Student: Haley

GLCE/Learning Goal:
P.FM.05.41 .42

Assessment task description and rationale:
Students were asked to "Answer the question: What happens when you sled?" There was space on the bottom of the page for students to draw diagrams or pictures to illustrate their ideas. The drawing was not required.

This was the question that they answered throughout the unit. They used carts and ramps to model sledding.

Assessment features:

We Move:

- Gravity is the force that causes the sled to move down the hill.
- Gravity pulls objects towards the center of the Earth.

We Speed:

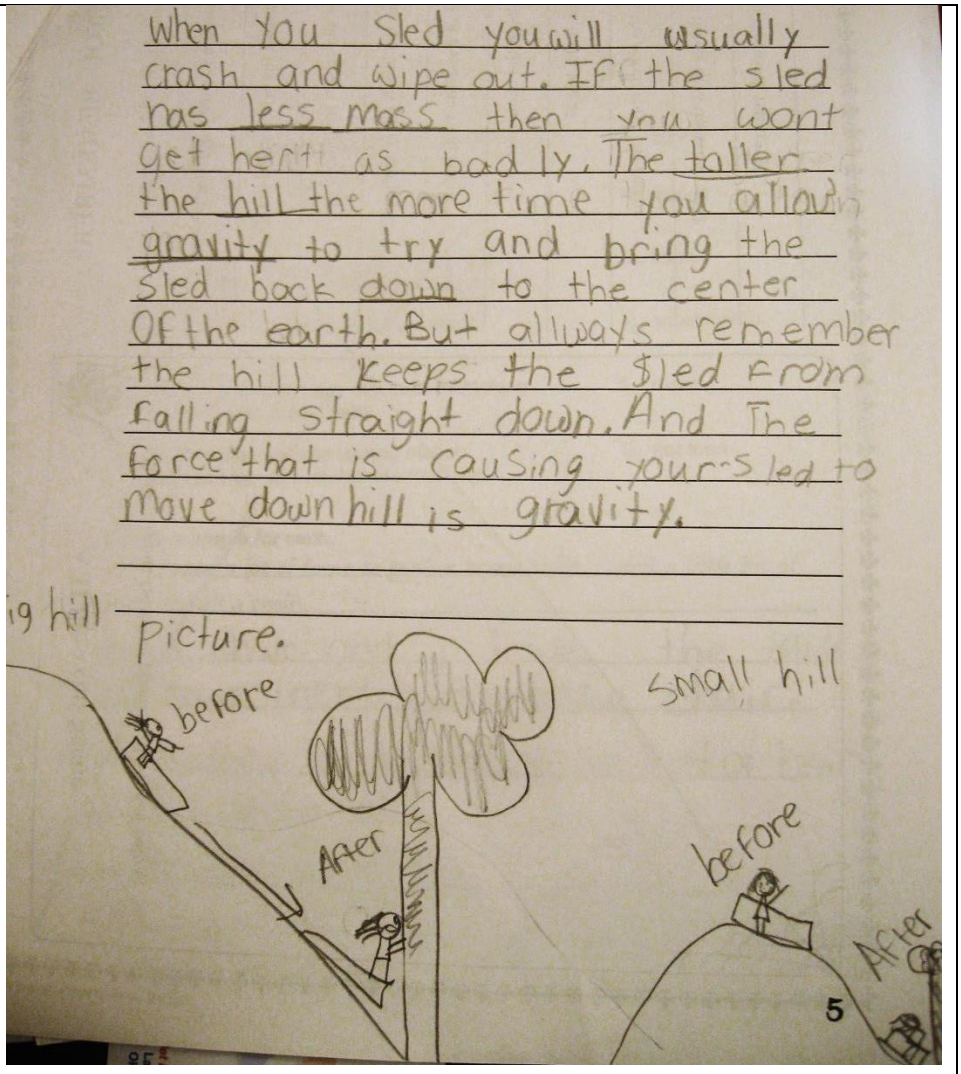
- The taller the hill, the more time is allowed for gravity to pull the sled down.
- The taller the hill, the faster the sled will go/the shorter the hill, the slower the sled will go.

We Wipeout:

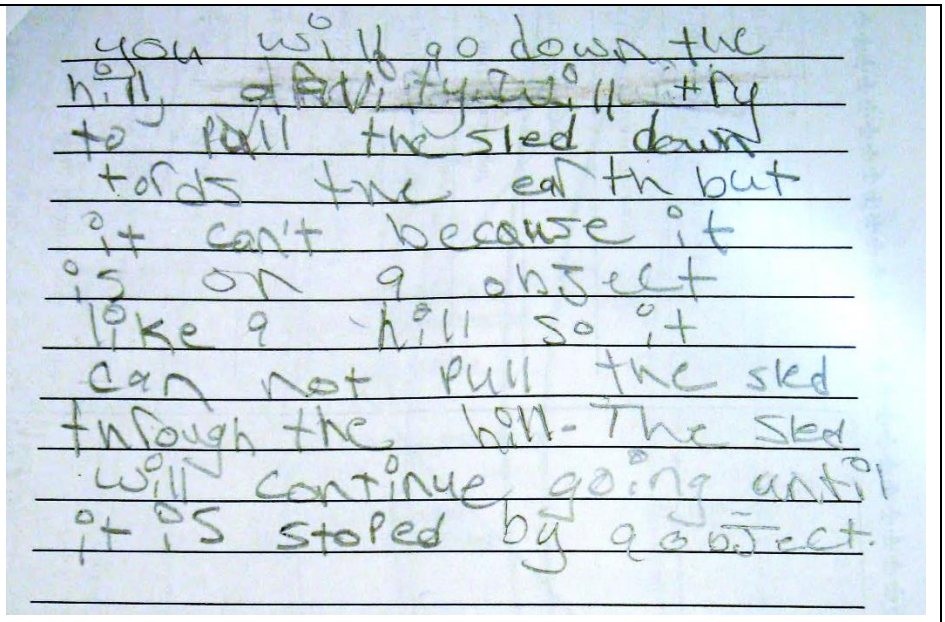
- The more mass a sled rider has, the more force it will exert./The less mass a sled rider has, the less force it will exert.
- Mass is how much "stuff" an object has. On Earth it is measured in weight.

We Keep Going:

- Description of how sled stops/how the rider might keep going. (Slows down from friction/colliding with



another object) • Inertia is an object's resistance to change its motion	
Evidence from work sample of weaknesses in student understanding: *Haley displayed an understanding for how a taller hill allows more time for gravity to act on the sled. However, she didn't use that description to explain why a sled would go faster on the taller hill. This could be a gap in her understanding, or just a step that she didn't fit into her explanation.*	**Evidence from work sample of strengths in student understanding:** *Haley had 7 of the 8 features, either in her writing or in the drawing. I accepted her mention of pain as it relates to mass as a completion of the 5th feature "The more mass a sled rider has, the more force it will exert./The less mass a sled rider has, the less force it will exert." Her description of the pain was a real life example of how we can indirectly measure force.* *The drawing of the sled riders on the bottom illustrated her strength at connecting speed and collisions. Specifically the "Before" and "After" of the sled riders on the right hill. The rider is seated down at the top of the hill. At the bottom of the hill, she illustrated the movement of the rider after the sled collided with the tree. This shows her understanding of how inertia affects what might happen during a collision or change of motion, which are features 7 and 8, which were not present in her written description.*

Student: Tim **GLCE/Learning Goal:** P.FM.05.41 .42 **Assessment task description and rationale:** Students were asked to "Answer the question: What happens when you sled?" There was space on the bottom of the page for students to draw diagrams or pictures to illustrate their ideas. The drawing was not required. This was the question that they answered throughout the unit. They used carts and ramps to model sledding. **Assessment features:** We Move: • Gravity is the force that causes the sled to move down the hill. • Gravity pulls objects towards	 you will go down the hill gravity will try to pull the sled down tords the earth but it can't because it is on a object like a hill so it can not pull the sled through the hill. The sled will continue going until it is stoped by a object.

the center of the Earth. We Speed: • The taller the hill, the more time is allowed for gravity to pull the sled down. • The taller the hill, the faster the sled will go/the shorter the hill, the slower the sled will go. We Wipeout: • The more mass a sled rider has, the more force it will exert./The less mass a sled rider has, the less force it will exert. • Mass is how much "stuff" an object has. On Earth it is measured in weight. We Keep Going: • Description of how sled stops/how the rider might keep going. (Slows down from friction/colliding with another object) • Inertia is an object's resistance to change its motion	
Evidence from work sample of weaknesses in student understanding: *Tim could have a misconception that the sled has to hit something to stop, even though friction is also a force that could slow and stop an object.*	**Evidence from work sample of strengths in student understanding:** *Tim could identify that gravity was the force that pulls the sled down the hill. She focused gravity. During our explanation of gravity, we defined it as the non-contact force that pulls all objects to Earth. As a class, we had a problem with that definition: Isn't the hill Earth? We had to be more specific with our definition of gravity. Tim held that conversation as the focus of this assessment question.* *Another strength in Tim's understanding is that mentioned that something had to stop the sled from continuing. Even though the First Law of Motion was a tricky concept for the students to first understand, she made a point to mention that something had to stop the sled.*

Student: Jamar

GLCE/Learning Goal:
P.FM.05.41 .42

Assessment task description and rationale:
Students were asked to "Answer the question: What happens when you sled?" There was space on the bottom of the page for students to draw diagrams or pictures to illustrate their ideas. The drawing was not required.

This was the question that they answered throughout the unit. They used carts and ramps to model sledding.

Assessment features:

We Move:

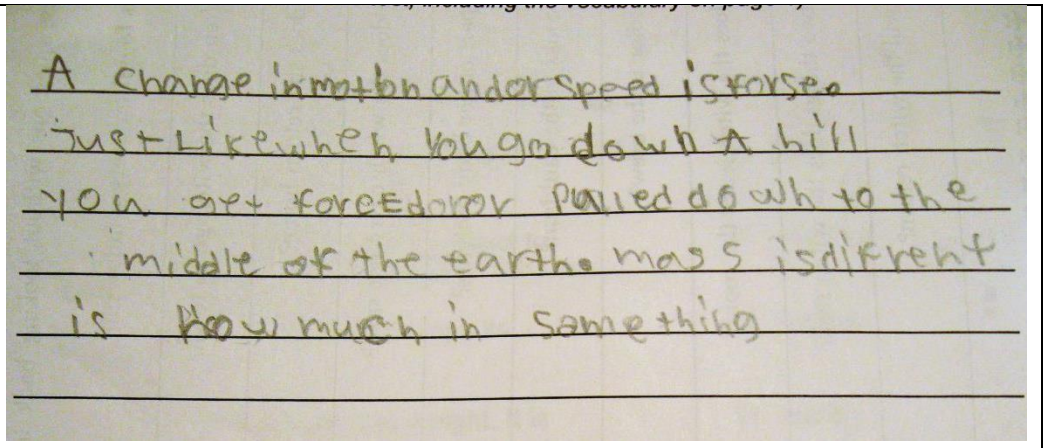
- Gravity is the force that causes the sled to move down the hill.
- Gravity pulls objects towards the center of the Earth.

We Speed:

- The taller the hill, the more time is allowed for gravity to pull the sled down.
- The taller the hill, the faster the sled will go/the shorter the hill, the slower the sled will go.

We Wipeout:

- The more mass a sled rider has, the more force it will exert./The less mass a sled rider has, the less force it will exert.
- Mass is how much "stuff" an object has.



On Earth it is measured in weight. We Keep Going: • Description of how sled stops/how the rider might keep going. (Slows down from friction/colliding with another object) • Inertia is an object's resistance to change its motion	
Evidence from work sample of weaknesses in student understanding: *Through this assessment, there are many weaknesses to Jamar's understanding. The absence of 5 features is the biggest weakness. He attempts to mention 3 features, but fails to properly explain.* *This was a very "definition-heavy" unit. His definition of "force" shows how confusing many defnitions can be. He was thinking about a change of direction and speed (acceleration). With so many definitions, I can see how this assessment could be confusing for Jamar who has attention problems.*	**Evidence from work sample of strengths in student understanding:** *Jamar showed little strengths in this response. His biggest strength was not an understanding of the explanation, but a relaying of information, like definitions. He tried to define words like "force" and "mass". He described how gravity is the force that pulls a sled, but does not name it as "gravity."* *This task was not an accurate assessment of Jamar's understanding. Through my conversations with him and observations of watching him work in his labs, I have seen more understanding than this attempt at a written explanation illustrates.*

Whole Class Response Chart

GLCE/Learning Goal:
P.FM.05.41 .42

Assessment task description and rationale:
Students were asked to "Answer the question: What happens when you sled?"

This was the question that they answered throughout the unit. They used carts and ramps to model sledding.

Assessment features:

We Move:
1. Gravity is the force that causes the sled to move down the hill.
2. Gravity pulls objects towards the center of the Earth.

We Speed:
3. The taller the hill, the more time is allowed for gravity to pull the sled down.
4. The taller the hill, the faster the sled will go/the shorter the hill, the slower the sled will go.

We Wipeout:
5. The more mass a sled rider has, the more force it will exert./The less mass a sled rider has, the less force it will exert.
6. The faster the sled is going, the more force it will exert./The slower the sled is going, the less force it will exert.

We Keep Going:
7. Description of how sled stops. (Slows down from friction/colliding with another object)
8. Inertia is an object's resistance to change its motion.

Student	Goal Features								# of goal features
	1	2	3	4	5	6	7	8	
Room 15									
Angela	X				X	X			3
Ashton	X						X		2
Billy	X			X					2
Caleb	X								1
Colin							X		1
Emmy									0
Gabe									0
Jadynn	X	X		X				X	4
Jamari									0
Jay	X		X	X					3
Kenny	X	X	X	X					4
Leigh	X	X	X			X			4
Lukas									0
Madison									0
Maya							X		1
Michael	X	X	X	X					4
Reggie	X	X							2
Samantha			X		X	X			3
Teresa									0
Violet	X						X		2

Room 15 #	11	5	5	5	2	3	4	1	
Room 16									
Bruce						X			1
Carla	X						X		2
Carmen	X	X	X	X					4
Grace	X	X	X	X					4
Haley	X	X	X		X	X	X	X	7
Hanna	X	X					X	X	4
Ian	X	X	X		X		X		5
Jamar		X				X			2
Jerrell	X	X							2
Joseph	X	X	X		X				4
Lucas	X	X							2
Nathalie	X			X	X	X	X		5
Nick									0
Orlando		X	X						2
Paris		X					X		2
Sam	X	X	X	X					4
Summer				X	X				2
Tara	X	X	X	X	X				5
Tim	X	X							2
Timothy							X		1
Zach									0
Room 16 #	13	14	8	6	6	4	7	2	
#	24	19	13	11	8	7	11	3	
%	57%	48%	32%	25%	41%	16%	25%	7%	

Student: Haley

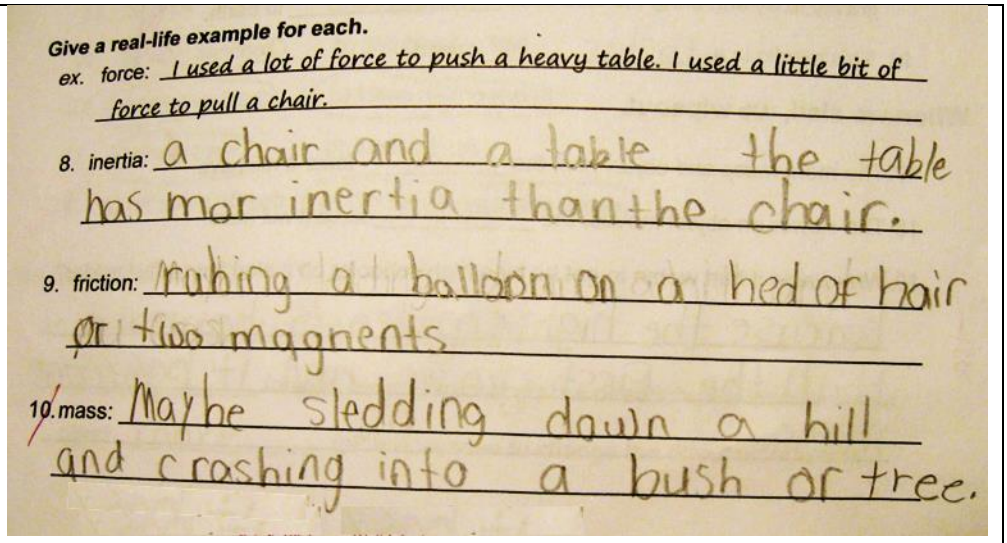
GLCE/Learning Goal:
P.FM.05.34

Assessment task description and rationale:

Students were asked to give real life examples of three science terms that we used throughout the unit. Even though we were focusing on sledding as our big question, it was still important that students could connect their learning to other examples in their lives. That would show a deeper understanding of the scientific knowledge.

Assessment features:

- Each example is based on factual explanations and patterns.



Give a real-life example for each.

ex. force: I used a lot of force to push a heavy table. I used a little bit of force to pull a chair.

8. inertia: a chair and a table the table has mor inertia than the chair.

9. friction: rubing a balloon on a hed of hair or two magnents

10. mass: Maybe sledding down a hill and crashing into a bush or tree.

Evidence from work sample of weaknesses in student understanding:

Haley's example of inertia satisfies the minimum acceptable response. The expectation of this assessment question was that the students would give an example of inertia with more explanation.

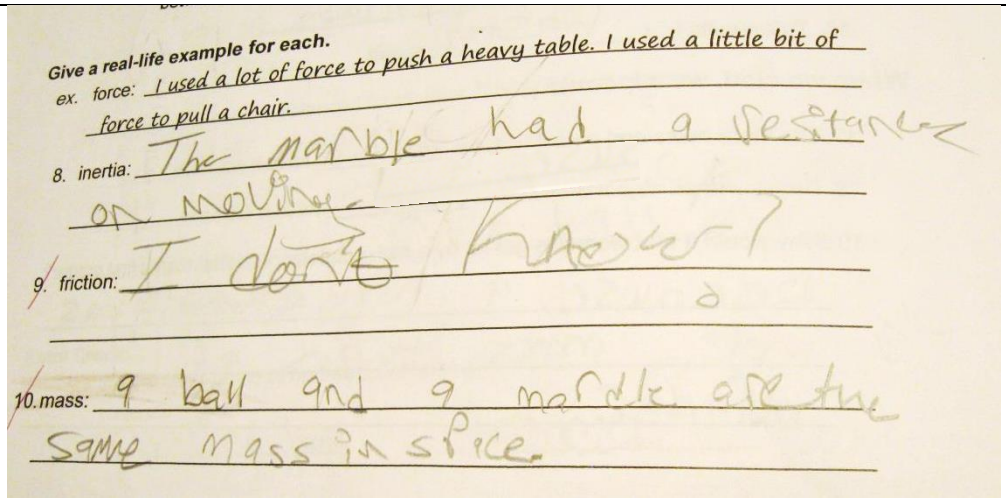
Although Haley gives a real life example of friction that was accepted as a positive answer, it still did not relate to the experiences that we has revolving around friction. She made a connection to the non-contact forces that

Evidence from work sample of strengths in student understanding:

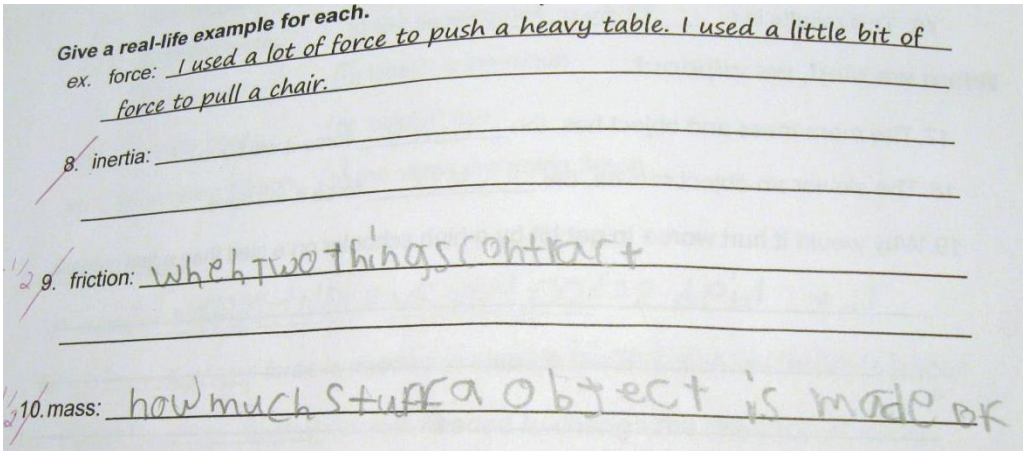
Haley's responses show that she has a basic understanding of inertia and friction. She did not just define the words like many other students. Her example for friction followed the example that was given to the students.

Haley connected her experiences with non-contact forces to give an example of friction. Even though we did not use friction in our explanations of static and magnets, Haley connected the different experiences.

the students explored. *The example of "mass" starts out with the word "Maybe". This in itself shows that Haley is aware of the weakness of her knowledge of mass.*	

Student: Tim **GLCE/Learning Goal:** P.FM.05.34 **Assessment task description and rationale:** Students were asked to give real life examples of three science terms that we used throughout the unit. Even though we were focusing on sledding as our big question, it was still important that students could connect their learning to other examples in their lives. That would show a deeper understanding of the scientific knowledge. **Assessment features:** • Each example is based on factual explanations and patterns.	 Give a real-life example for each. ex. force: I used a lot of force to push a heavy table. I used a little bit of force to pull a chair. 8. inertia: The marble had a resistance on moving. 9. friction: I don't know? 10. mass: a ball and a marble are the same mass in space.
Evidence from work sample of weaknesses in student understanding: *The biggest indicator of Tim's weakness was her answer, "I don't know!" for friction. She didn't even attempt to put down a definition. There could be many reasons why she chose to write this (this is a common answer that she gives). Even so, it is evidence*	**Evidence from work sample of strengths in student understanding:** *Tim's biggest strength in this assessment was with the concept of inertia. Even though she relied heavily on the definition of inertia (resistance), she could connect it to an experience that she had in class. A stronger answer would have continued, "…and stayed in place/continued in a straight line."*

that she didn't think she could answer the question. *Her example for mass was not explanatory enough. It could be true that a ball and a marble have the same mass in space. However, her response looks to be an over-compensation for a misconception that many students had. Many students believed that the mass of an object changed from the Earth to the moon. After many reinforcements in the fall during their other unit, and more from my unit, they students could recite that an object on the Earth will have the same mass on the moon. It seems like Tim took that explanation and extended it to all objects having the same mass.*	

Student: Jamar **GLCE/Learning Goal:** P.FM.05.34 **Assessment task description and rationale:** Students were asked to give real life examples of three science terms that we used throughout the unit. Even though we were focusing on sledding as our big question, it was still important that students could connect their learning to other examples in	 **Give a real-life example for each.** ex. force: I used a lot of force to push a heavy table. I used a little bit of force to pull a chair. 8. inertia: 9. friction: when two things contract 10. mass: how much stuff a object is made of

their lives. That would show a deeper understanding of the scientific knowledge. **Assessment features:** • Each example is based on factual explanations and patterns.	
Evidence from work sample of weaknesses in student understanding: *Jamar shows the same weakness in this assessment, as the last one. He can define the words, but cannot apply them to the real world. Even when the basis of our unit was sledding, he still did not choose to use sledding as a real life example. The evidence of his understanding is very weak in all of the written assessments.*	**Evidence from work sample of strengths in student understanding:** *Again, Jamar showed that he knew WHAT two of the three words meant by defining them. His strength is in defining mass.*

Whole Class Response Chart

GLCE/Learning Goal: P.FM.05.34

Assessment task description and rationale:

Students were asked to give real life examples of three science terms that we used throughout the unit. Even though we were focusing on sledding as our big question, it was still important that students could connect their learning to other examples in their lives. That would show a deeper understanding of the scientific knowledge.

Assessment features:

Each example is based on factual explanations and patterns.

1. Inertia
2. Friction
3. Mass

Student	Goal Features			# of goal features
	Inertia	Friction	Mass	
Room 15				
Angela			X	1
Ashton	X	X	X	3
Billy	X	X	X	3
Caleb				0
Colin		X	X	2
Emmy		X	X	2
Gabe	X	X	X	3
Jadynn	X	X	X	3
Jamari			X	1
Jay	X	X	X	3
Kenny	X	X	X	3
Leigh				0
Lukas			X	1
Madison			X	1
Maya	X		X	2
Michael	X	X	X	3
Raymond	X	X	X	3
Reggie	X	X	X	3
Samantha	X	X	X	3
Teresa		X	X	2
Violet		X		1
Room 15 #	11	14	18	
Room 16				
Bruce				0
Carla		X	X	2
Carmen		X	X	2
Grace		X		1
Haley	X	X		2

Hanna		X		1
Ian		X		1
Jamar				0
Jerrell				0
Joseph	X	X	X	3
Lucas	X	X	X	3
Nathalie	X	X	X	3
Nick				0
Orlando	X	X	X	3
Paris				0
Sam		X	X	2
Summer				0
Tara		X	X	3
Tim	X			1
Timothy				0
Zach		X	X	2
Room 16 #	6	13	9	
TOTAL #	17	27	27	
%	41%	64%	64%	

Part 2: Identifying Patterns in Student Learning and Responses

A pattern in the first assessment showed that different students were approaching the assessment differently. There were 4 different categories of response features for the first assessment. Most students focused on movement in relation to sledding. However, some students focused on the other 3 categories, as well.

By looking at the responses from Room 15, many students were able to mention both features of the said category. For example, if a student focused on mass and collisions, both of those features were present. However, that student would miss the other features. The most common features in the student work involved movement and the force that causes a sled to move. I think this is because movement and speed played a very large part at the beginning of the unit. The other learning goals often depended on an understanding of movement, so the students had more practice with it and it was "drilled" into them from the very beginning.

A part of my teaching that I would change for the future is to find more connections with "Speed," "Wipeouts," and ideas about the first law of motion. One way that I could have done this was to use explanations that connected to their lives, not just in sledding, but in other experiences as well. With more connections, the students have a way to remember the explanations.

I think that another way I could change my teaching would be to go deeper instead of wider. Because of the time constraints, I tried to fit too much information into the unit. If I focused primarily on movement, there might have been more than a 57% rate of those features. It is clear to see that the amount of features declined. Those learning goals were taught in that same order, so there is a clear reflection of what the students learned, and when.

Part 3: Effectiveness of Assessment Strategies

There were many limitations to the two assessments that I chose. First of all, they solely relied on students' written work. After observing and talking with the students, it is very clear to me that many of the students had a strong understanding of the material. However, their assessment results do not reflect that. The other part of the assessment that I didn't analyze here were multiple choice and fill in the blank questions. Even though the students showed more success with those, I don't think they were a better representation of the students' scientific understanding.

A strength of the first assessment was that it was a very broad question, "What happens when you sled?" It was the question that we "came up with" as a class and answered. However, that also turned out to be the biggest weakness, too. Many students gave perfectly factual answers to the question: "We have fun!" "We go down hills!" "We sled during the winter."

In the future, I would like the final assessment to be project-based. There are a few different was to do this, depending on student strengths. Maybe have the students work in groups to design a machine, then present it to the class. They could use different computer software to create a video of examples of the concepts in the real world, like using the playground equipment as a tool to explore forces. For both of those examples, the assessment wouldn't rely on written assessments. This is also a way to differentiate between the students. If a student wanted to write an essay on what happens when they sled, they could do that. As long as the features of the project or essay are the same, the students could show that they understand the learning goals in many ways.

Part 4: Lessons Learned

My expectations of this unit were a little low before I begin planning. As the planning and teaching started and continued, I started to realize that the teaching actually went pretty okay. I enjoyed it so much. Students were engaged, well-behaved, and could talk about what we were learning. According to the multiple-choice and fill-in-the-blank assessments, the students were meeting the learning goals. From looking at final grades, 87% of students from Room 16, and 84% Met or Exceeded Expectations on the final summative assessment. Each question was tied directly to a GLCE. However, I don't know how well that assessment was designed. The weakest part of the teaching was probably the science processes. There was not a lot of time to explore, or for students to come up with their own procedures.

If I were starting again from the very beginning of the year, or had more than 2 weeks for a unit, I would want to give students time to work on those skills. I think that if my students know WHY they are following a procedure, it will focus their attention on the important parts of it. These little parts of the procedure (the variables, the order in which you do perform tasks, and how data is measured) highlight the parts in a final scientific explanation. When the students are developing and trying out procedures, I think they will be able to connect their personal experiences with scientific explanations.

In the future, I know that I will be challenged by time constraints. There is only so much time to teach science, and there are hard decisions to make. I think that it is important for students to have a deep understanding, but there are standards that need to be taught. It is going to be challenging to find a balance between the breadth and depth of content. I think the results for my first assessment shows, very clearly, the results of a unit that covers an abundance of material in a short period of time.