities, and businesses such as motels, restaurants, and gas stations were built.
Yesterday, you began designing a theme park ride about some part of the supply chain. What are some good descriptive words that you’ve identified to use in your supplemental and marketing materials? Today, you will continue working in your groups to finish producing your materials.

- Students must develop the supplementary materials that will accompany the ride.
  - This includes the posters, exhibits around the ride, sounds, music, etc., that customers will encounter as they wait in line, experience the ride, and exit.
- Allow students to continue working in their groups to create the marketing products.
- Encourage students to use strong descriptive words in their writing and to be sure that their supplementary materials shows off their knowledge of the supply chain and is persuasive to consumers.
- Remind students that their products must be ready for presentations at the beginning of class on tomorrow.
- Circulate among groups to answer questions and help troubleshoot.
Post the following sentences on the board and instruct students to correct the spelling, grammar, and punctuation mistakes:

**the development of interstates allow people to travel more freely and safely however the new highways diverted traffic from small towns and many establishments went out of business**

**beginning in the 1960s and continuing through today people can travel almost anywhere on airplanes**

- Allow students 3-5 minutes to correct the sentences individually then lead a class discussion on the corrections:
  - *The development of interstates allowed people to travel more freely and safely; however, the new highways diverted traffic from small towns and many establishments went out of business.*
  - *Beginning in the 1960’s and continuing through today, people can travel almost anywhere on airplanes.*
Yesterday, you continued working with your teams to develop your theme park rides’ supplemental materials. What are you enjoying most about this project? Today you will finish your materials and present them to the class.

- Allow students to continue working in their groups to create the marketing products.
  - Marketing materials include brochures, layouts for a website, radio ads, etc.
- Encourage students to use strong descriptive words in their writing and to be sure that their supplementary materials shows off their knowledge of the supply chain and is persuasive to consumers.
- Circulate among groups to answer questions and help troubleshoot.
- Use the project scoring guide to evaluate students’ products and presentations.
## Vocabulary

### Summary of Vocabulary Activities:
- Setting the Stage
- Vocabulary Cards
- Semantic Mapping
- Contextual Redefinition
- Journal Entries
- Creating Board Games

<table>
<thead>
<tr>
<th>Table of Contents:</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gagne Instructional Design</td>
<td>26</td>
</tr>
<tr>
<td>Lesson Plan-Day 1</td>
<td>27</td>
</tr>
<tr>
<td>Vocabulary Cards</td>
<td>30</td>
</tr>
<tr>
<td>Lesson Plan-Day 2</td>
<td>32</td>
</tr>
<tr>
<td>Lesson Plan-Day 3</td>
<td>35</td>
</tr>
<tr>
<td>Journal Entry #1</td>
<td>37</td>
</tr>
<tr>
<td>Board Game Project Guide</td>
<td>38</td>
</tr>
<tr>
<td>Lesson Plan-Day 4</td>
<td>39</td>
</tr>
<tr>
<td>Journal Entry #2</td>
<td>41</td>
</tr>
<tr>
<td>Lesson Plan-Day 5</td>
<td>42</td>
</tr>
<tr>
<td>Journal Entry #3</td>
<td>44</td>
</tr>
<tr>
<td>Lesson Plan-Day 6</td>
<td>45</td>
</tr>
<tr>
<td>Journal Entry #4</td>
<td>47</td>
</tr>
<tr>
<td>Board Game Peer Scoring Guide</td>
<td>48</td>
</tr>
</tbody>
</table>
# Robert Gagne’s Nine Events of Effective Instruction

<table>
<thead>
<tr>
<th>Stage of Instruction</th>
<th>Event</th>
<th>Description</th>
<th>Unit Activity</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Instruction</td>
<td>Gaining Attention</td>
<td>Stimulates readiness to learn and participate. Stimuli like surprises or questions are typically used for this event.</td>
<td>Semantic Mapping</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Informing learners of the objectives</td>
<td>Generates expectancy by helping them understand what they will be learning</td>
<td>Inform Learners of the Objectives</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Stimulating recall of prior learning</td>
<td>Relating new information to something they already know or have experienced helps learners make sense of the lesson</td>
<td>Contextual Redefinition</td>
<td>Day 2</td>
</tr>
<tr>
<td>Instruction</td>
<td>Presenting the stimulus</td>
<td>New information is presented. Strategies like providing examples or presenting vocabulary should be used to present the lesson content to provide more effective instruction</td>
<td>Journals Entries</td>
<td>Days 3/4/5/6</td>
</tr>
<tr>
<td></td>
<td>Providing learning guidance</td>
<td>Helps facilitate the process of long-term information storage</td>
<td>Comprehension Questions</td>
<td>Days 3/4/5/6</td>
</tr>
<tr>
<td></td>
<td>Eliciting performance</td>
<td>Requires the learner to practice the new skill or behavior. The repetition further increases the likelihood of retention of the new information</td>
<td>Develop a Board Game</td>
<td>Day 3/Day 4</td>
</tr>
<tr>
<td>Post-Instruction</td>
<td>Providing feedback</td>
<td>Assess and further facilitate learning. Typically, activities designed for feedback are for comprehension, not scoring</td>
<td>Develop a Board Game</td>
<td>Day 3/Day 4</td>
</tr>
<tr>
<td></td>
<td>Assessing performance</td>
<td>To evaluate the effectiveness of the instructional events, you must test to see if the expected learning outcomes have been achieved</td>
<td>Play Testing</td>
<td>Day 5</td>
</tr>
<tr>
<td></td>
<td>Enhancing retention and transfer</td>
<td>Helps learners develop expertise by internalizing the new information. Methods for helping learners internalize are paraphrasing, generating examples, creating concept maps or outlines, and repetition</td>
<td>Play Others Games/Peer Review</td>
<td>Day 6</td>
</tr>
</tbody>
</table>
### Vocabulary - Day 1

<table>
<thead>
<tr>
<th>Unit Activities:</th>
<th>Setting the Stage, Vocabulary Matching, Semantic Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional Events:</strong></td>
<td>Gain Attention, Inform Learners of the Objectives, Stimulate Recall of Prior Learning.</td>
</tr>
<tr>
<td><strong>Materials and Supplies:</strong></td>
<td>Vocabulary Cards</td>
</tr>
<tr>
<td><strong>Essential Question:</strong></td>
<td>How does transportation impact my daily life?</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
<td>Students will be able to:</td>
</tr>
<tr>
<td><strong>Setting the Stage (10 minutes)</strong></td>
<td>1. Identify words associated with transportation.</td>
</tr>
<tr>
<td><strong>Inform Learners of the Objectives (3 minutes)</strong></td>
<td>2. Correctly match vocabulary words to their definitions.</td>
</tr>
</tbody>
</table>

**Purpose:** To capture attention and prepare students to learn and participate.

Ask students, “**How does transportation affect your daily life?**” Allow students to answer this question on their own paper for 2-3 minutes. Allow students to share their responses with the class.

**Purpose:** To help students understand what they are responsible for learning.

- Tell students: **Today we are going to become more familiar with some transportation vocabulary that you will be using in your other classes this week.**

**Tennessee Standards:**

0801.1.14

**Marzano’s Instructional Strategies:**

1. Identifying Similarities and Differences
Purpose: To familiarize students with new words, activate prior knowledge, and provide a guide to the concepts they will learn in this lesson.

- Prior to class, prepare vocabulary cards (see page 30-31). Using index cards, write the vocabulary word on one card and the definition on a separate card.
- Provide each student with one card. Students will have either a vocabulary card or a definition card.
- Students will walk around to find the student with the matching word or definition for the card they have.
- When students are in pairs, check for understanding. Have students share their vocabulary words and definitions with the class to ensure accuracy.

Purpose: To allow students to organize their prior knowledge of transportation and terms associated with transportation.

As a class, create a semantic map using the word transportation.

- Write the word **transportation** on the board.
- As students brainstorm words associated with transportation, record their responses on the board. All ideas are accepted.

Example:
• Working in groups of 2 or 3, have students group the words into categories based on their prior knowledge of relationships and associations.

• Remind students that they are responsible for coming up with their own categories.

• Students should be able to justify why they placed each item in each category.

Example:

- After students have completed their semantic maps, encourage them to share their classifications with the class.
Any winged vehicle capable of flight, generally heavier than air and driven by jet engines or propellers.  

A passenger vehicle that usually has four wheels and an internal combustion engine, used for land transport.  

A large vessel for deep-water navigation.  

The freight carried by a ship, an aircraft, or another vehicle.  

A structure spanning and providing passage over a gap or barrier, such as a river or roadway.  

A ship fitted for transporting containerized cargo.  

An individual who buys products or services for personal use and not for manufacturing or resale.  

A power-driven ship employed in commercial transport on the oceans and large inland bodies of water such as the Great Lakes.  

A series of connected railroad cars pulled or pushed by one or more locomotives.
The network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the sale, delivery, and production of a particular product.

A system of highways extending between the major cities of the 48 contiguous states.

A road, course, or way for travel from one place to another. A customary line of travel.

Relating to transportation by more than one means of movement, as by truck or rail.

A detailed list of goods shipped or services rendered, with an account of all costs: an itemized bill.

A long, large, flatbottom boat for transporting freight.

A manner, way or method of moving goods or people from one place to another.
### Procedures

**Review (7 minutes)**

**Purpose:** To capture attention and prepare students to learn and participate

Displayed on board as students enter the room: **What are some words related to transportation that you already know?**

- Ask students to write down their response to the question. Allow 3-5 minutes for students to do so.
- Allow students to share their responses with the class.
- Encourage students to explain or guess what they think the words mean.

**Purpose:** To help students understand what they are responsible for learning.

- Tell students: “Today we are going to become more familiar with the transportation vocabulary that you will be using in your other classes this week.”

---

### Essential Question:

How does transportation impact my daily life?

### Contextual Redefinition

<table>
<thead>
<tr>
<th>Learning Objectives:</th>
<th>Tennessee Standards:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform Learners of the Objectives, Stimulate Recall of Prior Learning.</td>
<td>0801.1.2</td>
</tr>
<tr>
<td>None</td>
<td>0801.1.14</td>
</tr>
</tbody>
</table>

### Unit Activities:

<table>
<thead>
<tr>
<th>Instructional Events:</th>
<th>Materials and Supplies:</th>
<th>Marzano’s Instructional Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inform Learners of the Objectives (3 minutes)</td>
<td>None</td>
<td>1. Cues, Questions, and Advance Organizers</td>
</tr>
</tbody>
</table>

### Vocabulary - Day 2

1. Predict and revise definitions of words based on context clues.

<table>
<thead>
<tr>
<th>0801.1.2</th>
<th>0801.1.14</th>
</tr>
</thead>
</table>

---

32
Purpose: To familiarize students with new words, activate prior knowledge, and provide a guide to the concepts they will learn in this unit.

- Display the following six words on the board or overhead: transportation, infrastructure, route, engineer, goods, supply chain, mode.
- For each word, ask students to write a brief definition based on what they think the word means.
- Allow students to share their predictions with the class.
- Display the following sentences in which each of the words used in proper context.
  - Mark was responsible for the transportation of materials from the supplier to the building site.
  - The earthquake damaged the cities' infrastructure.
  - After studying the map, they decided on the best route to take.
  - Mary enjoys designing things and hopes to become an engineer.
  - Goods will be delivered to the store every week.
  - Since trucks cannot travel due to the heavy snow, the supply chain has been interrupted.
  - Which mode of transportation will you be taking to Europe?
- As students read each word in correct context ask them use the context clues to revise their earlier definitions of each word.
- Again ask students to share their new definitions with the class.
• Finally, display the actual definitions of each word:
  - **Transportation**: The business of carrying or moving goods and people.
  - **Infrastructure**: The basic physical and organizational structures needed for the operation of a society or business.
  - **Route**: A way, such as a road, by which persons travel or by which goods are shipped or delivered.
  - **Engineer**: A person who is trained in the use or design of machines or engines, or in other areas such as electrical or chemical technology.
  - **Goods**: Products or merchandise that are manufactured for sale to consumers.
  - **Supply Chain**: The network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the sale, delivery, and production of a particular product.
  - **Mode**: A manner, way or method of moving goods or people from one place to another.

• Ask students to record the correct definition in their notebooks.

• Lead a brief discussion with students on how their definitions changed from their first guesses, after the contextual sentences, and with the final definitions.
Journal Entry 1, Transportation Board Games

Elicit Performance

Construction Paper, Scissors, Glue, Tape

Board Games Project Guide

What types of careers are available in transportation?

What roles do different modes of transportation play in moving goods and people?

1. Demonstrate understanding of vocabulary words.

2. Demonstrate understanding of careers in the transportation field.

GLE 0801.2.7

GLS0801.3.1

1. Cooperative Learning

Daily Review Question: Yesterday we learned some transportation vocabulary that you will be using this week. Did any of you use this vocabulary in other classes or at home yesterday? Today we are going to complete a journal entry about engineers and create a board game about transportation.

Purpose: To provide new information to students.

- There are four journal entries with supporting questions.
- Each day, allow students to read one entry and answer the subsequent questions.
- After students have completed the questions, discuss the answers as a group.
**Activities:**

**Elicit Performance:** Designing Transportation Board Games (35 minutes)

Purpose: To allow the learner to practice the new knowledge and assess and facilitate further student learning. The repetition further increases the likelihood of retention of the new information.

- Assign students to pairs or groups of three.
- Tell students that they will be working with their groups to create transportation board games. Groups will have three class periods to design, create, and play test their board games.
- Each game should include at least 3 vocabulary words covered in the contextual redefinition lesson and at least 2 careers associated with transportation.
- Discuss the Vocabulary Board Game Project Guide with students. Groups must also prepare clear, step-by-step written instructions and rules to explain how to play their game.
- Provide students with construction paper, scissors, tape, glue, and any other materials necessary.
- Encourage students to play-test their game several times to make sure they’ve worked out all the bugs. They will need to revise their instructions and rules as they encounter and solve problems with their game designs.
- As students begin working in groups, circulate to answer questions and help students troubleshoot.
Journal Entry #1
Urban and Regional Planners

Urban and regional planners promote the best use of a community’s land and resources. The larger the transportation system and the more complex its interactions with other systems, the more important the planning becomes.

Many issues need to be addressed before work on a new transportation system begins, including traffic congestion, air pollution, and the potential effects of population growth and change. Planners are essential to integrating transportation systems with each other, incorporating the systems into the environments where they are being built, and helping communities prepare for their current and future transportation requirements.

Planners are involved in all kinds of activities, from projecting costs to drafting legislation. They develop and examine long and short-term plans that provide for growth and revitalization of urban, suburban and rural communities, and they help local officials make decisions on social, economic, and environmental problems.

Planners often meet with land developers and ensure that builders and developers follow zoning codes, building codes, and environmental regulations. Planners prepare materials for community relations programs, speak at civic meetings, and appear before legislative committees and elected officials to explain and defend their proposals. If you become a planner, your work could include a combination of these or similar activities.

Answer the following questions in your journal:
1. What are some issues planners work on before beginning a new transportation system?
2. Why is a planner’s job so important?
3. How is a planner involved with the transportation industry?
4. There are many things involved in a planner’s job. Name at least 4 things a planner may do at work.
5. Do you think you would like to be a planner? Why or why not.

Board Game Project Guide

To show your understanding of the vocabulary words for this unit, your group will design and create a board game that teaches about transportation. You will need to create the game, all the pieces, and step-by-step instructions that describe how to play the game.

Your project will be evaluated as follows:

0 2 4 6 8 10 You design a board game which uses at least 3 vocabulary words.

0 2 4 6 8 10 Your game teaches the definition of the vocabulary words in some way.

0 2 4 6 8 10 Your game addresses at least 2 careers in the transportation field in some way.

0 2 4 6 8 10 You write clear game instructions that teach others how to play the game.

0 2 4 6 8 10 Your instructions are free from spelling and grammar errors.

0 2 4 6 8 10 Your instructions are easy to follow and make sense.

0 2 4 6 8 10 You create all the game pieces and materials necessary to play your game.

0 2 4 6 8 10 All of your game pieces and materials are free from spelling and grammar errors.

0 2 4 6 8 10 Your game materials are neat, easy to read, and demonstrate an appropriate level of effort and creativity.

0 2 4 6 8 10 Your group worked well together and made good use of class time.

TOTAL: /100 points

Comments:
Journal Entry 2, Vocabulary Board Games (continued)

Elicit Performance

Construction Paper, Scissors, Glue, Tape

Board Game Project Guide

What types of careers are available in transportation?

What roles do different modes of transportation play in moving goods and people?

1. Demonstrate understanding of vocabulary words.

2. Demonstrate understanding of careers in the transportation field.

GLE 0801.2.7

GLS0801.3.1

1. Cooperative Learning

Daily Review Question: *Yesterday we started creating transportation board games. Did any of you think about transportation in a different way, such as how an item got to your home? Did you find it difficult or easy to come up with an idea for your game? Today we are going to continue working in groups to make our games.*

**Purpose:** To provide new information to students

- Assign students the second journal entry with supporting questions.
- Ask students to read the journal entry and respond to the questions in their notebooks.
- After students have completed the questions discuss their answers as a group.
**Activities:**

**Elicit Performance:**

**Building Transportation Board Games (35 minutes)**

**Vocabulary - Day 4 Continued**

*Purpose:* To allow the learner to practice the new knowledge and assess and facilitate further student learning. The repetition further increases the likelihood of retention of the new information.

- Remind students that each game should include at least 3 vocabulary words covered in the contextual redefinition lesson and at least 2 careers associated with transportation.
- Remind students they must prepare clear, step-by-step written instructions and rules to explain how to play their game.
- Provide students with construction paper, scissors, tape, glue, and any other materials necessary.
- Encourage students to play-test their game several times to make sure they’ve worked out all the bugs. They will need to revise their instructions and rules as they encounter and solve problems with their game designs.
- As students begin working in groups, circulate to answer questions and help students troubleshoot.
Journal Entry #2

Engineers

Engineers use the theories and principles of science and mathematics to solve practical technical problems. Engineers design machinery, products, systems and processes for efficient and economical performance. Many engineers work at laboratories, industrial plants, or construction sites where they inspect, supervise, or solve on-site problems. If you are especially strong in math and science, you may want to consider a career as an engineer. The type of engineer you become will depend on the kinds of problems you want to solve.

- Aerospace engineers design, develop, test, and help manufacture commercial and military aircraft, missiles, and spacecraft.
- Chemical engineers use the principles of chemistry and engineering to solve problems involving the production or use of chemicals.
- Civil engineers work in the oldest branch of engineering. They design and supervise the construction of roads, airports, railroad tracks, tunnels, bridges, water supply and sewage systems, and buildings.
- Electrical and electronic engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment.
- Industrial engineers determine the most effective ways for organization to use the basic factors of production – people, machines, materials, information, and energy – to make or process a product.

Answer the following questions in your journal:
1. Name some places engineers may work.
2. What are some problems engineers may solve.
3. How is the engineering field a part of transportation?
4. Which type of engineering most interests you? What type of work does this engineer do?

Daily Review Question: Yesterday we continued working on transportation board games. What have you enjoyed about designing your games? Today we are going to continue working in groups to finish and play-test your games.

Purpose: To provide new information to students.

- Assign students the third journal entry.
- Ask students to read the journal entry and respond to the questions in their notebook.
- After students have completed the questions, discuss the answers as a group.
Purpose: To assess and facilitate further student learning.

As students playtest their games:

• Remind students that each game should include at least 3 vocabulary words covered in the contextual redefinition lesson and at least 2 careers associated with transportation.

• Remind students they must prepare clear, step-by-step written instructions and rules to explain how to play their game.

• They will need to revise their instructions and rules as they encounter any problems with their game designs.

• As students begin working in groups, circulate to answer questions and help students troubleshoot.
Journal Entry #3

Logistics

The term “logistics” may not be familiar to you, but the function is something that you benefit from every day. All the activities involved in moving an item – from the place where its raw materials are located, to the place where it was made or grown, to the place where it is used or consumed – can be described under the broad terms “logistics” or “distribution.”

People in a variety of logistics careers are responsible for getting the right products to the right places at the right time in good condition and at a reasonable cost. Managers who work in this industry are generally referred to as logistics managers. Logistics managers are involved in all phases of product distribution, from manufacturing to packaging, shipping, and sales to the end customer.

Because of the logistics process, there is fresh food in your local grocery store, regardless of the season. Next fall’s fashions are available in the summer – in time for you to do your back-to-school shopping. When you have a flat tire, you can replace it almost immediately, regardless of size requirements, and you will be able to buy it for a reasonable price. In fact, Americans can usually find most products they need when they need them without being overcharged because of the efforts of the many people in logistics careers.

Answer the following questions in your journal:
1. What is logistics?
2. What are some areas logistics managers are involved in?
3. How does logistics field help us everyday?
4. Do you think you would be interested in a career as a logistics manager? Why or why not.

Journal Entry 4, Vocabulary Board Games (continued)

Provide Feedback

Student Created Board Games

Board Game Peer Scoring Guide

What types of careers are available in transportation?

What roles do different modes of transportation play in moving goods and people?

1. Demonstrate understanding of vocabulary words.

2. Demonstrate understanding of careers in the transportation field.

GLE 0801.2.7

GLS0801.3.1

1. Cooperative Learning

Purpose: To provide new information to students.

- Assign students the fourth journal entry.
- Ask students to read the journal entry and respond to the questions in their notebook.
- After students have completed the questions discuss the answers as a group.

Daily Review Question: Yesterday you put the finishing touches on your board games. What questions do you have before you begin play testing other groups’ games? Today you will work with your group to play and assess other groups’ games.
Activities:

Enhancing and Retention and Transfer: Playing Board Games (35 minutes)

Purpose: To allow students to develop expertise with their new information and create a construct for transferring knowledge to long-term retention.

- In their design groups, have students exchange games with another group. Have them play the other group’s game and complete the Peer Scoring Guide.
- Remind students to make sure the game they are critiquing includes at least 3 vocabulary words and at least 2 careers that are associated with transportation.
- Encourage students to make sure the game they are playing has easy to read, clear instructions and rules.
- As students are playing, circulate to answer questions and help troubleshoot.
- If time permits, allow each group to exchange with another group. Students should also evaluate this group’s game.
Journal Entry #4  
Air Traffic Controllers

Air traffic controllers coordinate the movement of air traffic to make certain that planes stay a safe distance apart. Their immediate concern is safety, but controllers must also direct planes efficiently to reduce delays.

Air traffic controllers sit at consoles with green-glowing screens that display radar images generated by a computer. Although airport tower or terminal controllers watch over all planes traveling through the airport’s airspace, their main responsibility is to control the flow of aircraft in and out of the airport. Before the pilot can take off, he/she must get permission from the airport control tower.

Relying on radar and visual observation, air traffic controllers closely watch each airplane to ensure that a safe distance is maintained between all aircraft and to guide pilots between the hangar or ramp and the end of the airport’s airspace. During arrival or departure, several controllers handle each plane. As a plane approaches an airport, the pilot radios ahead to inform the terminal of its presence.

The controller in the radar room just beneath the control tower has a copy of the plane’s flight plan and has already observed the lane on radar. If the way is clear, the controller directs the pilot to a runway; if the airport is busy, the plane is fitted into a traffic pattern with other aircraft waiting to land. Once the plane has landed, a ground controller in the tower directs it along the taxiways to its assigned gate.

Answer the following questions in your journal:
1. What is an air traffic controller?
2. What is an air traffic controller’s main responsibility?
3. What types of equipment do air traffic controller’s use?
4. Do you think you would be interested in a career as an air traffic controller? Why or why not.

Board Games Peer Scoring Guide

0 1 2 3 4 5  The instructions for playing the game were clearly written and easy to understand.

0 1 2 3 4 5  The instructions for playing the game made sense and the game was easy to play.

0 1 2 3 4 5  All of the necessary pieces of the game were included.

0 1 2 3 4 5  The game reviewed some aspect of the supply chain.

0 1 2 3 4 5  The game, board, and all pieces were neatly made with no spelling or grammar errors.

0 1 2 3 4 5  The game showed an appropriate level of effort and creativity.

TOTAL: /30 points

Board Games Peer Scoring Guide

0 1 2 3 4 5  The instructions for playing the game were clearly written and easy to understand.

0 1 2 3 4 5  The instructions for playing the game made sense and the game was easy to play.

0 1 2 3 4 5  All of the necessary pieces of the game were included.

0 1 2 3 4 5  The game reviewed some aspect of the supply chain.

0 1 2 3 4 5  The game, board, and all pieces were neatly made with no spelling or grammar errors.

0 1 2 3 4 5  The game showed an appropriate level of effort and creativity.

TOTAL: /30 points
# Mathematics

## Summary of Activities:

- Setting the Stage
- Airplane Math
- Spaghetti Bridges Lab
- Graphing Bridges
- Velocity Lab

## Table of Contents:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gagne Instructional Design</td>
<td>50</td>
</tr>
<tr>
<td>Lesson Plan-Day 1</td>
<td>51</td>
</tr>
<tr>
<td>Airplane Math</td>
<td>53</td>
</tr>
<tr>
<td>Airplane Math PowerPoint</td>
<td>54</td>
</tr>
<tr>
<td>Lesson Plan-Day 2</td>
<td>55</td>
</tr>
<tr>
<td>Spaghetti Bridges Lab Report</td>
<td>57</td>
</tr>
<tr>
<td>Lesson Plan-Day 3</td>
<td>59</td>
</tr>
<tr>
<td>Lesson Plan-Day 4</td>
<td>60</td>
</tr>
<tr>
<td>Velocity Lab Report</td>
<td>63</td>
</tr>
<tr>
<td>Lesson Plan-Day 5</td>
<td>65</td>
</tr>
<tr>
<td>Stage of Instruction</td>
<td>Event</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Pre-Instruction</td>
<td>Gaining Attention</td>
</tr>
<tr>
<td></td>
<td>Informing learners of the objectives</td>
</tr>
<tr>
<td></td>
<td>Stimulating recall of prior learning</td>
</tr>
<tr>
<td>Instruction</td>
<td>Presenting the stimulus</td>
</tr>
<tr>
<td></td>
<td>Providing learning guidance</td>
</tr>
<tr>
<td></td>
<td>Eliciting performance</td>
</tr>
<tr>
<td>Post-Instruction</td>
<td>Providing feedback</td>
</tr>
<tr>
<td></td>
<td>Assessing performance</td>
</tr>
<tr>
<td></td>
<td>Enhancing retention and transfer</td>
</tr>
</tbody>
</table>
**Unit Activities:**

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**Instructional Events:**

### Setting the Stage

**Objectives:** Airplane Math
- Gain Attention, Inform Learners of Objectives, Stimulate Prior Recall

**Materials:**
- Airplane Math
- PowerPoint, protractors

**Student Handouts:**
- Airplane Math

**Essential Question:**
- How does transportation impact my daily life?
- In what ways can everyday transportation problems be solved through mathematics?

---

**Procedures**

**Gaining Attention:**

- Write the following question on the board or overhead: **Make a list of at least 5 ways that math relates to transportation.**
- Ask students to write down their responses to the question. Allow 3-5 minutes for students to do so. Encourage students to share their responses with the class.

**Inform Learners of the Objectives**

**Purpose:** To capture attention and prepare students to learn and participate.

- Write the following question on the board or overhead: **Make a list of at least 5 ways that math relates to transportation.**
- Ask students to write down their responses to the question. Allow 3-5 minutes for students to do so. Encourage students to share their responses with the class.

---

**Setting the Stage**

**Purpose:** To help students understand what they are responsible for learning.

Tell students, **“Through the course of this unit, we are going to study transportation, its impact on our daily lives, how problems in transportation can be solved through mathematics, and how different modes of transportation play important roles in moving people, goods, and ideas from place to place.”**

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**Learning Objectives:**

1. Give examples of the connections that exist between their daily lives and transportation.
2. Apply mathematical formulas to solve real-world problems related to transportation.

**Tennessee Standards:**
- GLE 0806.4.1
- GLE 0806.1.2
- GLE 0806.4.3
- GLE 0806.2.3

**Marzano’s Instructional Strategies:**
1. Identifying Similarities and Differences
2. Nonlinguistic Representation
3. Setting Objectives and Providing Feedback
Purpose: To familiarize students with new words, activate prior knowledge, and provide a guide to the concepts they will learn in this lesson.

- Tell students, "Let's look at a couple of pictures of planes landings and taking off and talk about what those have to do with us and math."

- Show students the photos contained in the Airplane Math Powerpoint.

- As a class, draw a diagram of each plane's approach to the horizontal ground, thus creating an acute angle.

- Students will measure the angles. This allows students to review use of protractors, measuring, and identify acute, obtuse, and right angles.

- Distribute one copy of "Airplane Math" to each student. Allow students to work individually or in pairs to complete each of the problems.

- You may need to review the Pythagorean Theorem with students.

- As a class, discuss the answers to each question.

- Remind students that they will be using math for the next two weeks to learn more about transportation.
Math is an important part of transportation. Use your knowledge of math and geometry to solve the problems below.

1. A large commercial airplane is coming in for a landing. Use the measurements given below and the Pythagorean Theorem to solve for x.

![Diagram of a triangle with sides 80 ft, 100 ft, and unknown x at the top]

2. Imagine you are the pilot of a Boeing 747. You need to determine how much runway you will need to safely take off. To figure this out, you will need to know the total weight of your plane and your cargo.

Weight of a typical 747: 396,000 lbs
Weight of your cargo: 204,000 lbs

Convert each of these weights into tons. (1 ton = 2,000 lbs)

Add the total weight of the plane and the cargo: _________ tons. This is your total weight.

A plane whose gross weight is 250 tons needs about 10,000 feet of runway to take off safely. Assume that for each additional ton (over 250 tons) you will need 40 extra feet of runway. How many feet of runway will you need to safely get your plane off the ground?

_______ feet

Use the formula for distance to find the answer to the following problems:

Rate = \frac{\text{Distance}}{\text{Time}}

Show your work for each question.

3. If an airplane travels at a rate of 500 mph. If the plane flies for 5 hours, how many miles will it travel?

A Boeing 747 uses approximately 1 gallon of fuel per second. Use this information to solve the following problems:

4. If a flight from Knoxville, TN to Las Vegas, NV takes 4 hours and 20 minutes, how many gallons of fuel will the plane use?

A gallon of jet fuel in Knoxville costs $4.80/gallon. How much will it cost in fuel to fly from Knoxville to Las Vegas?
Yesterday, we continued learning the ways in which transportation uses math. Today, you are going to conduct a lab using spaghetti to simulate bridges.

**Purpose:** To provide new content to students.

- Review dependent and independent variables with students:
  - Variable: something that can be changed, such as a characteristic or value.
  - Independent variable: a variable whose value or characteristics are not dependent on changes in other variables.
  - Dependent variable: a variable whose value or characteristics are changed by another variable.
- Ask students to consider what other variables (besides the number of sheets of paper used or the weight the bridge held) might affect the outcome of their paper bridge experiment.
Possible responses include: the types of cars used to test the bridge, the type of paper used, the type of tape used, whether the bridge was fixed or portable, the geometric designed used in the bridge design.

- Pose the following problems to students and ask them to identify the dependent and independent variables:
  - Amtrak is testing new train designs. The goal is for the train to travel at a speed of greater than 55 mph regardless of weight.
  - A new car prototype needs to meet the standard of 35 mpg at speeds of up to 70 mph.

**Purpose:** To facilitate the transfer of new knowledge to long-term retention.

- Divide students into pairs and distribute the following supplies to each group:
  - A copy of the “Spaghetti Bridges Lab Report” to each student
  - 15 pieces of uncooked spaghetti
  - A Styrofoam cup with a hole punched in each side of the cup
  - A large handful of counting stones

- In their pairs, students will insert one piece of spaghetti through the holes in the cup and suspend the cup by holding each end of the spaghetti.
  - Students then will add one stone at a time until the spaghetti breaks and then record the number of stones the spaghetti holds before breaking on their lab reports.

- They will then repeat this process with 2 pieces of spaghetti until at least one piece breaks. Again, students should record the number of stones on their lab report.

- Direct students to continue this process with 3, 4, and 5 pieces of spaghetti.

- Remind students that as they complete each step of the lab, they should record their results in the chart on their lab report.

*Spaghetti Bridge lab adapted from*
http://fcit.usf.edu/math/lessons/activities/spaghS.htm
Spaghetti Bridges Lab Report

Introduction: Engineers test the materials used in construction of buildings, roads, bridges, etc., for durability, strength, and safety. Testing models gives them the information in a manageable, cost efficient manner. The following activity is similar to a procedure used in testing the strength of bridge beams.

Materials:

- 1 paper cup with 2 holes punched on opposite sides
- 1 cupful of counting stones
- Uncooked spaghetti (15 pieces)

Procedures:

1. Thread a piece of spaghetti through the holes in the cup.
2. One person will suspend the cup by placing each index finger approximately one inch in from the ends of the spaghetti.
3. Another student will carefully add counting stones to the cup, one at a time, until the spaghetti breaks.
4. Record results below.
5. Repeat the above procedure with 2, 3, 4, and 5 pieces of spaghetti until one or more pieces of spaghetti breaks.

<table>
<thead>
<tr>
<th>(x) (Independent Variable)</th>
<th>(y) (Dependent Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of spaghetti</td>
<td># of counting stones</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Analysis:

6. Graph the results: On a piece of graph paper, plot the data from your table on a coordinate plane as ordered pairs (x, y).

7. Read the results: Looking at your graphed points, do they seem to lie along a straight line or curve?

Use the graph to answer the following:

A. Find the number of stones needed to break "bridges" of 6 pieces: _____ stones, 7 pieces: _____ stones, 8 pieces: _____ stones.

Adapted from http://fcit.usf.edu/math/lessons/activities/spaghS.htm
Spaghetti Bridges Lab Report

B. About how many more stones are required to break a "bridge" each time another piece of spaghetti was added? How can you tell this from your graph?

C. Extend the line or curve you have drawn so that it crosses the y-axis. Identify the ordered pair where this occurs: (0, ____). It sounds crazy, but the graph may suggest that a bridge of no spaghetti would crumple with a weight of ______ stones.

D. Describe in words how to determine the number of stones needed to break a bridge if you know the number of pieces of spaghetti.

Draw conclusions:

A. Use your description to predict how many stones would be needed before a bridge of 20 pieces of spaghetti would break. Show your work!

B. Translate your words above to an equation that could be used to determine the number of stones (y) needed if you know the number of pieces of spaghetti (x).

\[ y = \]

C. Use your equation to predict the number of stones needed to break a bridge of 50 pieces of spaghetti.

Adapted from http://fcit.usf.edu/math/lessons/activities/spaghS.htm
In what ways can everyday transportation problems be solved through mathematics?

1. Apply mathematical formulas to solve real world problems related to transportation.

   GLE 0806.5.2

2. Cooperative Learning

2. Generating and Testing Hypotheses

Yesterday, you conducted a lab to test how much weight spaghetti bridges would hold. What surprised you most about the number of stones the strands of spaghetti held? Today, you are going to continue working in your pairs to analyze the data you collected yesterday.

- Instruct students to continue working in the pairs from yesterday to complete all the analysis questions on the Spaghetti Lab Reports.
- Discuss each analysis question with the class. Some topics for discussion include:
  - Slope and rate of change
  - Linear relationships
  - What other real life concepts could we test?
- Encourage students to share their predictions with the class.

Spaghetti Bridge lab adapted from http://fcit.usf.edu/math/lessons/activities/spaghS.htm
Purpose: To determine if students are successfully meeting the learning objectives for this lesson.

- Post the following problem on the board:
  
  o The maximum speed that a train carrying cargo to a distribution center can go is dependent on the amount of weight in the train’s load. Use the chart below to graph the maximum speed for the train at various weights.

<table>
<thead>
<tr>
<th>Independent Variable (Weight)</th>
<th>Dependent Variable (Speed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 tons</td>
<td>60 mph</td>
</tr>
<tr>
<td>14 tons</td>
<td>55 mph</td>
</tr>
<tr>
<td>16 tons</td>
<td>50 mph</td>
</tr>
<tr>
<td>18 tons</td>
<td>45 mph</td>
</tr>
<tr>
<td>20 tons</td>
<td>40 mph</td>
</tr>
</tbody>
</table>

Yesterday, you completed your spaghetti bridges lab. Today, we’re going to review variables and learn about velocity!
Distribute a piece of graph paper to each student and instruct them to use the information in the problem on the board to create a graph.

Use this activity as an informal assessment to ensure that students have mastered graphing on a coordinate plane.

Purpose: To allow students to develop expertise with the new information and create a construct for transferring knowledge to long-term retention.

Ask students to think about a time when they have ridden a roller coaster. Allow a few students to share their favorite roller coaster and explain why it is their favorite.

Pose the following questions for student discussion:

- What determines how fast a roller coaster goes?
- Does it depend on how steep the drop of the roller coaster is?
- Do these factors affect the time it takes the roller coaster car to get to the bottom of a hill on an amusement ride?
- Tell students, “Today we are going to conduct a lab experimenting with velocity.”

Distribute a copy of the handout “Velocity Lab Report” to each student and discuss the lab with students.

Divide students into groups of 3-4 students.

Distribute the following supplies to each group:

- A board to be used as an incline (simulating a hill)
- Three large text books
- 1 hotwheel type car
- A stopwatch
- A tape measure
- Pencil

Students will need to measure and mark a start line at 10cm on the ramp. They will then need to measure and mark at 40cm, 80cm, and 120cm. (See diagram on page 3)
• They will then roll their car down the ramp at each height and use the stopwatch to determine how long it takes for the car to roll to each of the distances.

• Encourage students to repeat each trial 2 times.

• Once students have completed their lab, they should answer each of the analysis questions on their lab report.
Objective/Problem:
The purpose of this experiment is to:

Materials:
- a board to use as an incline
- stopwatch
- a hotwheels type car
- 3 large textbooks
- tape measure
- pencil

Hypothesis:
I think the result of this experiment will be:

Procedures:
1. Measure 10cm from one end of the board and mark that distance; this will be your **start line**. Now measure from the end of the board to 40cm, 80cm, and 120cm and make marks at each of these distances as well.

2. Place one textbook under one end of the board.

3. Use the stopwatch to determine how long it takes your car to roll from the **start line** to each of the distances marked on your board. Repeat the test to each distance two times. (Record the times for each on your data chart)

4. Repeat this process with two books and then three books.

Data:

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Trial 1</th>
<th>Trial 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distance (cm)</td>
<td>Distance (cm)</td>
</tr>
<tr>
<td>40 cm</td>
<td>80 cm</td>
<td>120 cm</td>
</tr>
<tr>
<td>1 Book:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Books:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Books:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analysis:

1. Average the time it takes the car to roll 40 cm at each height. Also find the averages for 80 cm and 120 cm.

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>40 cm</th>
<th>80 cm</th>
<th>120 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Book:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Books:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Books:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Use graph paper to plot the time it takes for the car to travel each length for each height. You will have 3 graphs when you are finished (one for each height).

3. Determine the velocity of the car for each distance and height. \((v=d/t)\)

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>40 cm</th>
<th>80 cm</th>
<th>120 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Book:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Books:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Books:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Carefully consider the following questions:
   
   a. What does rolling the car and measuring the time it takes each to roll each distance have to do with roller coasters?

   b. At which incline did the car roll the fastest?

   c. What connections are there between algebra, linear equations and Science?

Conclusions:
Yesterday, we started a lab on velocity. What observations are we starting to make about the incline of the ramp and the speed that the car travels? Today, you are going to finish your velocity labs.

- Allow students to continue working in their groups to complete their lab and answer the analysis questions on their lab report.
- Circulate among groups to answer questions and troubleshoot.
Science

Summary of Activities:

- Setting the Stage
- This is the Way We Go To School
- File Folder Bridges
- Engineering Process
- Modes of Transportation
- Modes of Transportation Presentations

Table of Contents:

- Inquiry Learning Description 67
- Lesson Plan-Day 1 68
- This is the Way We Go School 70
- Lesson Plan-Day 2 71
- Paper Bridges: Lab Report 73
- Lesson Plan-Day 3 75
- Designing and Building Modes of Transportation 77
- Engineering Process Graphic Organizer 79
- The Engineering Process PowerPoint 80
- Lesson Plan-Day 4 83
- Modes of Transportation Project Guide 85
- Lesson Plan-Day 5 86
- Lesson Plan-Day 6 87
<table>
<thead>
<tr>
<th>Inquiry Event</th>
<th>Description</th>
<th>Unit Activity</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage</td>
<td>Makes connections between past and present learning experiences, lay the organizational ground work for the activities ahead and stimulate their involvement in the anticipation of these activities</td>
<td>This is the Way We Go to School</td>
<td>Day 1</td>
</tr>
<tr>
<td>Explore</td>
<td>Provides an opportunity to get directly involved with the scientific materials and develop a base of experience with new concepts</td>
<td>File Folder Bridges</td>
<td>Day2</td>
</tr>
<tr>
<td>Explain</td>
<td>Helps students begin to understand, in greater depth, the materials and concepts they explored in the previous activities</td>
<td>Engineering Process</td>
<td>Day3</td>
</tr>
<tr>
<td>Elaborate</td>
<td>Provides opportunities for students to expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them</td>
<td>Modes of Transportation</td>
<td>Day 4/Day5</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Determines if students are successfully meeting the learning objectives for this lesson</td>
<td>Modes of Transportation Presentations</td>
<td>Day 6</td>
</tr>
</tbody>
</table>
Purpose: To help students make connections between past and present learning experiences, lay the organizational ground work for the activities ahead and stimulate their involvement in the anticipation of these activities.

Write the following question on the board or overhead: **What is transportation? How is transportation related to your daily life? How is it related to school?**

- Ask students to write down their responses to the question. Allow 3-5 minutes for students to do so.
- Ask each student to share their responses with the class.
- Pose the following questions for discussion:
  - In what ways would your daily life be different if walking were your only mode of transportation?

- Provide each student with a copy of the handout “This is the way we go to school.” Ask students to carefully read each question before you read the book.
Children’s Book (Continued)

- Read the book “This Is the Way We Go to School?” (by Edith Baer) to students.
- Give students time to complete each question on their handout.
- Ask each student to share one of their categories with the class. Record each different category on the board.
- Discuss why people came up with different ways to classify the modes of transportation by asking, “What was important to you as you decided how to classify?”
  - Students answers will vary, but may include: number of wheels, animals vs. machines, vehicles that require fuel, etc.
- Lead a discussion on the advantages and disadvantages that students identified for each mode of transportation.
  - Encourage students to brainstorm ways to overcome disadvantages listed.
- Pose the following questions for discussions:
  - What role does culture and geography play in how students get to school?
    - Different types of terrain necessitate certain modes of transportation...i.e. Large cities = mass transit, rural areas with limited infrastructure = non-motorized travel (bikes, animals)
  - How many different modes of transportation has our class used in the last week?
  - How might that list be different if we all lived in India? What about Italy?

Tell students, “Through the course of this unit we are going to study transportation, its impact on our daily lives, how transportation has changed over time, and how different modes of transportation help us move people, goods, and ideas from place to place.”
1. List below all of the modes of transportation as you can remember from the book:

2. Classify your list into 3 categories. You will need to create your own categories in the space below:

   Category: ___________  Category: ___________  Category: ___________

3. Choose four of the modes of transportation from your list above and consider the advantages and disadvantages of each. You must include at least 2 advantages and 2 disadvantages.

<table>
<thead>
<tr>
<th>MODE OF TRANSPORTATION</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
</table>

4. List all of the modes of transportation that you have personally used in the last week:
Explore

Set of Metric Weights, 1 file folder per group, Bridges of the World PowerPoint

Building Bridges Lab Report

How does transportation impact my daily life?

1. Give examples of the connections that exist between their daily lives and transportation.
2. Think critically to develop solutions to proposed problems.
3. Apply the engineering process to solve a given problem.

GLE 0807.Inq.1
GLE 0807.Inq.5

1. Reinforcing Effort and Providing Recognition
2. Cooperative Learning
3. Generating and Testing Hypotheses

Purpose: To provide students with an opportunity to get directly involved with the scientific materials and develop a base of experience with new concepts.

Tell students, “Yesterday we talked about the different way students travel to school. Transportation does not only include the vehicle you travel in but the route that you take. Many of you have to cross the river to get to school. How would you get to school if one day the bridges were all closed? Building things requires you to follow a plan, just like a recipe. Today we are going to learn a process that will help us go from our ideas to a complete product.”

Divide students into teams of 3-4 students. Provide each team with 1 standard index file folder and the following instructions:

- Your challenge is to build a bridge structure using the materials provided. Design your structure so that it can hold the maximum weight possible.
• You can build your structure anyway you like, but your structure must be portable! (This means you may not fasten or connect it to a table or other fixed structure.)

• Show students the Bridges of the World PowerPoint to provide examples of different designs for bridges.

• Groups should discuss which design they are going to build and provide a sketch to the teacher for approval.

• Once their designs have been approved, students will begin constructing their bridges.

• Provide a copy of the handout Building Bridges Lab Report.

• Circulate among groups to help troubleshoot and answer questions.

• After each group has completed construction of their bridge, invite each group to the front of the class to test their bridge.

• Start by placing one weight in the middle of the bridge. Continue adding weights until the bridge collapses or you’ve filled the bridge.

• Remind students to record the amount of weight their bridge held on their Lab sheet.
Objective/Problem:  The purpose of this experiment is:

Hypothesis:  I expect the outcome of this experiment to be:

Materials:  List all of your materials below:

Procedures:  List the step-by-step procedures of your experiment below (Step 1 has been listed for you):

1.  Draw a design for your bridge

Data:  Fill in your data in the chart below:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td></td>
</tr>
<tr>
<td># of Weight Supported</td>
<td></td>
</tr>
</tbody>
</table>
**Analysis:** Complete the following questions:

1. Does your bridge meet the original requirements? (size, materials, weight bearing)

2. Why were some of the bridges more successful at holding weight than others?

3. What characteristics did those bridges that were successful have in common?

4. What flaws were inherent (naturally part of) in the building materials? How did successful bridges overcome those flaws?

5. If you were to start over with your bridge design and rebuild it, what changes would you make this time?

6. Suppose all the bridges in a large city (New York City, for example) were closed. What effect would that have on that city? What are some specific ways that people would adapt to not using bridges?

7. The earthquake in October 1989 in the San Francisco Bay area caused great structural damage to many of the bridges in the area. What features would you design as part of a bridge to make it better able to withstand an earthquake? Explain your ideas. Draw a simple sketch of your idea. (Use the back of this page if necessary).

**Conclusions:** Based on the results of our experiment, we conclude:
Purpose: To help students begin to understand, in greater depth, the materials and concepts they explored in the previous activities.

Tell students, "Yesterday you built paper bridges. You should have started with a design, but some of you just jumped right into building without a strong plan. However, building things requires you to follow a plan, just like a recipe. Today we are going to learn a process that will help us go from our ideas to a complete product."

- Allow students to complete their Building Paper Bridges Lab Report.
- Lead a discussion of the analysis questions with students.
- Ask each student to write down everything they know about the steps to the Scientific Method. Give students 2 minutes.
Procedures:

Brainstorming (Continued)

- Then ask students to turn to a partner to share their ideas. Encourage students to add ideas from their partner’s list also.
- Ask pairs to volunteer information they know about the Scientific Method.
- Record student responses in the format of a concept map on the board.
- The focus should not be on correct answers, merely assessing prior knowledge.
- Student knowledge will vary depending on how much prior learning they’ve had on the Scientific Method.
- Tell students, “Today you’re going to learn about a similar process called the Engineering Process. Whether you realize it or not, you used the engineering process to build your MacGyver solutions. You will be asked to use the engineering process again later in the unit and share your steps with the class.”

- Use the PowerPoint presentation *The Engineering Process*.
- Students should complete the graphic organizer “The Engineering Process Concept Map” during the presentation.
- Be sure to allow time for students to fill in their graphic organizer throughout the presentation.
Designing and Building Modes of Transportation

Engineering Teamwork and Planning
You are a team of engineers given the challenge of designing a new mode of transportation. You must be able to demonstrate that your mode of transportation is functional.

Planning and Design Phase
Each team has been provided with a set of materials. Review these as a group and draw a design in the space below for your mode of transportation.

Construction Phase
As a team, build your prototype, and then complete the questions below:

1. How similar was your design to the prototype you built.

2. If you found you needed to make changes during the construction phase, describe why you made revisions.

3. Did you find you needed to add extra materials to your prototype during construction? If so, what parts did you need to add?
Designing and Building Modes of Transportation

**Testing Phase**
Test your prototype! If you find your prototype design doesn't work the first time, you'll have an opportunity to redesign and try again. Don't worry if it fails the first time. Part of engineering is testing and designing products until the optimal design is achieved.

**Evaluation Phase**
Answer the following questions to summarize your experience building a car. Work in teams to come up with group opinions.

1. Were you able to create a prototype that was functional?
2. If yes, did you need to rework your prototype during the testing process? What did you need to change to make it meet the challenge?
3. Do you think your design could scale upward and work as a full size mode of transportation? Why or why not?
4. What aspects of other teams’ prototypes did you find interesting? Were there aspects of other designs you wish you had incorporated into your own team's prototype?
5. How different were all the final prototypes? What did that tell you about problem solving?
6. If you had a chance to do this project again, what would your team have done differently?
7. Do you think you would have been able to create a successful prototype if you had not been working in a group? What did the group interaction add to the design and problem solving process?
The Engineering Process

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:
The Engineering Process

- Is a series of steps that engineers use to guide them as they solve problems.
- It is a process that is cyclical, can begin at any step, or move back and forth between steps numerous times.

Step 1: Ask

- Identify a need
  - What is the issue or problem you need to solve?
- Research the need
  - What have others done?
  - What are the constraints/criteria?
    - Constraints - the limiting factors to consider
    - Criteria - specifications to be met by your design

Example: I love poptarts for breakfast but don’t have time in the mornings to heat them without being late for the bus.

Need: A more efficient way to heat poptarts while I’m getting ready for school

Research: What products are currently available? Will a regular toaster work?

Step 2: Imagine

- Develop possible solutions
  - Brainstorm ideas
  - Consider all options
  - Choose the best one
Step 2: Imagine

- Example: I love poptarts for breakfast but don’t have time in the mornings to heat them without being late for the bus.
  - Brainstorm:
    - I could hire a butler to heat my poptarts.
    - I could create self-heating poptarts.
    - I could create a toaster with an timer that I can set automatically turn on and heat my poptarts while I’m getting ready.

Step 3: Plan

- Example: I love poptarts for breakfast but don’t have time in the mornings to heat them without being late for the bus.
  - Plan: I will create a prototype of an automatic toaster.

Step 4: Create

- Example: I love poptarts for breakfast but don’t have time in the mornings to heat them without being late for the bus.
  - Test: I test the toaster everyday for a week to see if it heats my poptarts in enough time for me to catch the bus.
  - Evaluate: 3 out of 5 mornings it burns my poptarts. The other 2 days it doesn’t heat them at all.

Step 5: Improve

- Modify the prototype to address weaknesses
  - Retest the solution to see if it now works better
**Step 5: Improve**

- Example: I love poptarts for breakfast but don’t have time in the mornings to heat them without being late for the bus.
  - Modify: I redesign the timer to be more efficient.
  - Retest: 5 out of 5 mornings my poptart is perfectly heated and I catch the bus on time!
Purpose: To provide opportunities for students to expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them.

Tell students, “Yesterday, we discussed the Engineering Process and what goes in to creating and designing a project and then redefining it as we work out the kinks. Today, you’re going to work in groups to use the engineering process on a new project.”

- Divide students into groups of no more than 3-4 students.
- Explain to students that they will be working as teams of "engineers" who have been given the challenge of designing a new mode of transportation.
- Distribute the project guide and scoring rubric to each team. Take time to explain that groups will be expected to:
Science - Day 4 Continued

**Procedures:**

**Modes of Transportation**

**Building the Design**

(30 minutes)

- Plan and draw their design on paper.
- Construct their design using materials provided.
- Test their design to see how far and how fast their mode of transportation can travel.
- Complete evaluation and reflection sheets.

- Place the material kits out so that teams can review the materials they will have to work with.
- Once the design is complete, students should sketch their designs on their project guide sheets. Remind students that you must approve their design sketch before they begin building.
- When you have approved the group's design, assign them a materials kit.
- As students begin building, remind them that they must have their design built and ready for testing by the beginning of class tomorrow.
- Remind students that they should be documenting how they are addressing each step in the engineering process for their presentations later this week.
Modes of Transportation Project Guide

You and your team will work to design and build a mode of transportation as described in the handouts that specify your group’s mode of transportation.

Your project will be evaluated as follows:

<table>
<thead>
<tr>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
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</tbody>
</table>

TOTAL: 85 / 100 points

Comments:
Elaborate:

None

The Engineering Process Presentation Scoring Sheet

What roles do different modes of transportation play in moving goods and people?

Purpose: To provide opportunities for students to expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them.

Tell students, “Yesterday, using the Engineering Design Process, your team of engineers designed and hopefully constructed your mode of transportation. What hazards or set-backs have you encountered? Hopefully you’re learning from your mistakes. Today, focus on those things that went wrong and how you went about adapting. We are going to document your progress through a presentation.”

- Allow teams to finish building their modes of transportation.
- Once the design is built, students should begin preparing their Engineering Process presentation.
- After the Evaluation and Reflection Sheets are completed, teams should then continue working on their Engineering Process presentations.
- Distribute a copy of the Engineering Process presentation scoring sheet to help guide students’ development of their presentations.

1. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.
2. Apply the engineering process to solve a given problem.

GLE 0807.Inq.1
GLE 0807.T/E.2

1. Nonlinguistic Representation
2. Cooperative Learning
3. Generating and Testing Hypotheses
<table>
<thead>
<tr>
<th>Inquiry Learning:</th>
<th>Evaluate</th>
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</thead>
<tbody>
<tr>
<td>Evaluate</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Materials:</th>
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</thead>
<tbody>
<tr>
<td>Computers with MS PowerPoint access or poster boards</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Student Handouts:</th>
</tr>
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<tbody>
<tr>
<td>Engineering Process Presentation Guides</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Essential Question:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What roles do different modes of transportation play in moving goods and people?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Evaluate the connections between different modes of transportation and the efficient movement of goods and people.</td>
</tr>
<tr>
<td>2. Apply the engineering process to solve a given problem.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Tennessee Standards:</th>
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<tr>
<td>GLE0807.Inq.5</td>
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<td>GLE 0807.T/E.2</td>
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<table>
<thead>
<tr>
<th>Marzano’s Instructional Strategies</th>
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</thead>
<tbody>
<tr>
<td>1. Nonlinguistic Representation</td>
</tr>
<tr>
<td>2. Cooperative Learning</td>
</tr>
<tr>
<td>3. Generating and Testing Hypotheses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedures</th>
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<tbody>
<tr>
<td>Evaluate:</td>
</tr>
<tr>
<td>Review (5 minutes)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The Engineering Process Presentations (45 minutes)</th>
</tr>
</thead>
</table>

Purpose: To determine if students are successfully meeting the learning objectives for this lesson.

Tell students, “Yesterday, you finished up your engineering process projects. What is the most surprising thing you learned in this process? Today, you are going to present your process presentations to the class.”

- Allow teams 10-15 minutes to complete and practice their presentations.
- Begin presentations. Each student should have an equal part in the presentations. Use the Engineering Process Presentation Guide to grade students’ presentations.
Social Studies

Summary of Activities:

Setting the Stage
Alpha Boxes
Modes of Transportation
RAFT
RAFT Presentations
Future of Transportation Student Reflections

Table of Contents:

Gagne Instructional Design 89
Lesson Plan-Day 1 90
Alpha Boxes 93
The History of Transportation Student Handout 94
Lesson Plan-Day 2 95
Lesson Plan-Day 3 96
Modes of Transportation RAFT Student Handout 98
RAFT Scoring Rubric 99
Lesson Plan-Day 4 100
Lesson Plan-Day 5 101
The Future of Transportation Student Handout 103
<table>
<thead>
<tr>
<th>Stage of Instruction</th>
<th>Event</th>
<th>Description</th>
<th>Unit Activity</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Instruction</td>
<td>Gaining Attention</td>
<td>Stimulates readiness to learn and participate. Stimuli like surprises or questions are typically used for this event.</td>
<td>Setting the Stage</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Informing learners of the objectives</td>
<td>Generates expectancy by helping them understand what they will be learning</td>
<td>Objectives</td>
<td>Day 1</td>
</tr>
<tr>
<td></td>
<td>Stimulating recall of prior learning</td>
<td>Relating new information to something they already know or have experienced helps learners make sense of the lesson</td>
<td>Alpha Boxes</td>
<td>Day 1</td>
</tr>
<tr>
<td>Instruction</td>
<td>Presenting the stimulus</td>
<td>New information is presented. Strategies like providing examples or presenting vocabulary should be used to present the lesson content to provide more effective instruction</td>
<td>Modes of Transportation: Cooperative Learning</td>
<td>Day 2</td>
</tr>
<tr>
<td></td>
<td>Providing learning guidance</td>
<td>Helps facilitate the process of long-term information storage</td>
<td>Modes of Transportation: Graphic Organizer</td>
<td>Day 2</td>
</tr>
<tr>
<td></td>
<td>Eliciting performance</td>
<td>Requires the learner to practice the new skill or behavior. The repetition further increases the likelihood of retention of the new information</td>
<td>Alpha Box Revisions</td>
<td>Day 3</td>
</tr>
<tr>
<td>Post-Instruction</td>
<td>Providing feedback</td>
<td>Assess and further facilitate learning. Typically, activities designed for feedback are for comprehension, not scoring</td>
<td>Alpha Box Revisions</td>
<td>Day 3</td>
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<tr>
<td></td>
<td>Assessing performance</td>
<td>To evaluate the effectiveness of the instructional events, you must test to see if the expected learning outcomes have been achieved</td>
<td>RAFT</td>
<td>Day 3/4</td>
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<tr>
<td></td>
<td>Enhancing retention and transfer</td>
<td>Helps learners develop expertise by internalizing the new information. Methods for helping learners internalize are paraphrasing, generating examples, creating concept maps or outlines, and repetition</td>
<td>The Future of Transportation</td>
<td>Day 5</td>
</tr>
</tbody>
</table>
Social Studies - Day 1

1. Give examples of the connections that exist between their daily lives and transportation.
2. Explain how transportation has changed over time from Exploration through today.
3. Identify major contributions to the field of transportation.

8.5.03b

1. Cooperative Learning
2. Setting Objectives and Providing Feedback
3. Cues, Questions, and Advance Learning

**Unit Activities:**

- Setting the Stage, Objectives, Alpha Boxes, Cooperative Learning
- Gain Attention, Inform Learners of Objectives, Stimulate Prior Recall, Present the Content

**Instructional Events:**

- Computers with Internet access, headphones (optional)
- Alpha Boxes, Modes of Transportation Graphic Organizer

**Materials:**

- How does transportation impact my daily life?
- How has transportation changed over time?

**Student Handouts:**

- Essential Question:
- Procedures

**Essential Question:**

- **Procedure:** To capture attention and prepare students to learn and participate.
  - Write the following question on the board or overhead: **List as many modes of transportation as you can think of. Now circle all of the modes that you personally have ridden. Choose one of those that you circled and describe your last ride.**
  - Ask students to write down their responses to the question. Allow 3-5 minutes for students to do so.
  - Allow students to share their responses with the class.

**Purpose:** To capture attention and prepare students to learn and participate.

- **Procedure:** To help students understand what they are responsible for learning.
  - Tell students, "**Through the course of this unit, we are going to study transportation, its impact on our daily lives, how transportation has changed over time, and how changes in transportation have impacted the development of our world, county, and state.**"
**Purpose:** To familiarize students with new words, activate prior knowledge, and provide a guide to the concepts they will learn in this lesson.

- Distribute one copy of the handout “Alpha Boxes” to each student.
- Each box on the sheet is divided in two. For the first part of this activity, students will brainstorm words related to transportation that start with each letter of the alphabet. These words will be recorded on the top half of the appropriate box (A=airplane, T=train, etc.).
- Allow students 5-10 minutes to brainstorm words and then invite students to share some of their words with the class.
- Remind students that they will come back and work in the lower half of the boxes later in the week.

**Purpose:** To provide new information to students

- Divide students into at least 6 groups (no more than 3-4 students per group)
- Assign each group one of the following modes of transportation: Ships, Railroad, Airplanes, Automobiles/Trucks, Pipelines, and Barges.
- Distribute a copy of the handout “History of Transportation Graphic Organizer.” Instruct students that each student must complete their own graphic organizer.
- Provide each group with a computer that has Internet access. If you have access to enough computers, have students work individually or in pairs at the computer.
- Direct students to the Discovery Streaming video documentary *The History of Transportation*.
  - [http://search.discoveryeducation.com/index.cfm?Ntk=d_Series&Ntt=History%20of%20Transportation&Nty=1&D=History%20of%20Transportation&N=0&blnSearchInit=1](http://search.discoveryeducation.com/index.cfm?Ntk=d_Series&Ntt=History%20of%20Transportation&Nty=1&D=History%20of%20Transportation&N=0&blnSearchInit=1)
- Direct each group to watch only the segments for their mode of transportation. Each video is comprised of 7-8 sections (Introduction, History, How it Works, Growth, Affects Lives, Affects Places, Cultural Change, Advantages/Disadvantages).
• Groups should pause the video at the end of each section to discuss and identify the THREE main points. The points should be recorded on the graphic organizer. Groups must come to consensus on each main point.

• Remind groups that they will have most of class on Tuesday to complete their assignment.
Directions: In the top half of each box, list a word that begins with that letter that is associated with transportation. You will fill in the bottom half of each box later in the week.

<table>
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<th>A</th>
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<td>V</td>
<td>W</td>
<td>X</td>
<td>Y</td>
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</table>
The History of Transportation:

Directions: As a group watch each segment of your assigned mode of transportation. At the end of each segment, pause the video come to consensus as a group on the three most important points in that segment.

Our group's mode of transportation: ________________________________

- Introduction
  1.
  2.
  3.

- History
  1.
  2.
  3.

- How it Works
  1.
  2.
  3.

- Growth
  1.
  2.
  3.

- How it Affects Lives
  1.
  2.
  3.

- How it Affects Places
  1.
  2.
  3.

- Cultural Changes
  1.
  2.
  3.

- Advantages/Disadvantages
  1.
  2.
  3.
Yesterday at the beginning of class we brainstormed and worked to fill in your Alpha Boxes. What were some of your ideas? Today, we are going to learn more about different modes of transportation.

- Direct students to return to their cooperative learning groups.
- Students should complete their video segments and identify the three main points from each segment.

**Purpose:** To facilitate the transfer of new knowledge to long-term retention.

- Encourage students to complete their graphic organizers for each section of the video.
- Remind students that it is important to come to consensus on each main point.
Revised Alpha Boxes, RAFTs

Provide Learner Guidance, Elicit Performance

Construction paper & markers

Alpha Boxes (see Monday), RAFT

How does transportation impact my daily life?

How has transportation changed over time?

For the past couple of days, you have been learning about different modes of transportation. What are those modes of transportation? What is one interesting fact about one of the modes of transportation that you learned? Today you are going to revise your Alpha Boxes from Monday and work in groups to creatively display your new knowledge.

Purpose: To facilitate the transfer of new knowledge to long-term retention and evaluate the effectiveness of instruction.

• Ask students to review the words they wrote in their Alpha Boxes on Monday.
• Students should now be able to add new words in the bottom half of each box to demonstrate their newly acquired knowledge.
• After students have had sufficient time to work independently, allow them to work with a partner to fill in any open boxes.
• Encourage students to share words with the class.

Purpose: To allow the learner to practice the new knowledge. The repetition further increases the likelihood of retention of new information.

• Distribute one copy of the RAFT handout to each cooperative learning group.
Procedures:

RAFT (Continued)

- Direct each group to select one of the roles to assume.
- Students will then work as a group to create the product described for that role.
- Remind students that they will have about 10 minutes to finish their products and prepare to present it to the class on Thursday.

Example: Students will assume the role of a city writing a love poem to the mode of transportation their groups studied (barges, airplanes, automobiles, etc.) on the topic of “What a difference you’ve made in my life!”
**Modes of Transportation RAFT**

Directions: Using the mode of transportation that your group researched, assume one of the roles given below and create the product described for that role. Be sure to include as many details from your research as possible. You will present your RAFT to the class on Thursday. Your presentation should include some sort of visual aid (picture, video, etc.).

<table>
<thead>
<tr>
<th>Role</th>
<th>Audience</th>
<th>Format</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>City (Places or Culture)</td>
<td>Mode of Transportation</td>
<td>Love Poem</td>
<td>“What a difference you’ve made in my life!”</td>
</tr>
<tr>
<td>Machinery (How It works)</td>
<td>World</td>
<td>Obituary</td>
<td>“Why I’m the most important part.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- List accomplishments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- List surviving parts</td>
<td></td>
</tr>
<tr>
<td>A teenager (Affects Lives)</td>
<td>Another teenager</td>
<td>A Text Conversation</td>
<td>“My life is so much easier with ___ (mode of transportation).”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Must include at least 6 texts and responses</td>
<td></td>
</tr>
<tr>
<td>Tree (History)</td>
<td>Young Tree</td>
<td>Memoir</td>
<td>“Oh! The changes I’ve seen.”</td>
</tr>
</tbody>
</table>
The purpose of the RAFT assignment is to allow your group to demonstrate all that you’ve learned about your assigned mode of transportation. Use this project to showcase important and interesting details you’ve learned.

Your RAFT will be graded as follows:

0 2 4 6 8 10 You create a RAFT from one of the choices provided.

0 2 4 6 8 10 Your RAFT includes specific details from the video segments on your mode of transportation.

0 2 4 6 8 10 Your RAFT demonstrates a clear understanding of the information included in the video segments.

0 2 4 6 8 10 Your RAFT includes a visual aid (picture, video, etc) that is relevant to your mode of transportation.

0 1 2 3 4 5 Your presentation to the class is organized, with all group members participating, and any materials are neat and easy to read.

0 1 2 3 4 5 Your group worked well together and made good use of class time. Your final product demonstrates time, effort, and creativity.

Total Score: /50 points
Yesterday you began working with a group on the RAFT assignment. Someone tell me what the Acronym RAFT stands for. Today, you are going to finish and present your RAFTs.

- Allow students 10 minutes to finish their RAFTs and prepare to present to the class.
- Ask each group to present their product to the class.
- Encourage students to ask each group questions about their mode of transportation.
Unit Activities: Future of Transportation, Student Reflections
Enhance Retention and Transfer

Learning Objectives:
1. Give examples of the connections that exist between their daily lives and transportation.
2. Explain how transportation has changed over time from Exploration through today.
3. How have changes in transportation impacted the development of TN?
4. How might future changes in transportation impact the ongoing development of TN?

Yesterday you presented your RAFTS. Today, we are going to examine how transportation might change in the future. What are some ways that transportation has changed since your grandparents were in middle school?

Purpose: To allow students to develop expertise with the new information and create a construct for transferring knowledge to long-term retention.

- Provide each team of students with the handout “The Future of Transportation.”
- Allow teams 10-15 minutes to work through the thinking prompts.
- Give teams a piece of drawing paper and ask them to sketch out a new mode of transportation that would provide maximum benefits with minimum disadvantages.
• Encourage students to share their ideas with the class.

• Once the class has discussed each group’s predictions, ask each student to write a response to the following reflection prompt (10-15 minutes):

  o **In what ways will future changes in transportation positively impact our society?** In what ways might those changes negatively impact society? Explain why you think so.

• Discuss students’ responses and their possible advantages/disadvantages.
Different modes of transportation have greatly impacted the development of Tennessee, the United States, and the world. Given the history of these changes, it may be possible to predict how future changes in transportation will impact the world our grandchildren will live in.

As a group, brainstorm three ways in which you think transportation will change (improve) over the next 100 years:

1.

2.

3.

Choose one of these improvements. Make a list of at least 4 ways that this improvement will change society:

1. 3.

2. 4.

For each of the changes you listed above, give one positive impact of the change and one negative impact:

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Language Arts

1. The process by which products get from where they were made to where you buy them is called the:
   - a. middle passage
   - b. direct route
   - c. supply chain
   - d. supply and demand

2. A(n) ____________ is where shipments are unloaded and sorted, orders are processed and shipped out to stores, and trucks pick up shipments.
   - a. subway terminal
   - b. distribution center
   - c. intersection
   - d. roundabout

3. What is one aspect of the "Just In Time" principle?
   - a. Inventory is kept in large amounts in store warehouses so they are always available to the customer.
   - b. Products are shipped to the store to arrive at the same time the customer wants them.
   - c. Products are shipped to the store after the customer orders them.
   - d. Products are only manufactured after the customer orders them.

4. Which of the following steps in the supply chain is out of order?
   - a. The product is made at the manufacturer's plant in China.
   - b. The product is sorted at a U.S. distribution center.
   - c. The product is loaded onto a container for shipping to the U.S.
   - d. The product is shipped to a port in the U.S.

5. All of the following are important when writing step-by-step or sequence instructions except:
   - a. test and retest your instructions to make sure you haven't skipped anything
   - b. use clear and precise words
   - c. edit your instructions carefully to make sure they are easy to understand and free of spelling and grammar errors
   - d. provide a strong title for instructions
6. Using the chart above, which of the following is the pattern or relationship between the number of steel beams and the length of the bridge in feet?
   - a. The number of steel beams is twice that of the length of the bridge.
   - b. The number of steel beams is half that of the length of the bridge.
   - c. The number of steel beams is multiplied by 2.8 to get the length of the bridge in feet.
   - d. The number of steel beams is multiplied by 3.5 to get the length of the bridge in feet.

7. Using the previous chart, what size bridge would 27.5 steel beams make?
   - a. 5
   - b. 96.25
   - c. 55
   - d. 76.5

8. A plane left at 10:00 AM and landed at 6:00 PM, carried 80 passengers to Seattle, WA, and traveled at a speed of 400 mph. How far did it fly?
   - a. 3200 miles
   - b. 300 miles
   - c. 32 miles
   - d. 3300 miles

9. Math can be used to solve everyday transportation problems. Which one of the following does not apply?
   - a. calculating transportation fuel costs
   - b. determining the average miles traveled per day delivering goods to retailers
   - c. measuring length and weight of steel beams compared to size of bridge
   - d. monitoring weather conditions for route selection

10. Use the Pythagorean Theorem to calculate the straight line distance between Nashville and Knoxville if the straight line distance between Chattanooga and Nashville is 134 miles and the straight line distance between Chattanooga and Knoxville is 112 miles.
    - a. 196.7
    - b. 154.4
    - c. 174.6
    - d. 211.8
11. When building a prototype in the Engineering Process, it is important to:
   O a. use only the highest quality materials
   O b. make the prototype the same size as your finished product
   O c. think of what problem you are addressing as you build the prototype
   O d. include every option you can imagine on the prototype

12. An independent variable is:
   O a. a variable whose values or characteristics are not dependent on changes in other variables
   O b. something that can be changed, such as a characteristic or value
   O c. a variable whose values or characteristics are changed by another variable
   O d. none of the above

13. Amtrak is testing new train designs. The goal is for the train to travel at a speed greater than 55 mpg regardless of weight. In this case, the dependent variable is:
   O a. the speed of the train
   O b. the weight the train is carrying
   O c. the distance the train is traveling
   O d. the time it takes the train to travel 55 miles

14. If you walk to the bus stop and then ride the bus to school and then reverse the process on the way home, how many methods of transportation did you use?
   O a. 1
   O b. 2
   O c. 3
   O d. 4

15. The engineering process is:
   O a. a series of steps used to guide scientists as they solve problems
   O b. a method of inquiry that is based on gathering observable data to prove or disprove theories
   O c. a process that is cyclical and can begin at any step, or move back and forth between steps numerous times
   O d. both answers b and c are correct
Social Studies

16. Which of the following modes of transportation is not used as often in Tennessee?
   - a. ships
   - b. airplanes
   - c. barges
   - d. trucks

17. The least likely form of transportation Civil War troops would have used to travel east to west in Tennessee would have been:
   - a. train
   - b. boat
   - c. horse
   - d. walking

18. Why is it important for new developments in the area of transportation to occur?
   - a. Travel and movement of goods, people and ideas becomes more efficient.
   - b. Travel and movement of goods, people and ideas becomes less efficient.
   - c. People move about more readily and the diffusion of cultures can occur.
   - d. Both a and c are correct.

19. Historically, major improvements to the transportation system in Tennessee towns and cities:
   - a. encouraged larger populations in the downtown area
   - b. encouraged sprawl development along the transportation route
   - c. discouraged the development of new businesses
   - d. made it difficult for goods to get to market

20. Improvements in transportation impact a state’s culture by:
   - a. making more goods and services available to people
   - b. bringing new ideas about music and philosophy to people
   - c. creating higher levels of air and water pollution
   - d. making goods and services cheaper for people to buy
|   |   |   |   |   |   
|---|---|---|---|---|---
| 21. I know a lot about careers in transportation. | Strongly Agree | Agree | Neither Agree or Disagree | Disagree | Strongly Disagree |
| 22. I would consider a career in transportation. |   |   |   |   |   |
| 23. My parents encourage me to do well in science. |   |   |   |   |   |
| 24. My parents encourage me to do well in math. |   |   |   |   |   |
| 25. I know someone who is a scientist. |   |   |   |   |   |
| 26. I know someone who is an engineer. |   |   |   |   |   |
| 27. I know someone who has a career in transportation. |   |   |   |   |   |
| 28. There are a lot of career options in transportation that are of interest to me. |   |   |   |   |   |
| 29. I would make a good scientist. |   |   |   |   |   |
| 30. I would make a good engineer. |   |   |   |   |   |
| 31. I have the skills and knowledge I need to do well in science. |   |   |   |   |   |
| 32. I have the skills and knowledge I need to do well in math. |   |   |   |   |   |
| 33. If I wanted to be a scientist my friends would make fun of me. |   |   |   |   |   |
| 34. If I wanted to be an engineer my friends would make fun of me. |   |   |   |   |   |
| 35. My parents would support me if I wanted to pursue a career in science. |   |   |   |   |   |
| 36. My parents would support me if I wanted to pursue a career in transportation. |   |   |   |   |   |
| 37. My parents would support me if I wanted to pursue a career in engineering. |   |   |   |   |   |
| 38. Transportation is an important part of my everyday life. |   |   |   |   |   |
| 39. There are ways that transportation connects to what I learn in school everyday. |   |   |   |   |   |
| 40. I can learn about transportation by studying math, history, writing, and science. |   |   |   |   |   |
Open-ended Questions:

If you have considered a career in transportation, what career have you thought about? Why would this be a good career for you?

What types of things would encourage you to consider a career in transportation?