

About the Book

Nobody believes Jake. Except the terrorists.

After witnessing an act of domestic terrorism while training on his bike, Jake is found near death, with a serious head injury and unable to remember the plane crash or the aftermath that landed him in the hospital.

A terrorist leader's teenage daughter, Betsy, is sent to kill Jake and eliminate him as a possible witness. When Jake's mother blames his head injury for his tales of attempted murder, he has to rely on his girlfriend, Laurissa, to help him escape the killers and the law enforcement agents convinced that Jake himself had a role in the crash.

About the Author

Mike Mullin first discovered he could make money writing in sixth grade. His teacher, Mrs. Brannon, occasionally paid students for using unusual words. Mike's first sale as a writer earned 10 cents for one word: tenacious.

Since then, Mike has always been involved with literature. One of his early jobs was shelving books at Central Library in Indianapolis. Later, he paid his way through graduate school in part by serving as a reference assistant for Indiana University's library. Mike has worked in his mother's business, Kids Ink Children's Bookstore, for more than twenty years, serving at various times as a store manager, buyer, school and library salesperson, and marketing consultant.

Mike wrote his first novel in elementary school—Captain Poopy's Sewer Adventures. He's been writing more or less non-stop ever since.

Table of Contents

Introduction
About the Book
About the Author
Pre-Reading Activities
Creative Challenges
Art in the Air Stream
Perspectives and Persistence in Writing
Engineering Challenges
Beyond the Basic Bicycle
Airplane Obstacle Course
Designing Jake's Dream Course14
Problem-Based Learning Challenges
Planning for Peak Performance
Drone Home: Debating and Creating Policies for Community Use
Ethics and Technology
Manipulating Media
Consider the Source
Writing Prompts



Lesson plans created by STEM Read (stemread.com)



Pre-reading Activities

1. Triple Venn Diagram

Give students a Venn diagram that contains three circles. Label the three circles Citizens, Government Agencies, and Military. Ask students to fill in the diagram comparing the roles of each designated group in combating terrorism.



2. Imagine a Plot

Ask students to imagine a story that involves an airplane, a tanker truck, and a bicycle. Have students write a short plot summary of their story.

3. All Wrong

Ask students to share a situation that they have experienced when they were in the wrong place at the wrong time.

4. Tweet It

Have students create a "tweet" that indicates what they think this story might be about. The message must be 280 characters or less.



Art in the Air Stream

Overview

Mike Mullin's Surface Tension features several vehicles that travel through air and space. As objects like bicycles, planes, and drones move through air and other gases, they experience changes in air pressure and flow. Physicists call this concept of fluid dynamics "turbulent flow" and try to create images that visualize the irregular and chaotic movement of air particles.

Data visualizations like this illustrate the power of science and art to communicate ideas. In this activity, students will learn about the turbulent flow models that Van Gogh created in "Starry Night" and use that as an inspiration to create a STEM-based work of art that illustrates the turbulent flow of air from different scenes in *Surface Tension*. They will use art elements and design principles to create a visual model of this phenomenon that is not only accurate, but also beautiful.

Grade(s): P: □ K: □ 1: □ 2: □ 3: □ 4: □ 5: □ 6: □ 7: □ 8: □ 9: ✓ 10: ✓ 11: ✓ 12: ✓

Standards

Fine Arts

- VA:Cr1.1.la. Use multiple approaches to begin creative endeavors.
- VA:CR1.2.IIa. Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design.

ELA

W.9-12.7 - Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate' synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Next Generation Science Standards

HS-ETS1-4 - Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Objectives

At the end of the lesson, students will know or be able to:

- Research the correlation between STEM concepts and works of art.
- Sketch air or gas flow patterns.

Tanglewood

Create an original work of art incorporating scientific knowledge.

Materials Required

- Computer access
- Drawing paper or canvas
- Pencils
- Various art supplies, such as pastels, oil pastels, acrylic or oil paints, watercolors, brushes, colored pencils, or collage materials

Procedure

- 1. Have students research the connections between Van Gogh's "Starry Night" and concepts of turbulent flow. One excellent source is the TED talk "Math & Van Gogh's 'Starry Night.'" <u>https://www.ted.com/talks/natalya_st_clair_the_unexpected_math_behind_van_gogh_s_starry_night</u>
- 2. Have students research other works of art and explore the science and math concepts related to the creation of those works.
- 3. Ask students to brainstorm scenes from *Surface Tension* that contain scientific occurrences that they could depict as a pattern. These might include
 - a. Flow pattern of methane gas
 - b. Air flow above and below the wings of an airplane
 - c. Air flow around a person riding a bicycle
 - d. Pattern of air movement around engines of a drone
 - e. The path a cell phone message takes as it bounces off various towers to arrive at multiple locations
- 4. Remind students that all of these patterns are basically invisible.
- 5. Task students with creating a work of art that makes the patterns visible and includes the patterns in a cohesive creation.

Considerations

Remind students of safe and responsible procedures for disposing of unused paints and for the cleaning brushes.

Extensions

Incorporate technology by allowing students to create digital works of art.



Perspectives and Persistence in Writing

Overview

In addition to writing *Surface Tension*, Mike Mullin is the author of the award-winning *Ashfall* series, which includes three novels and a novella. But even successful authors have to work hard to improve their writing, persist through failure and rejection, and hone new storytelling techniques.

When Mike Mullin talked about his writing process on the STEM Read Podcast, he shared how determination and grit contribute being a successful writer. He said, "The important thing is to fail, but to fail in the right way. We don't strive so that we can avoid failure; we strive so that we can failand learn from our failures-so that we can try it again."

Mike discussed an unpublished novel called *Heart's Blood*. That manuscript had a complex structure and multiple character viewpoints. According to Mike:

"I don't think I could have written Ashfall if I hadn't written Heart's Blood, a young adult horror novel that I wrote right before Ashfall. It never sold. You can't buy it anywhere, thank goodness because it sucked. Oh my god, it was terrible. But, you know, I learned a lot in writing it. I learned I wasn't ready to try multiple character viewpoints. I learned something about my own limitations as a writer."

With his latest book, *Surface Tension*, Mike said, "I went back to the multiple viewpoints I tried in *Heart's Blood*, and I thought maybe now [after writing the *Ashfall* series] I can pull it off."

In this activity, students will explore the writing techniques that Mike Mullin used to create the characters of Jake and Betsy and write an additional chapter from a secondary character's point of view. Students will also write an analysis and critique of how the shifting points of view affected their feelings toward the characters and their understanding of the characters' motivations. Finally, their critiques will answer the question, "Did Mike Mullin 'pull off' writing the book from multiple points of view?"

Grade(s):

 $\mathsf{P}: \square \quad \mathsf{K}: \square \quad 1: \square \quad 2: \square \quad 3: \square \quad 4: \square \quad 5: \square \quad 6: \square \quad 7: \square \quad 8: \square \quad 9: \checkmark \quad 10: \checkmark \quad 11: \checkmark \quad 12: \checkmark$

Standards

Tanglewood

ELA

- RL.11-12.3: Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).
- RL.11-12.5: Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.
- W.11-12.3.B: Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.

Objectives

At the end of the lesson, students will know or be able to:

- Think critically about a piece of literature
- Understand how literary devices impact story, structure, and meaning
- Use a variety of techniques to develop characterization in a piece of creative writing
- Analyze literature and formulate and substantiate claims about the impact of the author's choices

Materials

Paper and Writing Utensil and/or Computer Access

Procedure

- 1. Share excerpts from Mike Mullin's interview on The STEM Read Podcast (Episode 1: Science and Storytelling: http://northernpublicradio.org/post/stem-read-podcast-science-and-storytelling) and then discuss how the author constructs stories and characters.
- 2. As a group, discuss techniques that authors use to build characters. Here are some ideas to get students started:
 - a. **Word choice/dialogue:** How do characters speak? How do they describe things? How much do they talk? How fast do they talk? Do they tell the truth? How do you know?
 - b. Likes and dislikes: What are the characters' hobbies and interests? What do they love? What do they hate? How do you know?
 - c. **Physical description:** How does the character look? What types of clothes do they wear? How do they feel in or about different articles of clothing? How do they act and move?
 - d. **Relationships:** What are the characters' families like? Do they have good, bad, or complicated relationships with family and friends? Do they show physical affection toward others?
- 3. As students read Surface Tension, ask them record ways that Mike Mullin reveals character. Instruct them to highlight or transcribe lines that are particularly interesting or effective.
- 4. After students read the book, divide them into groups and ask them to discuss the following:
 - a. How did you feel about Mike Mullin's decision on alternating between Jake and Betsy's points of view?
 - b. Did your feelings toward the characters change throughout the book?
 - c. Some readers have said that, at first, they felt uncomfortable getting into Betsy's thoughts. Why do you think Mike Mullin decided to share her point of view and life experiences? How did he build empathy toward her throughout the book?
 - d. How would your reading of the novel have changed if you had only heard Jake's side of the story? If you had only heard Betsy's side of the story?



www.tanglewoodbooks.com

- 5. Ask students to pick a secondary character from the book, such as Laurissa or Agent Soufan, and look for passages that provide clues to their character and point of view. Have students fill in the blanks in their characterization and create a character sketch based on the writing techniques discussed in step 2.
- 6. Have students plan and draft a new chapter for *Surface Tension*. This chapter should follow the plot of the book, but writers should tell it from the point of view of a secondary character and use a variety of techniques to distinguish the character's unique voice and opinions.
- 7. Have students exchange and peer review each other's stories and then instruct them to use peer feedback to edit or improve their stories. Remind students about Mike Mullin's interview quotes on writing and revising.
- 8. Instruct students to write an informal reflection on what they have learned about characterization. Also, have them reflect on Mike Mullin's interview quotes about failure and persistence in writing. Did students' ideas about the writing and revision process change after learning that the author had written several drafts and even abandoned completed manuscripts during his career?
- 9. Prompt students to write a critique of how Mike Mullin creates character and shifts between multiple points of view. Ask students to share specific instances where the author developed character through the techniques you have discussed. Ask them to describe why the author might have made these choices in his storytelling and how his choices contributed to the overall effectiveness of the book.

Extensions

- Have students work in pairs to create dialogue exchanges between their secondary characters. What might the characters want from each other? What techniques will they use to get it?
- Have students select, read, and compare other books with multiple narrators.
- Incorporate technology by having your students create an online blog for their fan fiction or adapt their chapters as digital stories.



Beyond the Basic Bicycle

Overview

Jake, the main character of Mike Mullin's *Surface Tension*, is a serious cyclist training for a career in professional bike racing until he suffers a series of attacks and debilitating injuries. Jake is determined to overcome his injuries and the limitations of his equipment to get back to riding as quickly as possible.

For example, after his brain injury, Jake has trouble balancing on his bike. He adds training wheels to help regain strength and stability. How might he overcome or accommodate his hand injury, his burns, or his bullet wound?

In this engineering challenge, students will consider Jake's injuries and other disabilities and then research, plan, and create design documents of bicycle modifications to accommodate differently-abled riders.

Grade(s):

P:	K:	1:	2:	3:	4:	5:	6:	7:	8:	9: 🗹	10: 🗹	11: 🗹	12: 🗹
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Standards

PE/Health

23.D.4a: Explain how brain functions can be maintained and improved through activity.

Social/Emotional Learning

IC.4a: Identify strategies to make use of resources and overcome obstacles to achieve goals.

NEXT GENERATION SCIENCE STANDARDS

 HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Science & Engineering Practices

- Engaging in Argument from Evidence 9-12: Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions
- Science & Engineering Practices Engaging in Argument from Evidence 9-12: Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (trade-offs), constraints, and ethical issues.
- Constructing Explanations and Designing Solutions 9-12: Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations.

Objectives

At the end of the lesson, students will know or be able to:

- Design, evaluate, and/or refine bicycle adaptations that consider and accommodate specific physical requirements/needs of the cyclist
- Respond thoughtfully to diverse perspectives
- Compare and evaluate competing design solutions

Materials

- Drawing paper
- Writing paper or digital document availability
- Writing/coloring utensils.
- Availability of resources (internet, books)

Procedure

- 1. Ask students to identify the injuries that Jake and other characters sustained throughout the book and discuss how each of these injuries might impact the characters' ability to ride a bike.
- 2. Divide students into groups.
- 3. Instruct the groups to research bicycle varieties and current adaptive solutions for differentlyabled riders.
- 4. Ask groups to choose injuries from the book or other disabilities and then brainstorm ways to engineer a bicycle that can accommodate them.
- 5. Instruct groups to choose their most promising ideas and then research, plan, and create a design document that describes and illustrates the new design that can accommodate their rider.
 - a. The design document must include written details/specifics of the adaptations with the elements of the adaptations meticulously labeled within the design drawing.
- 6. Have groups present their solutions and address their unique adaptation ideas.
- 7. Guide the students through a class discussion to respectfully provide and receive feedback.
- 8. Instruct the groups to redesign or improve the design document based on the feedback they received.

Extension

- Create a small model of the prototype using found materials.
- Contact a local bike shop or a bicycle engineering company to get feedback and tips on their designs or on real accommodations.



Airplane Obstacle Course

Overview

In Mike Mullin's Surface Tension, domestic terrorists crash a plane by releasing large quantities of methane gas to change air pressure and air density around the plane shortly after takeoff. In real life, some experts have speculated that sudden eruptions of methane gas might be behind the phenomena of missing planes and ships in the Bermuda Triangle. Can the air around a plane really cause such dramatic results? What impact would air pressure and density have on the flight of a paper airplane?

In this multi-faceted engineering challenge, students will design and create paper airplanes that can achieve a maximum flying distance. After that, they will design an air obstacle course that introduces variables into the paper airplane's flight pattern to determine whether these variables minimize or maximize flight distance.

Grade(s):

 $\mathsf{P}: \square \quad \mathsf{K}: \square \quad 1: \square \quad 2: \square \quad 3: \square \quad 4: \square \quad 5: \square \quad 6: \square \quad 7: \square \quad 8: \square \quad 9: \checkmark \quad 10: \checkmark \quad 11: \checkmark \quad 12: \checkmark$

Standards

NEXT GENERATION SCIENCE STANDARDS

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Science and Engineering Practices

- Constructing Explanations and Designing Solutions 9-12: Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Asking Questions and Defining Problems: Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

ELA

W.9-12.7: Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.



Objectives

At the end of the lesson, students will know or be able to:

- Research how air temperature and density impact flight
- Research variables of paper airplane design and their effects on flight
- Design and engineer a paper airplane for distance flying
- Create an air obstacle course to optimize the flight distance of a paper airplane
- Create an air obstacle course to minimize flight distance of a paper airplane

Materials

- Internet access
- Paper for folding
- Paper and pencil for notes
- Stopwatch
- Measuring tape
- Small electric fans (two or more)
- Space heater
- Bag of ice in plastic tub

- 1. Divide students into groups.
- 2. Instruct the groups to research paper airplane design and watch videos about paper airplane construction.
- 3. Have students construct several different models. Students should name and number each model with a unique designation.
- 4. Have the groups test and revise their models based on the engineering design cycle. See NIU STEAM's Engineering Design Cycle as an example.
- 5. Have students select their most effective airplane design to use in the next testing phase.
- 6. In a suitable location, test each group's airplane. Make a log of each airplane and the flight distance achieved.
- 7. Test the airplanes again, recording each model's time in the air.
- 8. Share the results of the tests.
- 9. Have students improve their models and retest for both distance and airtime.
- 10. Instruct students to research how changes in air density, temperature, and movement of air affect flight and cause turbulence.



- 11. Introduce the variables for the obstacle course.
 - a. Two or more small electric fans
 - b. Space heater
 - c. Large bag of ice in a plastic tub placed on a stool or small table
- 12. Discuss how the students think each variable might affect the flight of the paper airplane.
- 13. Have students select whether they want to improve distance or airtime.
- 14. Have students arrange the variables in the testing area in a manner that will best maximize either distance or airtime achieved by their own model.
- 15. Have students adjust the arrangement of variables and test additional times.
- 16. Have students arrange the variables in the testing area in a manner that will minimize either distance or airtime achieved by a model from another group.
- 17. Have students adjust the arrangement of variables and test an additional time.

Considerations

Follow safety procedures for using the fans, space heater, and any extension cords. Be sure extension cords are taped to the floor. Electrical items should not be near any water source. Be certain that no paper comes in contact with the elements of the space heater.



Designing Jake's Dream Course

Overview

Before sustaining life-threatening injuries at the hands of domestic terrorists, Jake's passion in life was cycling. He created training routes that took him over a variety of terrains so that he could develop his skills and endurance. In this engineering challenge, students will create the ultimate cycling course to challenge Jake, increase his endurance, and help him return to peak performance.

Grade(s):

 $\mathsf{P}: \square \quad \mathsf{K}: \square \quad 1: \square \quad 2: \square \quad 3: \square \quad 4: \square \quad 5: \square \quad 6: \square \quad 7: \square \quad 8: \square \quad 9: \checkmark \quad 10: \checkmark \quad 11: \checkmark \quad 12: \checkmark$

Standards

Next Generation Science Standards

 HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Mathematics

- N.Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- G.MG.3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios.)

ELA

 W.9-12.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Objectives

After the lesson, students will know or be able to:

- Design a bicycle course.
- > Draw an aerial view of the bicycle course with color-coding for each aspect of the course.
- Create a 3D scale model of the course.
- Identify elevation, distances, slopes, the degree of curvature associated with the course in mathematical terms.
- Present course statistics and narrative about the design process in a summary document.

Materials

- Graph paper
- Drawing paper and utensils
- Writing paper and utensils
- Protractors
- Rulers
- Scissors or cutting knife
- Glue or masking tape
- Model construction materials, such as cardstock, cardboard, Styrofoam, craft foam sheets, balsa wood, dowel rods, or aluminum pans.

- 1. Task students with creating a long distance bicycle racecourse.
- 2. Divide students into teams.
- 3. Instruct students to research long distance bicycle racecourses.
- 4. Provide students with the information that one acre is equal to 43,560 sq. feet and one mile is equal to 5,280 feet.
- 5. Identify the components of the bicycle course which must include:
 - a. A 50-acre segment of land (any shape)
 - b. Hills with varying lengths and degrees of incline
 - c. Right and left curves with varying degrees of curvature
 - d. Flat stretches
 - e. At least one crossover or loop
 - f. A total distance of more than two miles
- 6. Instruct teams to use the Engineering Design Cycle to guide them through the stages of the project.
- 7. Have students sketch preliminary design concepts.
- 8. Have students determine a scale ratio that will enable them to draw an aerial view map of the bicycle course on paper.
- 9. Inform students that they must color code the various aspects of the aerial view (using one color for hills, one color for flat terrain, and so on) and include a visible map key.
- 10. Prompt students to use the aerial view as the "blueprint" to create a scale 3D model of the course.



- 11. Have students evaluate the slope of hills and severity of curves in the model to determine if riding this course is realistic or possible for a cyclist.
- 12. Have students create a mathematical description of each angle of ascent or descent, curve angle, and calculate the total distance of the course, reporting this in the summary document.
- 13. Have groups present models to the class.
- 14. Guide the students through a class discussion to respectfully provide and receive feedback.
- 15. Instruct the groups to redesign or improve the course based on the feedback they received. Groups should include modifications and rationales for changes in the final version of their summary document.

Extensions

- Calculate the force on a rider of 150 pounds accelerating downhill at several different speeds.
- Use a computer-aided design (CAD) program to create a 3-dimentional representation of the bicycle course.
- Have students create enhancements, such as trees, ponds, rocks, or other features to the 3D models to improve the scenery for riders and spectators.
- Contact local park districts about bicycle trails in the area. Create a topographic map of one of the trails.



Planning for Peak Performance

Overview

Jake used various routes and pacing to prepare his body for the demands of competitive cycling. Cyclists like him must have a comprehensive training program that increases endurance, enhances sprint times, and develops consistent pace and cadence.

The same is true with other types of physical activity. All athletes have training programs that help them stay in optimum physical condition for their sport. Problem-Based Learning (PBL) challenge, students will work individually to identify fitness goals and develop a training program that will help them reach those goals. They will also identify metrics that will help them determine if they are on track to meet their goals and adjust their program as needed.

At the end of the activity, students will share their findings and recommendations with peers and community members to help increase fitness in their school and community.

Grade(s):

P: □ K: □ 1: □ 2: □ 3: □ 4: □ 5: □ 6: □ 7: □ 8: □ 9: ☑ 10: ☑ 11: ☑ 12: ☑

Standards

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

- Planning and Carrying Out Investigations: Select appropriate tools to collect, record, analyze, and evaluate data.
- Planning and Carrying Out Investigations: Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success and other variables.

PE/Health

- 19.B.4a: Analyze various movement patterns for efficiency and effectiveness.
- 20.A.4a: Interpret the effects of exercise/physical activity on the level of health-related and skillrelated fitness.
- 20.B.4a: Record and interpret health-related physiological data (e.g., blood pressure, body mass index, oxygen exchange), with and without the use of technology.
- 20.C.4d: Design and implement a personal fitness program.

Mathematics

S.ID.1: Represent data with plots on the real number line (dot plots, histograms, and box plots).



Objectives

At the end of the lesson, students will know or be able to:

- Design a training program and training guideline timetable
- Design a data collection document
- Record and graph daily training data
- Develop a self-assessment performance evaluation document
- Record and interpret physiological training data
- Write and present a summary of the activity

Materials

- Stopwatch
- Computer access

- 1. As a class, discuss the Jake's training routine.
 - a. What were his goals?
 - b. What different physical activities were included in his training plan?
 - c. What was his training schedule?
- 2. Have students research training plans for various types of cycle racing.
- 3. Using the information they found, have students evaluate Jake's training program.
 - a. What were the strengths of his program?
 - b. What would you change or improve?
 - c. How might his program change if he wanted to increase his endurance versus his speed?
- 4. Present students with the activity prompt. Identify an individual fitness goal and develop a seven-day training plan. This goal could focus on general fitness or on a sport of their choice.
- 5. As a class, brainstorm the type of data or metrics students will collect to determine the effect of training on an individual's fitness level.
- 6. Have students create a data collection document that they will use to record data throughout the project.
- 7. Have each student record baseline data, according to the types of data each student has decided to collect. (For example, heart rate, blood pressure, weight lifting ability, daily sleep, and general nutrition outline).
- 8. Have students research appropriate physical training challenges based on age, weight, and current stamina, and then choose fitness goals.



- Have students design a seven-day training regimen based on their baseline data and goals. The regimen should take into account nutrition, rest time, intensity of activity, as well as the current fitness level.
- 10. Have students create a performance evaluation self-assessment to fill out daily.
- 11. Instruct students to collect and graph daily fitness data points along with notes indicating any variance from the scheduled program. Document weather variances such as wind, temperature, and humidity.
- 12. At the end of the week, collect identical data as in the baseline report.
- 13. Have students evaluate the training program using all assessment data.
- 14. Have students indicate areas of program strength and shortcomings.
- 15. Have students revise program to improve performance.
- 16. Ideally, this process should be repeated over the course of several weeks.
- 17. Have students write up summary reports about the activity and their progress towards their goals.
- 18. Share the reports with PE classes, write an article about the reports for the school newspaper, or communicate the information to another community entity to educate and inspire others to set fitness goals.

Extensions

- Incorporate computer-assisted data collection programs.
- Create similar programs for runners or other athletes.

Considerations

As a non-medical advisor, training considerations should be based on common practice and should not overtax the student. Advise students to seek trained medical assistance should they have concerns.



Drone Home: Debating and Creating Policies for Community Use

Overview

Today, drones are being used to do everything from creating amazing aerial photography, to helping farmers monitor crops, to conducting un-manned military strikes in warzones. Companies like Amazon and Domino's Pizza are even investigating how to deliver products and pizza right to customers' doors. However, in Mike Mullin's *Surface Tension*, FBI Agent Tapper misuses drones meant for surveillance and national defense to manipulate and threaten Jake, his friends, and his family.

In this Problem-Based Learning (PBL) challenge, students will research pros and cons of using drones, participate in a debate about the issue, and develop a drone policy for their community.

Grade(s):

P: □ K: □ 1: □ 2: □ 3: □ 4: □ 5: □ 6: □ 7: □ 8: □ 9: ✔ 10: ✔ 11: ✔ 12: ✔

Standards

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

- Engaging in Argument from Evidence 9-12: Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (tradeoffs), constraints, and ethical issues.
- Engaging in Argument from Evidence 9-12: Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Engaging in Argument from Evidence 9-12: Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
- Obtaining, Evaluating, and Communicating Information: Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

ELA

- SL.9-12.1.d: Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information of research is required to deepen the investigation or complete the task.
- SL.9-12.3: Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

SL.9-12.4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

Objectives

At the end of the lesson, students will know or be able to:

- Participate in a formal debate
- Research, compare, and evaluate competing arguments
- Collaborate with others to create a drone policy proposal
- Present findings and proposals to a community audience

- 1. Introduce or review the procedure for formal debate. Here are several resources for the debate procedure.
 - a. www.edu.gov.mb.ca/k12/cur/socstud/frame_found_sr2/tns/tn-13.pdf
 - b. http://www.educationworld.com/a_lesson/03/lp304-01.shtml
 - c. http://noisyclassroom.com/oracy-ideas/introducing-debate-in-the-citizenship-classroom/
- 2. Discuss what the group currently understands about private, commercial, and military uses of drones and explore school or community drone policies that might exist.
- 3. Create debate groups to represent the negative or affirmative argument for drone usage.
- 4. Set the question, "Should drones be allowed to operate in our community?"
- 5. Have groups research data to support their debate stance.
- 6. Host a debate with teams supporting either the affirmative or negative argument.
- 7. Ask small groups to use information gathered from the debate to develop a drone policy for the community.
- 8. Foster further debate or discussion about the various policy concepts.
- 9. As a class, create a unified drone policy for the school or community.
- 10. Provide an opportunity for the students to present the unified proposal to a community entity.



Extension

- Invite someone to your school to demonstrate drones.
- Research FAA rules about drones.
- Interview an airline pilot to find out his/her point of view about drones.
- Interview members of your state's National Guard about the use of drones for surveillance and defense.



Manipulating Media

Overview

In Mike Mullin's Surface Tension, powerful people were able to control the amount and type of information they shared as they tried to manipulate Jake and the people around him.

Today there are a variety of media sources putting a different slant on information. Reports on the same event or even the same interview can vary significantly depending on the source. Some reports are factual while others have been manipulated to change the meaning or intent. In this simulation challenge, students will record an interview and then work in groups to edit the interview to alter viewers' perception of the content. After the activity, students will reflect and write about ethics and media literacy.

Grade(s):

P:	К:	1:	2:	3:	4:	5:	6:	7:	8:	9: 🗹	10: 🗹	11: 🗹	12: 🗹
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Standards

ELA

- WHST.9-12.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST. 9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Social Science

SS.CV.6.9-12: Describe how political parties, the media and public interest groups both influence and reflect social and political interests.

Objectives

At the end of the lesson, students will know or be able to:

- List ways that media is manipulated
- Write and conduct an interview
- Create and present a re-edited news story
- Discuss ethical behavior related to technology
- Write an essay reflecting on the challenge

Materials

- Computer access
- Software to record videos
- Software to edit recordings
- Paper and pencil

- 1. Ask students if they have ever noticed the same news story presented from very different points of view by two different sources.
- 2. Discuss with students their understanding of fake news and media bias.
- 3. Divide students into groups.
- 4. Explain that students are going to record an interview that will later be edited by others to change the perspective of the information.
- 5. Instruct groups to prepare to interview a peer on a school or community issue. The interview must include a minimum of five questions with a maximum of eight questions. The interview questions should:
 - a. Require subjective and narrative answers.
 - b. Require an opinion or particular perspective.
 - c. Be respectful and pertain to the issue.
- 6. Have groups select and interview a peer who is not part of their group.
- 7. Have students conduct and record the interview.
- 8. Distribute the recorded interviews to different groups.
- 9. Task students with creating a fake news story through editing and other techniques. The fake news story must present a different perspective than that of the original interview. The news story must include:
- a. Audio clips from the original interview
- b. A change in point of view from the original interviewee's perspective.
- c. Reporter voice over or narration.
- d. A video image related to the perspective of the manipulated news story.
- 10. Have students present both the original interview and the manipulated news story.
- 11. Follow each presentation with a discussion on how the information was changed or manipulated.
- 12. Instruct students to write an essay reflecting on the challenge and how it relates to their understanding of the media.



Extension

- Consider using just one interview created by the entire class and having all of the groups edit that interview.
- Consider assigning each group a persona that might dictate how they would alter or manipulate the interview. For example, an interview about Trick-or-Treating could be edited by groups that represent the owners of a candy corporation or a local organic farm.



Consider the Source

Overview

In Mike Mullin's Surface Tension Betsy's father is the leader of a domestic terrorist group that uses everything from internet forums to elaborate anti-Muslim plots to spread fear and hate. Betsy herself moderates a forum on an internet platform called Stormbreak. Although she is a teen who lives a sheltered life in an abusive environment, her online persona is considered a thought leader and even a mothering figure to members of Stormbreak's online community. How much do readers really know about their source of information? Would revelations about her true age and identity impact her followers' views of Stormbreak's forums?

Surface Tension's examination the trustworthiness of traditional and social media mirrors real life controversies over "fake news," media echo chambers, and attempts by foreign powers to sway elections through social media. Investigations into these events have even prompted Facebook to reconsider how they evaluate sources of information and advertisements.

According to the American Press Institute, "Good decision-making depends on people having reliable, accurate facts put in a meaningful context." (Retrieved on 6/01/2018 from https://www. americanpressinstitute.org/journalism-essentials/what-is-journalism/elements-journalism/)

In this challenge, students will investigate the controversies surrounding the trustworthiness of online information and then create a rubric to evaluate either social media or news sites for accuracy of information.

Grade(s): P:□ K:□ 1:□ 2:□ 3:□ 4:□ 5:□ 6:□ 7:□ 8:□ 9:☑ 10:☑ 11:☑ 12:☑

Standards

Social Science

- SS.IS.4.9-12: Gather and evaluate information from multiple sources while considering the origin, credibility, point of view, authority, structure, context, and corroborative value of the sources.
- SS.Psy.4.9-12: Analyze how biological, psychological, and social cultural factors and their interactions influence individuals' behavior and mental processes.
- SS.CV.6.9-12: Describe how political parties, the media, and public interest groups both influence and reflect social and political interests.



ELA

- RI.11-12.6: Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness or beauty of the text.
- WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a purpose and audience.

Objectives

At the end of the lesson, students will know or be able to:

- Understand the controversy over the accuracy of information on traditional and social media
- Create a rubric
- Use the rubric to evaluate a minimum of three online media sites for accuracy and/or sources of information
- Present evaluations and findings

- 1. Share the following with students. Rubrics have three main components.
 - a. **Criteria** are the aspects that are being rated. For this activity, these may include: accuracy, writing quality, content, navigation, design, updates, ethics, copyright attribution, interactivity, sense of community, freedom from bias, privacy policy, censorship, and documentation of sources. Criteria should focus on the important aspects of the concept or product.
 - b. Levels of Quality give a name to various ratings levels. The best rubrics have an even number of ratings. This way, users cannot not simply select the middle rating for all criteria. Levels can be as simple as poor, satisfactory, good, excellent or as creative as no, meh, fine, awesome. The order for listing the levels is up to the discretion of the creator.
 - c. **Descriptors** list evidence-based factors for each of the levels of quality. These should be directly related to the criteria and clearly defined. Descriptors minimize scoring errors if they are observable or measurable.
- 2. Share some examples of rubrics with students. Show some that are exemplars and others that are poorly designed. Ask discussion questions.
 - a. Do the rubrics contain all of the components?
 - b. Are levels of quality clearly defined? Do they span a logical range for ratings?
 - c. Do descriptors provide enough information to make scoring decisions?
 - d. What changes would improve the rubrics?

- 3. Divide students into groups. Task students with creating a rubric to evaluate a social media or news site. The rubric should include:
 - a. Four levels of quality
 - b. A minimum of six criterion
 - c. Clearly defined descriptors
- 4. Once rubrics are completed, have students share them with the class and repeat the discussion questions from step 2.
- 5. Instruct students to use the feedback to revise their rubrics.
- 6. Task students with evaluating a minimum of three social media or news sites using the developed rubrics.
- 7. Task students with presenting the information they gathered using the format of their choice (e.g. blog, poster, presentation, etc.). The narrative should include how the strength or weaknesses of the sites might affect the behavior and attitudes of a societal group or an individual.

Considerations

Your school may require parental permissions to allow students to investigate various sites or access any social media. If your school blocks access to social media, consider using news sites instead.



Writing Prompts

Science Ethics

Technology has the potential to improve or disrupt societies. In the book, the Sons of Paine engineer a release of methane gas capable of bringing down an airplane, while a corrupt FBI agent use drones to personally harass and terrorize a suspect. Scientists are constantly on the brink of new discoveries and advancements. Sometimes these discoveries can lead to the creation of weapons or dangerous substances. Is there a danger in pursuing these discoveries? Is the pursuit of knowledge worth any potential risk? Write a persuasive essay arguing one way or the other.

Freedom of Expression in School Libraries

The Sons of Paine are characterized by their strong anti-Muslim prejudice. In our society, racial, cultural, and religious tensions prevail. Some would argue that literature depicting these prejudices should not be allowed in schools. Write a persuasive response defending or rejecting the idea that this type of literature belongs in schools. Use ideas in *Surface Tension* to support your conclusion.

Drone Ethics and Policy

FBI Agent Tapper uses a drone to target Mrs. Solley and Laurissa and convince Jake to give him information. The drone is weaponized and capable of delivering fatal shots remotely. Write a letter to the director of the FBI explaining whether this type of technology should be accessible to and used by government agents. Consider who should (or should not) have access to this technology, as well as the ethics of using such technology in the US and abroad.

Daughter of Paine

Betsy is a polarizing character because of the role she plays in The Sons of Paine's acts of domestic terrorism. Based on her actions and circumstances throughout the book, how do your feelings about her change? Do you empathize with her or despise her by the end of the story? If she were brought to trial and you were on the jury, would you find her guilty of terrorism? Why or why not?

Back in the Saddle

Jake's passion in life is cycling. He dreams of a career in professional racing, but his career is cut short by an act of terrorism. As Jake recovers from his injuries and tries to return to cycling, he experiences extreme physical challenges, frustration, and depression. Was there ever a time that you had to stop doing the thing that you loved most? How did it impact you emotionally? What strategies did you use to overcome challenges or accept the loss?

