



STEAMatWork4Kids Lesson Plan – Science (Primary and Secondary)

Lesson Title	SOLUTIONS AND TRADEOFFS
Objectives	<p>Primary and secondary: Students find a topic of interest in the STEAMatWork4Kids.org website. Students research that topic and learn what is causing the problem, then brainstorm ideas for solutions.</p> <p>Secondary students only: Create a tradeoff matrix to determine pros and cons of their solutions.</p>
NGSS Standards	<p>3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p> <p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem . . .</p> <p>MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution . . .</p> <p>MS-ETS1-2 Evaluate competing design solutions using a tradeoff matrix . . .</p>
Materials	<ul style="list-style-type: none">• Laptop or tablet cart (1 laptop per pair/student) & LCD projector and/or Promethean Board• Primary: The first page of the Solutions and Tradeoffs Worksheet (below)• Secondary: Both pages of the Solutions and Tradeoffs Worksheet (below)
Procedure	<p>Part I: Explore website and demonstrate the activity using an example</p> <p>Primary and Secondary Students:</p> <ul style="list-style-type: none">• Introduce students to STEAMatWork4Kids.org website by exploring one interview together in a computer lab or on a Promethean Board. Visit the suggested websites after the article.• Ask students to imagine they are that scientist, working on this problem. For example, if you're looking at the interview with Danielle Dixson, she is investigating is coral reef degradation. Show them how to fill in the first page of "Solutions and Tradeoffs Worksheet" using coral as an example.• What specific problems are causing coral degradation? For coral reefs you would mention warming oceans, overfishing, pollution and ocean water acidification.• Ask students to brainstorm ideas that might solve the problem.• Discuss the pros and cons of their solutions. <p>Now let the students choose an interview with someone who is working to solve a problem. They may work in small groups, individually, or as a whole class. Ask them to fill out the first page of the "Solutions and Tradeoffs Worksheet" on their own. They will need to do research to find out what is causing the problem. Ask them to brainstorm some solutions. Share their ideas in pairs. Discuss as a whole group if time permits.</p>



Secondary students only:

- Build a tradeoff matrix for the coral reef problem to demonstrate how it works. Choose the best four solutions.
- Discuss the ratings of each of the four solutions. Discussion should include long-term, short-term issues and possible unintended consequences.
- Can you choose features of several solutions to build an even better solution?

Your tradeoff matrix for coral reef degradation might look something like this:

Possible Solutions	Make 3-d coral where new coral can grow	Grow genetically-altered (heat-resistant) corals	Cool the water surrounding reefs	Install solar panels on all buildings to slow climate change
Feasible	5	4	2	1
Affordable	3	1	1	2
Easy to maintain	3	3	1	3
Eco-Friendly	4	2	5	5
Effective	1	2	5	2
Total	16	12	14	13

Part II: Make your own Tradeoff matrix

- Students go back to their "Solutions and Tradeoffs Worksheet." This time they will fill out page 2.
- Fill in the top row with their best four solutions.
- In small groups or as a whole class, students rank their solutions on a scale of 1-5. Emphasize that they need to take unintended consequences into account.

Part III: Sharing and Discussion

- If time permits, students present their tradeoff Table with the class. What do they feel is the best solution?



Name(s) _____

SOLUTIONS AND TRADEOFFS WORKSHEET

Topic	<p>Chose an interview topic that could use a technological solution, e.g. threatened grizzly bear or whale populations, sleep problems, better car design, plant disease, etc.</p> <p>Name of STEM professional from www.STEAMatWork4Kids.org :</p> <p>Title of the interview:</p> <p>What problem is this person trying to solve?</p>												
Problem to Solve	<p>What specific things are causing the problem? This will require some research. List your ideas below.</p> <table><tr><td>1.</td><td>4.</td></tr><tr><td>2.</td><td>5.</td></tr><tr><td>3.</td><td>6.</td></tr></table>	1.	4.	2.	5.	3.	6.						
1.	4.												
2.	5.												
3.	6.												
Finding a good solution	<p>Brainstorm ways that technology could help solve that problem.</p> <table><tr><td>1.</td><td>7.</td></tr><tr><td>2.</td><td>8.</td></tr><tr><td>3.</td><td>9.</td></tr><tr><td>4.</td><td>10.</td></tr><tr><td>5.</td><td>11.</td></tr><tr><td>6.</td><td>12.</td></tr></table>	1.	7.	2.	8.	3.	9.	4.	10.	5.	11.	6.	12.
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2.	8.												
3.	9.												
4.	10.												
5.	11.												
6.	12.												



Build a Tradeoff Matrix below:

(secondary)

List your four best ideas for solutions across the top row of the table (A-D). You can use the given tradeoff criteria (effectiveness etc) on the table or cross them out and come up with your own.

Discussion each solution and rate it on a scale of 1-5. "1" means it has problems. "5" means it has this attribute.

Solution	A.	B.	C.	D.
Feasible				
Affordable				
Easy to maintain				
Eco-friendly				
Effective				
Total				

Are there features in two or more solutions that you could combine to make the best solution?

If you were trying to solve this problem, how would you invest your time and money?