STEAM Lesson Plan
Overview

Before the Lesson

- **Review:** Standards, time recommendations, and modifications are included to support effective planning.
- **Materials:** Refer to the materials guide for recommended items, estimated quantities, and ready-to-shop links.
- **Preview:** The lesson presentation is available in multiple formats to meet diverse needs. Student examples are provided to support student creation. Reviewing these resources before teaching will help you assist students more effectively. Detailed information about each resource is included within the lesson plan.
- **Print:** Review resources such as the STEAM journal, research pages, rubrics, figurines, and testing markers. Print the desired versions as needed. All print materials and further information are located in the "Additional STEAM Items" section of the lesson plan.

During the Lesson

STEP 1: Ask	STEP 2: Imagine	STEP 3: Analyze	STEP 4: Plan
Define your problem and learn key information.	Use your experiences and background knowledge to form initial ideas.	Use your experiences and new knowledge to brainstorm and form new ideas.	Make strategic decisions based on your knowledge to form an effective idea.

STEP 5: Create	STEP 6: Adapt	STEP 7: Evaluate	STEP 8: Share
Use your resources to make your own creation.	Use mini-tests to reflect and make necessary changes to your creation.	Make final improvements to your creation and conduct evaluations to test final results.	Communicate the effectiveness of your design.

- **Presentation:** The lesson is divided into eight steps, each focusing on a specific aspect of the lesson. The lesson plan aligns with these steps and provides an overview, estimated time, and practical tips for success at each stage.
- **Print:** Complete STEAM journals and rubrics as the lesson progresses. Other print resources are used only during/after specific steps of the lesson.

After the Lesson

- **Review:** Ensure that STEAM journal entries and rubrics are completed.
- **Extend:** Choose related lessons and extension activities to continue and deepen student learning.

Additional STEAM Items

- **Review and Print:** Review the information provided for each resource, determine how you will use each one, and print the necessary materials.

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Engineering

Wind Powered Boats

Create a boat that effectively uses wind power to move

Before the Lesson

STEAM Category	Engineering
Ideal Grade(s)	2+
Standards	K-2-ETS1-1/2/3 (Engineering Design- grades K-2), 3-5ETS1-1/2/3 (Engineering Design- grades 3-5), 2-PS1-2.
Lesson Placement	This lesson is designed to enhance knowledge gained during a material properties science unit. It also connects to a second grade wind and water effects science unit.
Time Recommendations	• Whole lesson: 90-135 minutes. • You can split this lesson into two sessions: pause the lesson after Step 5- Check-in #1, and resume building during the next session. ◦ Expect small issues to occur when projects sit for extended periods, such as tape causing unsupported parts to fall.
Possible Modifications	The following modifications can be made to the lesson: • Boats can be tested in or out of water. See step #7 for testing information.
Materials	• Materials are listed on the following pages. • Prepping materials before class helps the flow of the lesson. Gathering supplies and grouping them into bins for each table group allows for quick distribution. • If you don't have access to a specific material, make do with what you have! If you have additional materials that could enhance the project, feel free to use them. • Please note that some specialty items may need to be ordered ahead of time: Chipboard, plastic wrap, and testing materials • Review the STEAM journal and decide which version you would like to print. There is a full version that includes each step, as well as shorter versions that include only the key aspects that must be documented.

NOTES

REMEMBER

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STEAM Material Guide

How many materials should I have available?

HIGH USE MATERIALS

These materials are typically used by students in large quantities as the backbone of their creations. However, students may choose different materials as their main building material. It is recommended to have at least 10 units per student project.

MEDIUM USE MATERIALS

These materials are typically used by students in varying quantities. While they are rarely the main materials in the creation, these materials are commonly used in each project. It is recommended to have at least 5 units per student project.

LOW USE MATERIALS

These materials are typically used by students in small amounts. They are not the main materials in the creation but are used sparingly within projects. It is recommended to have at least 1-2 units per student project. ***If a specific number is needed, it is noted in the material list on the following pages.***

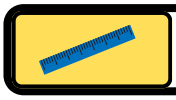
OPTIONAL SPECIALTY MATERIALS

These materials are entirely optional. Each specialty item is intended to enhance the project but is not necessary for its success. They can be used if available, but their inclusion is not required for a successful project.

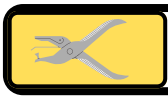
GENERAL STEAM MATERIALS

It is recommended to have these materials available for all STEAM engineering projects.

Art Supplies


Ruler

Scotch Tape


Single Hole Punch

Glue

Pencils

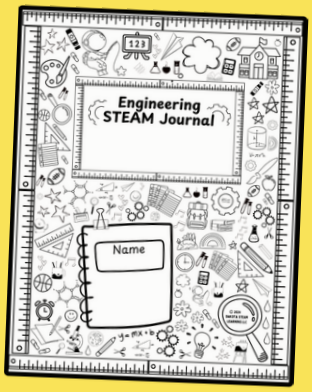
Cardboard Cutter

Scissors

PRINT RECOMMENDATIONS

These are the recommended print materials for the project:

- STEAM Journal
- Figurine
- Research Pages
- Rubrics



Printable versions are located within the lesson plan.

SPECIALTY TESTING MATERIALS

Specialty testing materials are used to assess the quality and structure of engineering projects. These materials can be purchased in small quantities for repeated use or in larger quantities so each student can test individually. For example, you could provide a few cars for shared testing or give each student their own car for multiple uses.

Car Figurine

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Engineering

Wind Powered Boats

Please note that the links provided in our material lists are affiliate links, which means we may earn a commission if you make a purchase through them. These links are offered for inspiration purposes only; you are not required to use these exact products and can choose alternatives that best suit your needs and budget.

Materials & Links	Essential, Optional, or Testing	Usage Level	Notes	Calculations
Pencil	Essential	1/student		
Scissors	Essential	1/student		
Masking Tape	Essential	High	See taping video for tips and tricks.	
Straws	Essential	High	Bendy straws work best.	
Pipe Cleaners	Essential	Low		
Cardstock Cards	Essential	Medium		
Popsicle Sticks	Essential	High	Use natural color due to color dyeing when wet.	
Coffee Filters	Essential	Medium		
Foil Sheets	Essential	Medium		
Chipboard	Essential	Low	Recommend limiting to 1/student. Cardstock paper can be used as an alternative.	
Plastic wrap	Essential	Low		
Water Basin	Testing	1	Water version of testing.	
Paper fans	Testing	1 pack	Water version of testing.	
Wax Paper	Testing	Low	Dry version of testing.	
Hair Dryer	Testing	1	Dry version of testing.	
Specialty Figurine	Optional	1/student	Paper figurine included in lesson.	

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Engineering

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Recommended Print				
STEAM Journal	Essential	1/student	Print options available. Choose based on goals and student needs.	
Figurine Print	Essential	1/student	Print options available. Choose based on desired size unless speciality figurines are purchased.	
Research Sheets	Essential	1/group	Print 1/group and hand out as necessary.	

- Dakota STEAM does not guarantee any particular result in connection with the Activities and specifically that participation in the Activities does not guarantee any level of academic success for Minor Children or the attainment of any particular skill set.
- Material need estimates are based on Dakota STEAM Learning's experience with the content. They are best estimates, not guarantees.
- If you do not have the necessary materials available, you can modify your material list to reflect what you have or add a constraint limiting the amount of materials participants are allowed to use.
- Show participants best practices for using tape to minimize waste on projects. Dakota STEAM Learning's YouTube offers video resources to support these expectations.

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STEP 1: Ask

Define your problem and learn key information.

STEP 2: Imagine

Use your experiences and background knowledge to form initial ideas.

STEP 3: Analyze

Use your experiences and new knowledge to brainstorm and form new ideas.

STEP 4: Plan

Make strategic decisions based on your knowledge to form an effective idea.

STEP 5: Create

Use your resources to make your own creation.

STEP 6: Adapt

Use mini-tests to reflect and make necessary changes to your creation.

STEP 7: Evaluate

Make final improvements to your creation and conduct evaluations to test final results.

STEP 8: Share

Communicate the effectiveness of your design.

Notes

Engineering Lesson Presentation

Presentation Information

Overview	The lesson is divided into eight steps, listed on the left side of this sheet. Each step covers a specific aspect of the lesson.
STEAM Journal	When it is time for students to complete the STEAM journal pages, the presentation will clearly indicate this. At these points, students will be prompted to fill out the corresponding journal sheet, and the presentation will provide helpful information to guide them in completing each page effectively
Video Links	Presentations may feature embedded videos produced by Dakota STEAM Learning, which can be accessed on YouTube (please ensure you have access to the platform). Additionally, some presentations may include slides with a blank box, indicating an ideal spot to showcase a video on a particular topic. Due to copyright restrictions, we do not include videos created by other YouTube content creators in our lessons. Here are some recommended YouTube channels to consider when selecting a video: SciShow Kids, Crash Course Kids, NG Science, and TED-Ed.

Presentation Links

Click the emblem to view.

Canva	**Canva Link** This link provides access to a public view version of the presentation. You must have internet access to use this version. Click the Canva emblem to view the presentation.
PDF	**PDF Link** This link provides a PDF version of the presentation slides. Internet access is not required to view the presentation, except when accessing links within the slides. Click the PDF emblem to view the presentation.
▶	**YouTube Video** A shortened video version of the lesson is available. Note: These videos are condensed to quickly communicate the lesson's key information. STEAM journal slides have been omitted to keep the videos approximately 10 minutes long. Click the YouTube emblem to view.

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During the Lesson

Engineering Resources

Use the YouTube emblem to access engineering basics resource videos.

YouTube Resources

STEP #1: Ask

Estimated Time	Less than 5 minutes
Step Overview	This step is designed to define the key information for the challenge the students will be solving.
Specific Tips & Tricks	• Be sure that students understand the information. Students can pair up and redefine the challenge, highlighting the criteria for success and any constraints. • If you modify the materials list, be sure to highlight these changes for students. Showing them specific items—especially unfamiliar ones—can help them start to form ideas.
STEAM Journal	Students do not have any journal pages to complete during this step.
Management	This will be taught whole group.

STEP #2: Imagine

Estimated Time	5-10 minutes
Step Overview	This step is designed to activate schema and practice communication skills.
Specific Tips & Tricks	When activating schema, use a think-pair-share routine for these questions. Students can document their ideas during the "think" portion of the routine.
STEAM Journal	Students will document their schema on the topic in their journal once during this step. They should be given an opportunity to write or draw their ideas before being asked to share with others.
Management	This step will begin as a whole group activity. Then, students will work independently. Afterwards, they will share in pairs or small groups, and the step can conclude with a whole group discussion.

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STEP #3: Analyze

Estimated Time	10-15 minutes
Step Overview	This step is designed for students to analyze pertinent information for potential value for their design.
Specific Tips & Tricks	• This STEAM section provides insights into the science content being reinforced, along with relevant examples that may assist in the building process. ◦ Tip: If you are not very knowledgeable about this science topic, select and show an age-appropriate video.
STEAM Journal	Students will document new information learned after the research is presented.
Research Ideas	Students can be asked to conduct their own research, which allows the lesson to become more cross-curricular. Allow extra time for this activity. Research topics: buoyancy, boats, sailboats

STEP #4: Plan

Estimated Time	10-15 minutes.
Step Overview	This step is designed for students to make strategic decisions about their new designs based on knowledge gained.
Diagramming	Diagramming is a key skill in engineering. Be sure to emphasize students' ability not only to draw their ideas but also to define the materials being used. If students are hesitant to write, they can draw lines from the materials to the appropriate spots on their design. A guided diagram slide may be included, which poses strategic questions to assist students in diagramming. These guiding questions help students break down the design into smaller, individual decisions and stay organized while diagramming.
Specific Tips & Tricks	• This step provides time to work on key communication skills. Having students explain their ideas to another student after diagramming encourages them to think critically about their design and allows them to receive feedback. Emphasize points of agreement from the feedback presentation slide before allowing students to give feedback. • It is not recommended for students to work in groups on short projects; they need an opportunity to try their own ideas before collaborating with others. Full-length lessons are available for teamwork challenges, which include two building sessions—one individual, followed by a larger-scale team build.

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STEP #5: Create

Estimated Time	30-45 minutes
Step Overview	This is the creation step.

Specific Tips & Tricks	• Review the student examples before teaching this portion so you can assist struggling students. Try not to show the examples directly to students, but use them to provide specific ideas as needed.
	• Allow about 20 minutes between check-ins. These check-ins are a quick way to identify which students need help.
	• If students are struggling, revisiting the research recap slide can provide visual cues. Research pages can be printed and provided to students.
	• Common student struggles include:
	  ◦ Having holes at joints-must reinforce and overlap
	  ◦ Too small of a sail-not enough surface area to "catch the wind"
	  ◦ Support issues-might need multiple supports
	  ◦ Unbalanced- sail(s) can flip the boat if they are not centered.
	  ◦ Having a very heavy boat-the sail can not move it

STEAM Journal	Students will document their check-in results in their journals. This allows you to identify which students you want to check in with during this time.

STEP #6: Adapt

Estimated Time	10-15 minutes
Step Overview	This step is designed to encourage students to reflect and adapt to challenges facing their design.
Specific Tips & Tricks	• This step can be used fluidly with step #5. Many students will progress to step #6 while others are still in the beginning stages of building. As soon as students start having a good portion of their design created, you can introduce the mini-tests and students can conduct them as ready.
STEAM Journal	Students document their mini-test results and identify the changes they need to make in their STEAM journal.
Mini-testing Logistics	• Mini-tests are designed to encourage students to reflect and predict potential issues with their creations moving forward. • Students can stay at their spot and blow on their boat to check for sail inflation. Wax paper can be set up for dry testing. Do not recommend using water yet.

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STEP 8: Share

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STEP #7: Evaluate

Estimated Time	15 minutes
Step Overview	This step is designed to conduct final testing.
Specific Tips & Tricks	• Students typically finish their creations at different times. Testing can be set up as students finish, or a specific testing time can be established. In either case, some students will have extra time before or after testing. Be sure to set expectations for this time, such as helping others, completing engineering mini challenges, or reading.
STEAM Journal	Students will document their final testing results in their STEAM journal.
Testing Logistics	• Wet testing: Set up a water basin (outside if possible) and label one end with the "Start" marker and the opposite end (length wise) with the "Finish" marker. Make sure to hit the sail(s) with the air, not the water. The boat must safely travel across the basin without any water entering the boat or hitting the figurine. Use paper fans to simulate wind due to safety hazards concerning hair dryers near water. • Dry testing: Place a 3 ft. piece of wax paper on the floor and label one end with the "Start" marker and the opposite end with the "Finish" marker. Blow air on the sail(s) and it must get from the "Start" to the "Finish" without blowing over or flipping. Use a hair dryer to simulate wind, if possible.

STEP #8: Share

Estimated Time	15-20 minutes
Step Overview	This step is designed to allow the students to reflect and share their results and experiences with other students.
Specific Tips & Tricks	• You can incorporate technology into this step. Students can create multimedia presentations, portfolios, and similar projects. They may need to take pictures during earlier steps for use in their presentations.
STEAM Journal	Students will document their reflections in their STEAM journal. This can guide their presentation.
Clean Up	The least fun part of STEAM! Students can sort materials into trash (anything that has been cut) and reusable materials. Having two distinguishable bins at every table helps speed up the process. Removing projects from the area, such as placing them in backpacks before cleaning, helps ensure that students' projects don't accidentally get ruined or thrown away.

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After the Lesson

STEAM Rubrics	These rubrics are designed to assess 21st-century STEAM skills. They can be completed for individual students or on a whole-class recording sheet. While rubrics do not need to be completed for every project, they are an important part of comprehensive STEAM programming and serve as valuable tools for documenting growth in STEAM areas over time. Self-assessment rubrics and STEAM goal sheets are also included so students can reflect on and assess their progress during and after the creation process. Multiple self-assessment rubrics are provided at varying levels of complexity; choose the level that best matches your students' abilities.
Related Lesson Links	The following Dakota STEAM lesson(s) are designed to accompany this lesson: • Hearty Homes- Engineering (Material Properties) • Wind and Water- Art (Water and Wind and their effects on Earth)
Extension Activity	The following extension activity ideas complement the content being highlighted in this lesson: • Informative writing ○ Students create a large diagram of their boat and explain why each material was chosen for design aspect, highlighting it's material properties. *These ideas have not (yet) been turned into Dakota STEAM content.*

Notes

Additional STEAM Items

STEAM JOURNAL

Print the desired pages. Note that multiple versions of some pages are included to better meet your needs. You do not need to print all of the pages, just decide which version works best for your students.

RESEARCH PAGES

Research is located within the slide presentation. The research pages are designed to be given to individual students or groups to help them during the creation process. These pages provide a visual reference and reminder of the research and inspiration studied.

STUDENT EXAMPLES/RUBRICS

Student examples are not intended for student viewing. If shown, students tend to replicate rather than innovate. These examples are included to provide grade-appropriate references for teachers, which can be used to help guide struggling students.

The provided rubrics are designed to focus on 21st-century skills specific to engineering projects. Recording sheets are also included and can be modified to fit your specific goals.

TESTING MATERIALS/ FIGURINE

Testing information is located in the slide presentation. Any necessary physical testing markers are included for placement in the testing area.

Figurines are provided, when necessary, to meet the criteria for success or the constraints of the challenge. A variety of sizes are included to best meet the needs of students completing the challenge. Larger figurines typically make the challenge more difficult. Optional specialty figurines are always linked in the materials list as alternatives.

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Engineering STEAM Journal

Wind Powered Boats

Name:

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Engineering STEAM Journal

Name:

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STEP #1: ASK

What is our problem?

How can we create a boat that uses wind power to move across water?

STEP #2: IMAGINE

What do you know that could help you?

Draw or write what you know.

STEP #3: ANALYZE

What is something new you learned from the research?

Draw or write what you learned.

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STEP #4: PLAN

What is the problem?

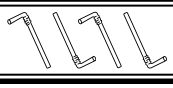
How can we create a boat that uses wind power to move across water?

DIAGRAM

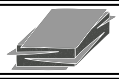
Draw and label your problem-solving design.

Materials Available

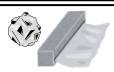
Popsicle Sticks


Straws

Pipe Cleaners


Cardstock Paper

Plastic Wrap


Foil

Coffee Filters

Chipboard

DIAGRAM

CITE YOUR REASONING

Check the box that best cites your evidence for success.

☐ Research ☐ Schema

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STEP #5: CREATE

Check-ins

Check-in #1

Time

I'm doing great. I don't need help.

I'm doing okay. I could use a check-in.

I'm struggling. I could use some help.

Check-in #2

Time

STEP #6: ADAPT

Mini Test Results

Record the following:

	Results	Changes Needed
1	☐ Criteria Met ☐ Constraints Followed	
2	☐ Criteria Met ☐ Constraints Followed	
3	☐ Criteria Met ☐ Constraints Followed	
4	☐ Criteria Met ☐ Constraints Followed	
5	☐ Criteria Met ☐ Constraints Followed	

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STEP #7: EVALUATE

Final Test Results

Check the box if the design met the requirement.

- ☐ The boat floats.
- ☐ No water enters the boat.
- ☐ Figurine stays dry during testing.
- ☐ Boat moves from start to finish.

STEP #8: SHARE

Final Test Results

What information do you want to share with others?

Draw or write down your information.

- ☐ **Results**
  Explain how your creation did when tested.
- ☐ **Reflect**
  Explain why you believe your creation was effective or ineffective.
- ☐ **Surprises**
  What surprised you the most when you were creating? What did you learn?

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Mini STEAM Journal

What is the problem?

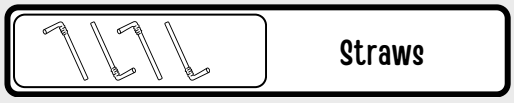
How can we create a boat that uses wind power to move across water?

DIAGRAM

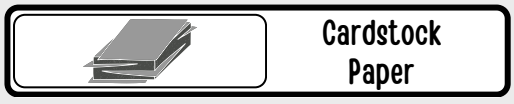
Draw and label your problem-solving design.

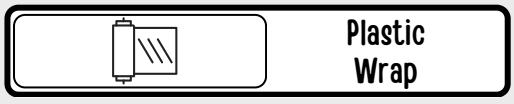
Materials Available

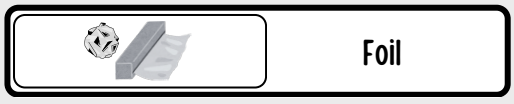
Popsicle Sticks

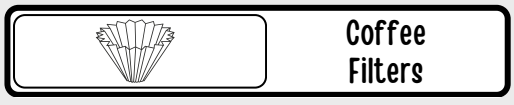

Straws

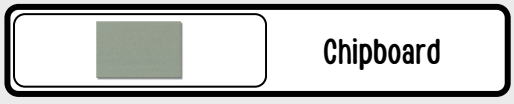
Pipe Cleaners


Cardstock Paper


Plastic Wrap


Foil


Coffee Filters


Chipboard

DIAGRAM

TESTING RESULTS

Check the box if the design met the requirement.

- ☐ The boat floats.
- ☐ Figurine stays dry during testing.
- ☐ No water enters the boat.
- ☐ Boat moves from start to finish.

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Engineering STEAM Journal

Wind Powered Boats

Name:

S.T.E.A.M

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Engineering STEAM Journal

Wind Powered Boats

Name:

S.T.E.A.M

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Mini STEAM Journal

What is the problem?

How can we create a boat that uses wind power to move across water?

DIAGRAM

Draw and label your problem-solving design.

Materials Available

Popsicle Sticks

Straws

Pipe Cleaners

Cardstock Paper

Plastic Wrap

Foil

Coffee Filters

Chipboard

DIAGRAM

TESTING RESULTS

Check the box if the design met the requirements.

- ☐ The boat floats.
- ☐ Figurine stays dry during testing.
- ☐ No water enters the boat.
- ☐ Boat moves from start to finish.

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Mini STEAM Journal

What is the problem?

How can we create a boat that uses wind power to move across water?

DIAGRAM

Draw and label your problem-solving design.

Materials Available

Popsicle Sticks

Straws

Pipe Cleaners

Cardstock Paper

Plastic Wrap

Foil

Coffee Filters

Chipboard

DIAGRAM

TESTING RESULTS

Check the box if the design met the requirements.

- ☐ The boat floats.
- ☐ Figurine stays dry during testing.
- ☐ No water enters the boat.
- ☐ Boat moves from start to finish.

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STEAM Research

FLOATING

Boats stay on top of water because of a special force called buoyancy. When a boat is placed in water, it pushes some water out of the way. The water then pushes back on the boat, helping it to float.For a boat to float, it needs to be lighter than the amount of water it pushes aside. If the boat is too heavy, it will sink.

SAILBOATS

Sailboats are special boats that use wind to move across water. They have large pieces of fabric called sails that catch the wind, much like a kite catches the air. When the wind blows against the sail, it pushes the boat forward. To control where the boat goes, sailboats have a flat piece called a rudder under the water at the back of the boat.

SAILS

The sails on a sailboat are usually shaped like triangles or rectangles. This special shape helps them catch the wind more effectively. The angle at which the sail is positioned also matters. Sailors can adjust the sails to catch the wind from different directions. By changing the angle of the sail, they can make the boat go faster or steer it in a certain direction.

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STEAM Research Recap

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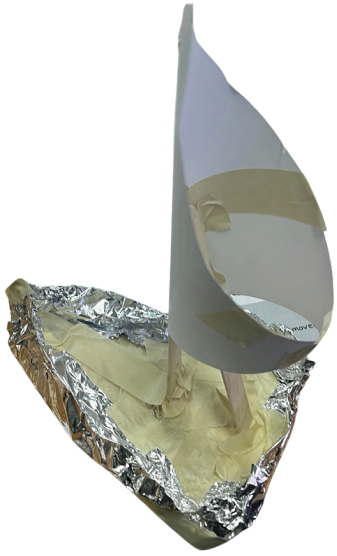
Engineering Student Examples

Met the Criteria

Rectangular design with high sides, no holes, and large sail. The curved design and balanced placement of the support allowed the light boat to move quickly.



Triangular design with high sides, no holes, and large curved sail with multiple supports.

Rectangular design with high sides, no holes, and a large sail with multiple supports. Would have worked better if the sail wasn't in the very front of the boat. Lots of spinning.

Did Not Meet the Criteria

The bottom of the boat is flat, allowing water to instantly flood the deck. The sail was also too small and flat to be moved by the air.

The sail is not supported enough to stand on its own. Therefore, it falls and is unable to move the boat.

Effective design shape but the use of foil led to the sail ripping once hit with air. Unable to move the boat.

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Name: **Project: Wind Powered Boats**

Teacher Rubric

Engineering, Short Version

STEAM Skills

Category	4	3	2	1
Critical Thinking -formulating ideas	Developed a well thought-out and detailed plan to solve the problem.	Able to formulate a plan to solve the problem independently.	Struggled to come up with an idea to solve the problem and required assistance.	Was unable to come up with an idea to solve the problem.
Communication -sharing ideas	Able to effectively share both the "what" and "why" about their design while citing evidence.	Able to effectively share both the "what" and "why" about their design.	Effectively shares the "what" of their design with others but unable to articulate the "why".	Unable to share ideas with others. No "what" or "why".
Communication -giving feedback	Gives meaningful feedback to others that helps them improve their work.	Gives meaningful and respectful feedback to others.	Gives respectful feedback to others, but the feedback may not be helpful.	Unable to give respectful feedback to others.
Creativity	Original creation that may be inspired by another source, and includes unique elements.	Original creation that may include elements from other sources.	Creation is similar to an idea from another source.	Creation closely copied ideas from another source.
Critical Thinking -making changes	Made necessary changes while building, showing reflection on challenges faced and responding appropriately.	Made necessary changes while building, based on the results.	Hesitant to make necessary changes when needed.	Unable to respond to challenges or make necessary changes when needed.
Overall Score	**16+**	**11-15**	**7-10**	**<6**

Project Specific Results

Constraints	*Attitude*	*Perseverance*	*Building Skills*	*Feedback*
Did the individual follow all constraints? **Yes No**	Did the individual maintain a positive attitude while working on the project? **Yes No**	Did the individual persevere when the project became challenging? **Yes No**	Was the individual able to build the project on their own? **Yes No**	

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Name: **Project: Wind Powered Boats**

Teacher Rubric

Engineering, Short Version

STEAM Skills

Category	4	3	2	1
Critical Thinking -formulating ideas	Developed a well thought-out and detailed plan to solve the problem.	Able to formulate a plan to solve the problem independently.	Struggled to come up with an idea to solve the problem and required assistance.	Was unable to come up with an idea to solve the problem.
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Did the individual follow all constraints? **Yes No**	Did the individual maintain a positive attitude while working on the project? **Yes No**	Did the individual persevere when the project became challenging? **Yes No**	Was the individual able to build the project on their own? **Yes No**	

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Name: **Project: Wind Powered Boats**

Self Rubric

Short Version

STEAM Skills

Category	4	3	2	1
Critical Thinking -formulating ideas	I thought of a clear and detailed idea to solve the problem.	I was able to think of an idea to solve the problem all by myself.	I thought of an idea with some help.	I couldn't think of an idea.
Communication -sharing ideas	I explained both what my idea is and why I think it's a good idea, giving details and proof.	I explained what my idea is and why I chose it, with details.	I was able to say what my idea is, but I couldn't explain why I chose it.	I did not tell anyone my ideas.
Communication -giving feedback	I gave others helpful feedback with enough details so they could make changes.	I gave feedback to others that was kind and helpful.	I gave kind and respectful feedback to others.	I did not give feedback to others, or the feedback I gave was not kind.
Creativity	My idea is new. I added things that no one has seen before.	My idea is new. I used things I've seen before, but I put them together in a new way.	My idea is like something that has been made before.	My idea looks like something that has been made before.
Critical Thinking -making changes	I made changes to my plan based on my mini-tests and reflections.	I made changes to my plan while I was building.	I made only a few changes to my plan while I was building.	I didn't make any changes to my plan.
Overall Score	**16+**	**11-15**	**7-10**	**<6**

Project Specific Results

Constraints	*Attitude*	*Perseverance*	*Building Skills*	*Reflections*
Did you follow all constraints? **Yes No**	Did you keep a positive attitude while working on the project? **Yes No**	Did you persevere when the project got difficult? **Yes No**	Were you able to build your project on your own? **Yes No**	

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Name: **Project: Wind Powered Boats**

Self Rubric

Short Version

STEAM Skills

Category	4	3	2	1
Critical Thinking -formulating ideas	I thought of a clear and detailed idea to solve the problem.	I was able to think of an idea to solve the problem all by myself.	I thought of an idea with some help.	I couldn't think of an idea.
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Project Specific Results

Constraints	*Attitude*	*Perseverance*	*Building Skills*	*Reflections*
Did you follow all constraints? **Yes No**	Did you keep a positive attitude while working on the project? **Yes No**	Did you persevere when the project got difficult? **Yes No**	Were you able to build your project on your own? **Yes No**	

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Name: **Project: Wind Powered Boats**

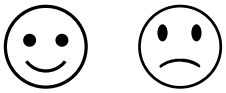
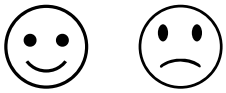
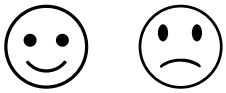
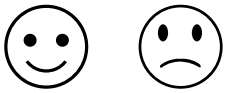
Self Rubric

Short Version

STEAM Skills

Category	4	3	2	1
Critical Thinking -formulating ideas	I thought of an idea and made a plan for it.	I thought of an idea.	Someone helped me think of my idea.	I had no idea.
Communication -sharing ideas	I told my partner my "what" and "why" with details.	I told my partner my "what" and "why".	I told my partner my "what".	I did not talk to my partner.
Communication -giving feedback	My partner changed their plan because of my feedback.	I helped my partner and used kind words.	I used kind words when talking to my partner.	I did not talk to my partner.
Creativity	My idea is new. I included parts that no one has seen before.	My idea is new.	My idea looks like something I've seen before, but it has a few differences.	My idea looks like something I have seen before.
Critical Thinking -making changes	I changed my plan when something didn't work.	I changed my plan three or more times.	I changed my plan one or two times.	I made my plan.
Overall Score	16+	11-15	7-10	<6

Project Specific Results

Constraints	*Attitude*	*Perseverance*	*Building Skills*	*Reflections*
Did you follow all rules for the build? 	Did you keep a positive attitude while working on the project? 	Did you keep trying when the project got hard? 	Were you able to build your project on your own? 	Draw an emoji that shows how you felt about this project.

Name: **Project: Wind Powered Boats**

Self Rubric

Short Version

STEAM Skills

Category				
	4	3	2	1
Critical Thinking -formulating ideas	I thought of an idea and made a plan for it.	I thought of an idea.	Someone helped me think of my idea.	I had no idea.
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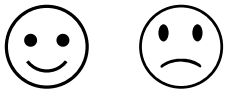
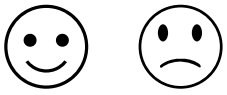
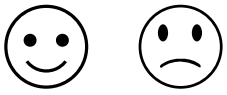
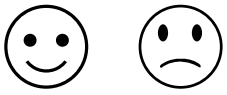
Project Specific Results

Constraints	*Attitude*	*Perseverance*	*Building Skills*	*Reflections*
Did you follow all rules for the build? 	Did you keep a positive attitude while working on the project? 	Did you keep trying when the project got hard? 	Were you able to build your project on your own? 	Draw an emoji that shows how you felt about this project.

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Class Recording Sheet

Project: Wind Powered Boats

Student	Critical Thinking -formulating ideas	Communicate -sharing ideas	Communicate -giving feedback	Creativity	Critical Thinking -making changes

Class Recording Sheet

Project: Wind Powered Boats

Student	Constraint Adherence	Attitude	Perseverance	Building Skills	Completion

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My STEAM Goals

Name:

Project: Wind Powered Boats

Creativity	Critical Thinking	Communication	Collaboration	STEAM Skills
I can come up with new ways to solve problems that no one has thought of before.	I can think of ways to solve problems using my own ideas.	I can share my ideas with others. I talk when it's my turn and listen when it's someone else's turn.	I can work with others on STEAM projects safely- physically and emotionally.	I can complete STEAM projects.
I can make creations using my own ideas.	I can make changes when necessary, based on results.	I can share both my "what" and my "why" with others. I can justify my thinking.	I can help my team. I can contribute to my team projects.	I can keep a positive attitude when creating.
I can follow steps, but I can also add my own special touch when it makes sense.	I can see how things I learn or do are connected to each other.	I can give others meaningful feedback.	I can use my best skills to help my team.	I can persevere when things get hard.
If my idea doesn't work, I can try again.	I can follow constraints while meeting my criteria for success.	I can identify good feedback and make changes based on it.	I can encourage my teammates and positively impact our group.	I can be a creator. I can create without assistance.

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My STEAM Goals

Name:

Project: Wind Powered Boats

Creativity	Critical Thinking	Communication	Collaboration	STEAM Skills
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My STEAM Goals

Name:

Project: Wind Powered Boats

Science	Technology	Engineering	Art	Math
I can make a hypothesis.	I can use technology to share ideas.	I can build things to solve problems.	I can make predictions about how art is made.	I can use math to solve problems.
I can follow procedure directions and complete projects.	I can use coding and/or robotics to solve problems.	I can share my ideas with others.	I can follow art procedures to create masterpieces.	I can use math principles when making artwork.
I can make conclusions about scientific principles.	I can use technology in new ways.	I can work with others to create solutions to problems.	I can add my own creativity to my artwork.	I can use math skills when following science procedures.
I can work with others on STEAM projects safely.	I can keep a positive attitude when creating.	I can identify problems with my ideas and make changes.	I can persevere when things get hard.	I can be a creator. I create without assistance.

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My STEAM Goals

Name:

Project: Wind Powered Boats

Science	Technology	Engineering	Art	Math
I can make a hypothesis.	I can use technology to share ideas.	I can build things to solve problems.	I can make predictions about how art is made.	I can use math to solve problems.
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Testing Markers

Print, cut out, and place the following items in the corresponding locations of your testing area.

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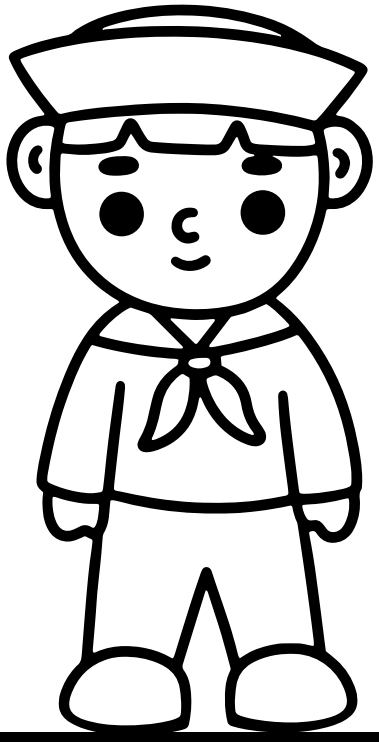
Figurine

Use this template to represent your creation.
Cut around the figurine and tabs, making sure to cut along the outside of both to create one piece.
Wrap the tabs into a circle and adhere over the stars.



Cut on the dotted line.
Staple or tape the stars together.
This helps it stand up!

Place your name on the strip or give your figurine a name!

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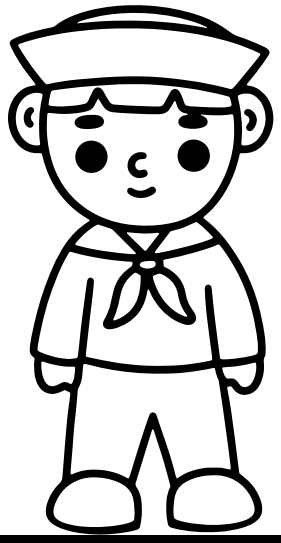
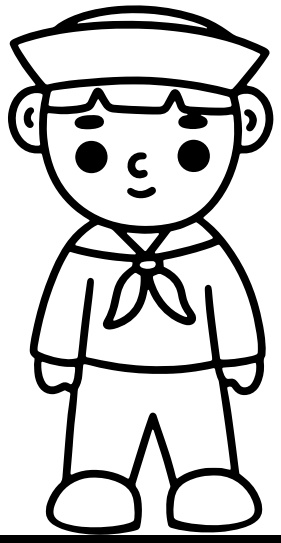
Cut on the dotted line.
Staple or tape the stars together.
This helps it stand up!



Place your name on the strip or give your figurine a name!



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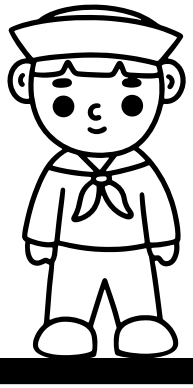

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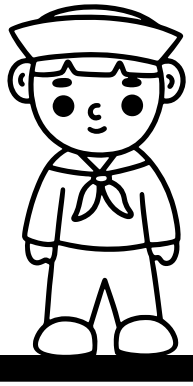

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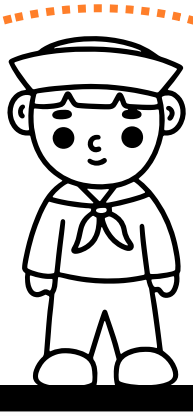

Place your name on the strip or give your figurine a name!

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Engineering Design Process

We have created our own Engineering Design Process, which is similar to the traditional process; however, our version has been modified to better meet students' needs.

We offer two versions of our Engineering Design Process lessons: short and full-length. We recommend completing the full version whenever possible, as the short version is intended for situations with time or material constraints.

The full version is preferred because it allows students to build schema before making a final build. In Step 2 of our Engineering Design Process (EDP), students complete an initial small build, helping them develop key understanding before tackling a large-scale project. This is important for two reasons. First, it allows students to experience failure in a low-stakes environment, making the initial exploration a valuable learning opportunity and helping them become comfortable with the challenge before they are expected to succeed. Second, collaboration is a key aspect of STEAM, and the next phase is designed to be a large-scale collaborative build.

Through years of teaching, we have learned that asking students to collaborate before they have had the opportunity to create their own ideas can lead to frustration and collaboration issues. After adding the initial exploration step to our EDP, we observed significant improvements in collaboration skills and student enjoyment, as well as more successful student creations. The full version is specifically designed for STEAM engineering challenges that target critical thinking skills.

A full-length challenge typically takes 2.5 to 4 hours to complete. We recommend breaking the lesson into multiple sessions. Suggested stopping points include: after completing the initial exploration builds, after finishing the final build diagram, and halfway through the creation process.

Short Versions

So why do we even have short versions?

LIFE

We all know that sometimes an extremely lengthy STEAM challenge is not realistic given the limited time educators have available. In the short version, students do not complete an initial exploration—only a final build. These are not intended to be completed collaboratively, but they can be if you feel confident in your students' abilities.

VARIETY

Some students do not enjoy working collaboratively. As a result, we recommend using a 2:1 ratio for building challenges: two collaborative challenges for every one individual challenge. This ratio provides a good balance without diminishing the value of collaboration in STEAM.

CREATIVITY

We believe that creativity-focused engineering design challenges play an important role in a STEAM curriculum, and these challenges are usually best completed individually. Therefore, creativity-focused engineering lessons will typically be offered as short versions.

Short versions typically take about 1 to 2 hours to complete. Giving students time limitations may be necessary. The lesson can also be split into multiple days.

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About Our Products

We create engineering (both short and full-length), science, and art lessons/activity challenges for students and families. Each lesson includes a variety of accompanying resources. STEAM journals and presentation slides have been created using the Canva website (www.canva.com).

Before teaching a lesson, be sure to review our lesson plan with embedded materials sheet, teacher tips and tricks, student work examples, STEAM journal sheets, figurines (engineering only), research pages, and presentation slides. All of our lessons include a wide range of resources to support your success. Since our lessons are designed from a STEAM perspective, their structure differs from traditional art, science, or engineering lessons. As a result, we have provided as many resources as possible to help you guide your students through a STEAM lesson.

All of our lessons are centered around building critical thinking and creativity skills. They also include numerous opportunities for communication and collaboration, as we believe that developing these four skills—critical thinking, creativity, communication, and collaboration—is what makes STEAM truly important and why we are passionate about these lessons.

Thank you!

Thank you for purchasing a product from Dakota STEAM Learning LLC!
Our goal is to provide other educators with the same success we have seen in our own classrooms.

Dakota STEAM does not guarantee any specific results from participation in the activities. Participation does not ensure any particular level of academic success or the attainment of any specific skill set.

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If you have any questions about the resources, please contact admin@dakotasteamlearning.com

Thank you,

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