

Asphalt Versus Concrete

Students will decide on which road surface—asphalt or concrete—is best for a given situation. For Grades 6-8.

INTRODUCTION

Culminating Activity:

You are a civil engineer in a region that experiences four seasons throughout the year. You work for an asphalt company that specializes in asphalt construction. The county wants to pave a two-lane dirt road that is a quarter-mile long. Your job is to create a persuasive proposal to convince the county that they should choose asphalt or concrete to pave the road.

Checking for Understanding & Engagement

- What is your “problem” in this situation?
- What career focus does this lesson address?
- Can any of you think of people besides civil engineers that would benefit from knowing the advantages and disadvantages of concrete versus asphalt?
- Do any of you see yourself doing something like in this in the future?

Objectives (Students Will Be Able To...)

- Students will analyze the impact and benefits that asphalt roads have in communities.
- Students will write a persuasive proposal.

ACTIVITIES IN THIS LESSON

Reading Activity

Group Work

Activity

Students read the online article “[Pros and Cons: Asphalt vs. Concrete Driveway](#)” in groups in order to acquaint themselves with the issue at hand.

The instructor then develops vocabulary on the words *concrete* and *asphalt*, elaborating on the definition through examples and pictures. Students practice spelling the two words.

Checking for Understanding & Engagement

- How would you describe the difference in appearance between concrete and asphalt?
- Where do you see asphalt and concrete being used around school?
- Name one reason why you think more people don't construct asphalt driveways if asphalt is better?

Research Activity

Research/Annotate

Activity

The instructor employs a think-aloud (see p. 108 of *The Art and Science of Lesson Design*) to teach students how to use Google Scholar to find research articles.

Think-aloud example:

"Hmmm... what kind of keywords can I use? 'Concrete' and 'asphalt' for sure. Do I want my article to feature both materials? Yes. So, maybe I had better use the AND Boolean operator. But I'm worried that I'm going to get too many hits. What can I do to get better results?"

Once the instructor has checked for understanding and questioned for engagement, student groups begin searching for articles on comparing asphalt to concrete.

The following is a list of online articles that students can use in case they are unable to find relevant articles:

- [Concrete vs Asphalt Roads: Pros and Cons of Each](#)
- [Concrete Vs. Asphalt Roads — Which Is Better?](#)

Checking for Understanding & Engagement

- What decisions did I make when searching for online articles and why?
- What does Boolean mean?
- Write a sentence using Boolean on your whiteboard and show me.
- Let's all pronounce Boolean together.

- What is one important thing to remember when performing online searches?
- Suppose you were wanting to find articles on tree diseases but not maple trees. What kind of search term could you use?
- What factors make concrete not adequate compared to asphalt?
- What factors make asphalt a better option instead of concrete for roads?
- Would you have done the search differently? Explain.
- What do you think would be the impacts of reconstructing all concrete roads into asphalt roads?
- If concrete lasts longer, why would it still not be as efficient as asphalt roads in a town? Explain.
- What is different about a driveway from a road that affects the choice of using asphalt or concrete?
- Suppose someone wants to build a race track to race cars. Should the builder use concrete or asphalt? Explain.

Mathematics and Spreadsheet

Lecture

Activity

Students in this activity compute the total cost of paving the road using the two materials. The instructor employs a think-aloud to demonstrate how they would estimate the width of the road, compute the total surface area of the road, and find the total cost.

Students then structure their Excel spreadsheets to compute the costs automatically. Students use designated cells to hold important constants, such as the cost rate of each material. Students then use dollar signs in their Excel formulas to refer these cells (i.e., absolute addressing).

The instructor develops technical vocabulary by teaching students the difference between the terms *absolute addressing* (the use of dollar signs to hold a cell reference fixed) and *relative addressing* (the absence of dollar signs, allowing cell references to change with scrolling).

Checking for Understanding & Engagement

- What is your total estimated surface area?
- What is your total cost for each material?
- How did you go about finding the total cost?

- What are the dollar signs used for in an Excel formula?
- What is relative addressing?
- What is absolute addressing?
- How is the term *addressing* used in computer science?
- Can you provide an example where knowing how to use the dollar signs in an Excel formula could come in handy?

NOTE: The computation of total costs from rates is a Grade 6 standard. Grade 7/8 teachers will want to treat this skill as a subskill and not include it in their standard of proficiency. See Chapter 5 of *The Art and Science of Lesson Design*.

Writing

Independent Practice

Activity

This activity centers on completing a graphic organizer (an organizational cognitive strategy as described in *The Art and Science of Lesson Design*) for a persuasive proposal, such as the one found on the PerryHazel blog. (Many examples are found on the web, but many do not feature the counterargument which is an important aspect of persuasive proposals.)

The teacher uses an elaborative cognitive method (see p. 105 of *The Art and Science of Lesson Design*) to have students understand that proposals must have both strengths and weaknesses from both sides (asphalt and concrete). Students utilize their graphic organizer to help recognize these.

The teacher then uses an organizational cognitive strategy to teach the students about the different parts that make up a persuasive proposal.

Students will then develop and structure a persuasive proposal and understand that it is important for them to know how to do this because many different careers require persuasive proposals.

Lastly, they are also being taught that even though they are taking the stance for supporting asphalt roads over concrete, they still must address the major likely counterargument to their opinion.

Checking for Understanding & Engagement

- What did you select for the main idea and why?
- What are the three reasons you chose to support your opinion and why?
- What is your counterargument and how are you addressing it?

- What is your concluding statement?
- Describe in your own words the structure of a persuasive proposal.
- Why is it important to fill in the counterargument portion of the graphic organizer?
- Why is the increased initial cost of asphalt worth it to build instead of concrete? Explain.
- If somebody sends you a proposal, what are three things you would want to examine?
- On a scale of 1 to 5, with 5 the most persuasive, how persuasive do you rank your proposal and why?
- If somebody sends you a proposal, what are three things you would want to examine?

Resources and Materials

- [How to Write a Persuasive Project Proposal](#)
- [Proposal Templates](#)

Career Exploration

Group Work

Activity

The teacher asks students to explore the civil engineering career field using online research. Students are asked to identify such features as the average salary and roles/responsibilities.

They are then asked to research online those traits that make for effective civil engineers. Finally, they self-evaluate their own traits to determine which areas align the most and least to the civil engineering field.

Checking for Understanding & Engagement

- State three facts about the civil engineering field
- Who hires civil engineers?
- How much do civil engineers make each year?
- Does a civil engineering field interest you?
- What is the one thing you would like/dislike about being a civil engineer?

Homework

Independent Practice

Assignment 1

Students hand write the words *concrete* and *asphalt* in complete sentences to reinforce vocabulary development with respect to spelling.

They also write the definitions of *relative addressing* and *absolute addressing* to reinforce recall of these terms.

Assignment 2

Students write their persuasive proposal using the information found in the graphic organizer. (They take home a paper copy of the graphic organizer even though it is accessible on the shared Google Drive.)

SUMMATIVE ASSESSMENT

Assessment Type: Writing Samples

Students will turn their graphic organizer and completed proposal in for feedback.

Low-level grammar and spelling will not be scored but will be marked according to Writing Across the Curriculum guidelines (i.e., only marking corrections on the first six lines of the proposal).

NOTE: This lesson plan incorporates use of the Rigor Cube approach to lesson planning described in *The Art and Science of Lesson Design* by Walkup and Squire. Culminating activities are described in Chapter 2. Students also used the Metacog Log described on p. 112 to monitor their own learning throughout the lesson.

Lesson Times

Concrete vs Asphalt: 40 minutes

Math and Excel: 10 minutes

Writing: 20 minutes

Career Exploration: 15 minutes

Industries / Subjects / Grades

Industries / Pathways

- Transportation
- Operations

K-12 Subjects

- English-Language Arts
- Mathematics

Grade Levels

- 6, 7, 8

Standards and Objectives

Standards

California's 2013 CTE Standards

- **CTE.T.A.5.1** Identify environmental conditions that would impact various aspects of the transportation industry
- **CTE.T.A.7.1** Identify the infrastructure needed to move people, goods, and equipment from one location to another (highways, bridges, waterways, railways).

California Math Common Core Standards

- **6.RP.2** Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.
- **6.RP.3.b** Solve unit rate problems including those involving unit pricing and constant speed.

California English Common Core Standards

- **WHST.6-8.1a** Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- **WHST.6-8.1b** Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- **WHST.6-8.1e** Provide a concluding statement or section that follows from or supports the argument presented.

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