

Introduction

Formative Assessment Exemplar- K.3.2

Introduction:

The following formative assessment exemplar was created by a team of Utah educators to be used as a resource in the classroom. It was reviewed for appropriateness by a Bias and Sensitivity/Special Education team and by state science leaders. While no assessment is perfect, it is intended to be used as a formative tool that enables teachers to obtain evidence of student learning, identify gaps in that learning, and adjust instruction for all three dimensions (i.e., Science and Engineering Practices, Crosscutting Concepts, Disciplinary Core Ideas) included in a specific Science and Engineering Education (SEEd) Standard.

In order to fully assess students' understanding of all three dimensions of a SEEd standard, the assessment is written in a format called a cluster. Each cluster starts with a phenomenon, provides a task statement, necessary supporting information, and a sequenced list of questions using the gather, reason, and communicate model (Moulding et al., 2021) as a way to scaffold student sensemaking. The phenomenon used in an assessment exemplar is an analogous phenomenon (one that should not have been taught during instruction) to assess how well students can transfer and apply their learning in a novel situation. The cluster provides an example of the expected rigor of student learning for all three dimensions of a specific standard. In order to serve this purpose, this assessment is NOT INTENDED TO BE USED AS A LESSON FOR STUDENTS.

Because this assessment exemplar is a resource, teachers can choose to use it however they want for formative assessment purposes. It can be adjusted and formatted to fit a teacher's instructional needs. For example, teachers can choose to delete questions, add questions, edit questions, or break the tasks into smaller segments to be given to students over multiple days.

Of note: All formative assessment clusters were revised based on feedback from educators after being utilized in the classroom. During the revision process, each cluster was specifically checked to make sure the phenomena was authentic to the DCI, supporting information was provided for the phenomena, the SEPs, CCCs, and DCIs were appropriate for the learning progressions, the cluster supported student sensemaking through the Gather, Reason, and Communicate instructional model, and the final communication prompt aligned with the cluster phenomena. As inconsistencies were found, revisions were made to support student sensemaking. If other inconsistencies exist that need to be addressed, please email the current Utah State Science Education Specialists with feedback.

General Format:

Each formative assessment exemplar contains the following components:

1. Teacher Facing Information: This provides teachers with the full cluster as well as additional information including the question types, alignment to three dimensions, and answer key. Additionally, an example of a proficient student answer and a proficiency scale for all three dimensions are included to support the evaluation of the last item of the assessment.
2. Students Facing Assessment: This is what the student may see. It is in a form that can be printed or uploaded to a learning platform. (Exception: Questions including simulations will need technology to utilize during assessment.)

Accommodation Considerations:

Teachers should consider possible common ways to provide accommodations for students with disabilities, English language learners, students with diverse needs or students from different cultural backgrounds. For example, these accommodations may include: Providing academic language supports, presenting sentence stems, or reading aloud to students. All students should be allowed access to a dictionary.

References:

Moulding, B., Huff, K., & Van der Veen, W. (2021). *Engaging Students in Science Investigation Using GRC*. Ogden, UT: ELM Tree Publishing.

Teacher Facing Info

Teacher Facing Information

Standard: K.3.2

Analyze data to determine how a **design solution** causes a change in the speed or direction of an object with a push or a pull. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, or knockdown other objects. (PS2.A, PS2.B, PS2.C, PS3.C, ETS1.A, ETS1.B, ETS1.C)

(Each standard is a student performance expectation that includes all three dimensions of science.)

This is an engineering standard.

Assessment Format: Online and Print (with alternative Read-Aloud)


Phenomenon	
<p>A child sees a friend swinging on a swing without someone pushing him. He wants to figure out how he can do it, too.</p>  <p>https://www.flickr.com/photos/avlxyz/33578866348/in/photos_tream/</p>	<p>Proficient Student Explanation</p> <p>To swing on your own, straighten your legs to push forward and pull your legs under to go backwards.</p>
Cluster Task Statement	
<p>Use the information below to investigate and answer questions about how you can make a swing move.</p> <p>(Alternate Read-Aloud: see Appendix 1)</p>	
Supporting Information	
<p>View the video to answer the question below.</p> <p>How to SWING on a Swing Set!! (Easy for Kids)</p> <p>(Alternate Read-Aloud: see Appendix 1)</p>	

Table 1: Swing movement tests











Test 1  Child stands behind the swing and pushes the swing.	swing moves forward 
Test 2  Child stands behind the swing and pulls the swing.	swing moves back 

Table 2 : Observations of child swinging. [How to SWING on a Swing Set!! \(Easy for Kids\)](#) show with sound off.


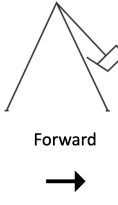
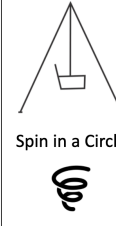
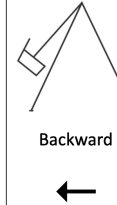

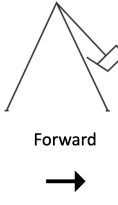
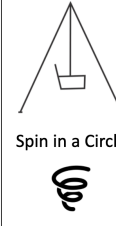
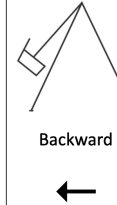

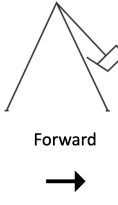
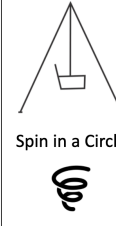
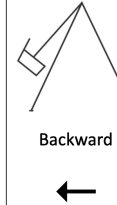

Observation 1  Child sits on a swing and pushes legs out straight in front.	swing moves forward 
Observation 2  Child sits on the swing and pulls legs underneath the swing.	swing moves back 
Observation 3 Child sits on a swing and moves legs side to side.	Swing does not move forward or back 
Observation 4 Child sits on a swing but doesn't move legs or arms	Swing does not move in any direction 

Cluster Questions

Gather:
 Cluster Question #__1__
 Question Type: multiple select
 Addresses:
 X__ DCI: (PS2.A) The speed or direction of an object changes with a push or pull.
 X__ SEP: Analyzing and

Question 1




What questions would help the child find out how to keep the swing going. Check two

<p>Interpreting Data</p> <p>X___ CCC: Cause and Effect</p> <p>Answer:</p> <p>What does the boy do with his legs when he swings?</p> <p>What makes the swing move?</p>	<div><p>Question 1</p><p>What questions would help the child find out how to keep the swing going? Check two.</p><table><tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr><tr><td>How many swings are there?</td><td>What does the boy do with his legs when he swings?</td><td>How high is the boy swinging?</td><td>What makes the swing move?</td></tr></table></div>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many swings are there?	What does the boy do with his legs when he swings?	How high is the boy swinging?	What makes the swing move?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
How many swings are there?	What does the boy do with his legs when he swings?	How high is the boy swinging?	What makes the swing move?						
<p>Gather:</p> <p>Cluster Question #__1__</p> <p>Question Type: multiple select</p> <p>Addresses:</p> <p>X___ DCI: (PS2.A) The speed or direction of an object changes with a push or pull.</p> <p>X___ SEP: Analyzing and Interpreting Data</p> <p>X___ CCC: Cause and Effect</p> <p>Answer:</p> <p>forward arrow</p> <p>→</p> <p>backward arrow</p> <p>←</p>	<div><p>Question 2</p><p>Using Table 1, color the two boxes that show which ways a swing moves when you push and pull your legs forward and backward.</p><div><p>Question 2</p><p>Using Table 1, color the two boxes that show which way the swing moves when you push and pull it.</p><table><tr><td></td><td></td><td></td><td></td></tr><tr><td>No Movement</td><td>Forward</td><td>Spin in a Circle</td><td>Backward</td></tr></table></div></div>					No Movement	Forward	Spin in a Circle	Backward
									
No Movement	Forward	Spin in a Circle	Backward						
<p>Reason:</p> <p>Cluster Question #__2__</p> <p>Question Type: multiple choice</p> <p>Addresses:</p> <p>X___ DCI: (PS2.A, PS2.C) The speed or direction of an object changes with a push or pull. An object stays still or moves dependent on pushes and pulls.</p> <p>X___ SEP Constructing Explanation and Designing Solutions</p> <p>X___ CCC cause and effect</p> <p>Answer:</p> <p>forward</p>	<div><p>Question 3</p><p>Using Table 2, circle the arrow that shows which way the swing will go if you push your legs out straight.</p><div><p>Question 3</p><p>Using Table 2, circle the arrow that shows which way the swing will go if you push your legs out straight.</p><div></div><p>https://images.emo-pin.com/psf2016/0001148</p></div></div>								
<p>Reason:</p>	<p>Question 4</p>								

backward

Diagram illustrating the motion of a child on a swing. The child is shown in the middle of a swing cycle, with arrows indicating the direction of motion (left and right). The URL <https://images.sno.com/api/v2/images/7c7c617a> is provided below the image.

Answer: 1

<p>1</p>  <p>https://youtu.be/3UxvCtGfGg</p> <p>Walk the swing back with my legs then push forward.</p>	<p>2</p>  <p>http://www.youtube.com/watch?v=QnqkzKwPc7E&list=PL7B3d3d11</p> <p>Turn the swing around in a circle</p>	<p>3</p>  <p>http://www.youtube.com/watch?v=QnqkzKwPc7E&list=PL7B3d3d11</p> <p>Sit on the swing and keep your body still</p>
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True or False. Communicate what you know about pushes and pulls.

Constructing Explanations and Designing Solutions

X__ CCC Cause and Effect

Answer:

True

False

True

False

Question 6

True or False. Communicate what you know about pushes and pulls.

Pushes and pulls can move the swing.



The swing will move if I sit on it without moving my body.



If I push and pull my legs forward and backward the swing will keep moving.



If I move my legs side to side the swing will move forward and backward.



Proficiency Scale

Proficient Student Explanation

To swing on your own, straighten your legs to push forward and pull your legs under to go backwards.

Level 1 - Emerging	Level 2 - Partially Proficient	Level 3 - Proficient	Level 4 - Extending
SEP: Does not meet the minimum standard to receive a 2.	SEP: With prompting, record information (observations, thoughts, and ideas). With prompting, use observations (firsthand or from media) to describe patterns and/or relationships in	SEP: Record information (observations, thoughts, and ideas). Use and share pictures, drawings, and/or writings of observations. Use observations (firsthand or from media) to describe	SEP: Extends beyond proficient in any way.

	<p>the natural and designed world(s) in order to answer scientific questions and solve problems.</p> <p>With guidance, analyze data from tests of an object or tool to determine if it works as intended.</p>	<p>patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.</p> <p>Compare predictions (based on prior experiences) to what occurred (observable events).</p> <p>Analyze data from tests of an object or tool to determine if it works as intended</p>	
<p>CCC: Does not meet the minimum standard to receive a 2.</p>	<p>CCC: With support, identify observable patterns to describe the causes of events.</p> <p>With guidance, designs simple tests to gather evidence to support or refute ideas about causes.</p>	<p>CCC: Identify observable patterns to describe the causes of events.</p> <p>Designs simple tests to gather evidence to support or refute ideas about causes.</p>	<p>CCC: Extends beyond proficient in any way.</p>
<p>DCI: Does not meet the minimum standard to receive a 2.</p>	<p>DCI: With guidance, record information (observations, thoughts, ideas). Use and share pictures, drawings, and/or writings of observations.</p>	<p>DCI: Record information (observations, thoughts, ideas). Use and share pictures, drawings, and/or writings of observations.</p>	<p>DCI: Extends beyond proficient in any way.</p>

	<p>With guidance, use observations to describe patterns and/or relationships in order to answer scientific questions and solve problems.</p> <p>With guidance, compare predictions (based on prior experiences) to what occurred (observable events).</p> <p>With guidance analyze data from tests of an object or tool to determine if it works as intended</p>	<p>Use observations to describe patterns and/or relationships in order to answer scientific questions and solve problems.</p> <p>Compare predictions (based on prior experiences) to what occurred (observable events).</p> <p>Analyze data from tests of an object or tool to determine if it works as intended</p>	
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(Student Facing Format on following page)

Student Assessment

Name _____ Date _____

Stimulus

A child sees a friend swinging on a swing without someone pushing him. He wants to figure out how he can do it, too.

Figure 1: children playing on swings



<https://www.flickr.com/photos/avxyz/33578866348/in/photostream/>

Your Task

Use the information below to investigate and answer questions about how you can make a swing move.

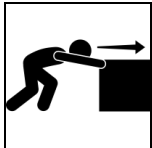



(Alternate Read-Aloud: see Appendix 1)

Question 1

What questions would help the child find out how to keep the swing going? Check two.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How many swings are there?	What does the boy do with his legs when he swings?	How high is the boy swinging?	What makes the swing move?

Table 1: Swing movement tests

Test 1  Child stands behind the swing and pushes the swing.	swing moves forward 
Test 2  <small>Created by Adrien Coquet from Noun Project</small> Child stands behind the swing and pulls the swing.	swing moves back 

Question 2

Using Table 1, color the two boxes that show which way the swing moves when you push and pull it.

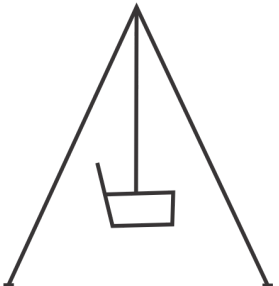

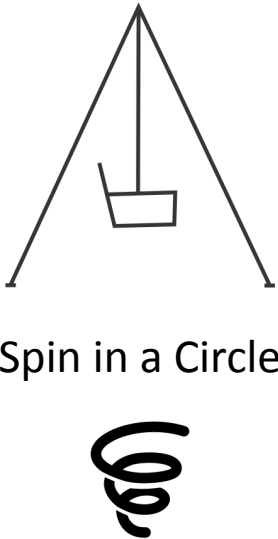
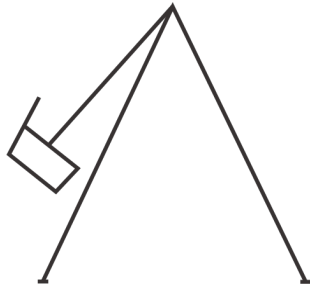




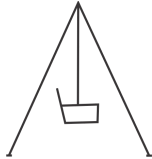

 <p>No Movement</p>	 <p>Forward</p> <p>→</p>	 <p>Spin in a Circle</p>	 <p>Backward</p> <p>←</p>
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Table 2 : Observations of child swinging. [How to SWING on a Swing Set!! \(Easy for Kids\)](#) show with sound off.

<p>Observation 1</p>  <p>Child sits on a swing and pushes legs out straight in front.</p>	<p>swing moves forward</p> 
<p>Observation 2</p>  <p>Child sits on the swing and pulls legs underneath the swing.</p>	<p>swing moves back</p> 
<p>Observation 3</p> <p>Child sits on a swing and moves legs side to side.</p>	<p>Swing does not move forward or back</p> 
<p>Observation 4</p> <p>Child sits on a swing but doesn't move legs or arms</p>	<p>Swing does not move in any direction</p> 

Question 3

Using Table 2, circle the arrow that shows which way the swing will go if you push your legs out straight.



<https://images.app.goo.gl/peP8W4aKyaDC8TLe8>

Question 4

Using Table 2, circle the arrow that shows which way the swing will go if you pull your legs in?

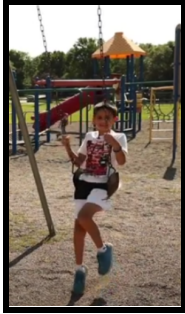


<https://images.app.goo.gl/af3VzaG7xPyS6T1o7>

Question 5

How would you start your swing moving forward and backward? Circle the number in the box.

1



<https://youtu.be/F0uCFrlr10Q>

Walk the swing back with my legs then push forward.

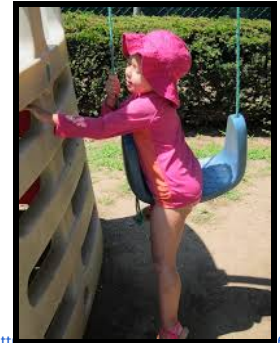
2



<https://www.flickr.com/photos/joeshlabotnik/44767563171>

Turn the swing around in a circle

3











<http://www.flickr.com/photos/joeshlabotnik/44767563171>

Sit on the swing and keep your body still

Question 6

True or False. Communicate what you know about pushes and pulls.

Pushes and pulls can move the swing.		
The swing will move if I sit on it without moving my body.		
If I push and pull my legs forward and backward the swing will keep moving.		
If I move my legs side to side the swing will move forward and backward.		

Appendix 1

Alternate Read-Aloud Text: How to Keep a Swing Moving



<https://www.youtube.com/watch?v=F0uCFRlI0Q>

Today you will learn how to swing on a swing all by yourself. First, you have to sit in the swing. Place the swing under your legs and hold on to the chains so your hands feel comfortable.



<https://www.youtube.com/watch?v=F0uCFRiI0Q>

To start swinging, you walk your legs back as far as you can and then lift your feet. Your swing will start moving.



<https://www.youtube.com/watch?v=F0uCFIrlI0Q>

There are two motions on a swing, the forward motion and the backward motion. When in the forward motion, you lean back and push your legs straight out in front of you.



<https://www.youtube.com/watch?v=F0uCFRil0Q>

When in the backward motion, you will sit up tall, pull your legs back and tuck your feet under you.



<https://www.youtube.com/watch?v=F0uCElril0Q>

Now you just repeat the two motions over and over again. Lean back, push your legs forward, sit up and pull your feet in. Lean back, push your legs forward, sit up and tuck your feet.

Do these things and you will be having fun swinging before you know it!