

Test Creation Assignment

Laurie E. Goode

The College of William and Mary

Spring 2009

Table of Contents

Overview Information.....	3
Design of Test.....	4
Table of Specifications.....	5
Validity and Reliability.....	5
Types of Questions.....	6
Scoring.....	7
Test.....	8
Answer Key.....	17
Constructive Reflection.....	26

Overview Information

The following assessment was created for a third grade class that has completed a unit on simple and compound machines. The assessment is intended to be used as a summative assessment to determine the students' learning and their mastery of the intended learning outcomes. While the assessment focuses on the specific intended learning outcomes designated in the curriculum, the larger curricular aims of science have been taken into consideration as well. These aims include helping students observe the world around them while learning to analyze characteristics of items, materials, etc. in the world. Students learn that materials can change and are not always constant. Students must learn to grapple with the unknown and learn that there are not always answers in life, while becoming comfortable trying to find answers in a systematic manner. Broad topics studied in the science curriculum include weather and space, life systems, force and energy, and matter.

The unit of simple machines is categorized under the larger topic of force and energy. The unit is intended to help students explore and understand the use of machines in our everyday life. The unit will take place over a period of ten days. Students will have opportunities to discover and explore common items that use simple machines while also creating an apparatus that uses one or more simple machines in a cooperative learning project.

The test was specifically created to meet the needs of a third grade class at Norge Elementary School in Williamsburg, Virginia. The class consists of 22 students with assorted ability ranges. Of the eleven boys and eleven girls, the majority of students are on or above reading level, although there is one student who continues to struggle with reading. Three students work with a reading specialist daily. There are five students who attend the advanced program for language arts once per week and four students are pulled out once per week for the advanced mathematics program. There are no accommodations or adaptations from Individual Education Programs or 504 plans that must be considered as this classroom is not an inclusion class. However, there is an English as a Second Language learner, although his academic English is on grade level with the other students and he speaks without a foreign accent, so no accommodations are needed. The students are arranged at five tables. Three tables have four students and two tables have four students with a fifth student added on the end of the table in an individual desk. Privacy folders will be used during the implementation of the assessment.

Design of Test

The test was designed to align with both the curriculum and the instruction of the unit. The curriculum is outlined by the state in the Standards of Learning. The standard addressed for the simple machines unit is Virginia Science Standard 3.2:

The student will investigate and understand simple machines and their uses. Key concepts include:

- a) types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge);
- b) how simple machines function;
- c) compound machines (scissors, wheelbarrow, and bicycle); and
- d) examples of simple and compound machines found in the school, home, and work environment.

The intended learning outcomes, which were mentioned earlier, can be found in the Curriculum Framework provided by the Virginia Department of Education. The intended learning outcomes explains each standard in detail, providing more specific content. For Virginia Science Standard 3.2, the intended learning outcomes are outlined as follows:

The student will:

1. Identify and differentiate the six types of simple machines: lever, screw, pulley, wheel and axle, inclined plane, and wedge.
2. Analyze the application of and explain the function of each of the six types of simple machines. An example would be that an inclined plane is a ramp to make it easier for a heavy object to be moved up or down.
3. Differentiate and classify specific examples of simple machines found in school and household items. These include a screwdriver, nutcracker, screw, flagpole pulley, ramp, and seesaw.
4. Design and construct an apparatus that contains a simple machine.
5. Identify and classify the simple machines which compose a compound machine, such as scissors, wheelbarrow, and bicycle.

The test is designed to assess each of these intended learning outcomes except the fourth, as this intended learning outcome reaches the synthesis cognitive level of Bloom's taxonomy, a higher cognitive level that cannot be addressed adequately on a paper and pencil assessment. The students will demonstrate mastery of this intended learning outcome through a cooperative learning project completed during instruction of the unit.

A table of specifications was created in order to ensure alignment among curriculum, instruction, and assessment. The content of the intended learning outcomes are placed along the left side of the table and Bloom's cognitive levels are along the top of the table. A diamond indicates the intersection of the content and the demanded cognitive level.

Table of Specifications

Content	Cognitive Levels					
	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Types of simple machines	Q: 1-5, 10, 18 ◆			Q: 14, 19 ◆		
Application and function of simple machines		Q: 9, 15, 20 ◆		Q: 11, 12, 17 ◆		
Specific examples of simple machines in school and household items			Q: 8, 16 ◆	Q: 7, 13 ◆		
Apparatus that contains a simple machine					Coop. Learning Project ◆	
The simple machines composed of a compound machine	Q: 6 ◆			Q: 7, 20 ◆		

Validity and Reliability

It is the responsibility of the classroom teacher to provide a valid and reliable assessment to draw conclusions about student learning. The preceding table of specifications offers evidence of validity for this assessment. The assessment demonstrates both construct and content validity. Each question of the assessment aligns with the intended learning outcomes, both in content and in cognitive levels. The way the assessment accurately pulls a sample of questions from all intersections also provides evidence for content validity. This evidence of content validity also offers support of the assessment's construct validity, or face validity. Since the assessment shows content validity and matches the intended learning outcomes, it also is construct validity. The science test covers content about simple machines. In other words, at first glance, the test appears to be about simple machines, the intended subject, so the test, therefore, is validly constructed.

Since the construct validity and content validity are strong, the potential for predictive validity of the assessment is also strong. If the performances on the test are consistent with how the teacher expects students to perform based on in-class assignments, homework, and quizzes about simple machines, then the assessment has strong predictive validity. If the performances are inconsistent with other scores on the same content, then the construct and content validity should be revisited to improve the predictive validity.

There are potential threats to reliability that surround this test. Perhaps students are unfamiliar with the new information presented on the test intended to measure students' analysis skills so they are unable to answer to the best of their ability. However, many efforts have been taken to reduce the potential for systematic teacher error. Questions were constructed using tips from *Teacher Made Assessments* (Gareis & Grant, 2008) to increase the reliability of the assessment. For example, the questions' stems take care not to provide any information that could give away the correct answer. The readability of the test is on grade level for third grade, which decreases the chance that students will not understand the questions due to reading level. However, to ensure that the assessment is measuring all students' learning of simple machines, the test can be given orally to the student who is reading below grade level.

Types of Questions

The test includes both selected-response and supply response questions in an attempt to assess all cognitive levels demanded by the intended learning outcomes. The test begins with select-response matching questions. This is to assess the general knowledge of types of simple machines. The test then progresses to select response classification. This section is intended to measure students' ability to apply and analyze the functions of simple machines and how they can be used to create compound machines. The last part of the select-response questions are multiple choice. This is the largest section of the test due to the design of the Standards of Learning tests at the end of the year. The multiple choice questions are designed to measure a range of cognitive levels. Pictures, extended prompts, and novel situations are included to measure the students' ability to analyze information about simple machines.

Due to the students' unfamiliarity with supply-response questions on tests at this point in the school year, only one supply response question is included on the assessment. This question is intended to show what students know and how students think about new information through their writing. Struggling writers will have the opportunity to give an oral response but are still required to write an answer as well. It is important for students to be able to convey ideas through words and writing, as written communication is an important ability to master as a student and as a citizen in today's technology world.

Scoring

Questions one through five are each worth one point. There is a total of five points available for question six, one-half point for each item placed in the correct column. There are fourteen available points for question seven, one point for each correctly defined simple machines. If the item is placed in an incorrect column, the student loses one-half of a point. The points are allocated in this manner for questions six and seven to emphasize the importance of knowing the types of simple machines used in the common items. All of the multiple choice questions are worth two points each, and the supply response is worth 12 points, for a total of 60 available points. The overall breakdown of point allocation is summarized in the following table.

<i>Question</i>	<i>Points</i>
Matching	5 points (1 point each)
Classifying items as simple or compound machines	5 points (1/2 point each)
Classifying items by type(s) of machine(s)	14 points (1 point each)
Multiple Choice	24 points (2 points each)
Supply Response	12 points (see rubric)
TOTAL POINTS	60 points

To consistently allocate points for the supply response, this rubric should be used. Each correct simple machine named receives 3 points. For a clear explanation of each machine's job in relation to the wheelbarrow, the student receives 3 points. If both machines are named and both machines are explained, the student receives 12 points. Because of the novelty of supply response questions, there are no points allocated for handwriting or complete sentences, although both will be encouraged.

Name: _____ Date: _____

Simple Machines Test

Directions: Draw a line matching the picture to the type of machine used. Use the dots to start and end your line. You will not use all of the machine choices.

1.



○

○ INCLINED
PLANE

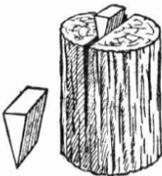
2.



○

○ LEVER

3.



○

○ PULLEY

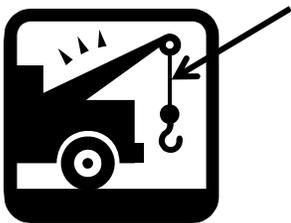
4.



○

○ SCREW

5.



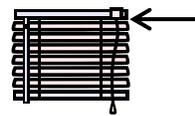
○

○ WEDGE

○ WHEEL AND
AXLE

Directions: Identify the following ten items as simple machines or compound machines by writing the name of the item in the correct column. Pictures of the items are given to help you.

6.

baseball bat 	bicycle 	doorknob 	light bulb 	mini blinds 
pencil sharpener 	scissors 	seesaw 	staircase 	water faucet 

SIMPLE MACHINE

COMPOUND MACHINE

Directions: Using the same list (look back at the pictures if needed), classify the items by which simple machine(s) is/are used. Write the item in the correct simple machine column. Some items may be written more than once.

7.

baseball bat	bicycle	doorknob	light bulb	mini blinds
pencil sharpener	scissors	seesaw	staircase	water faucet

Inclined Plane	Lever	Pulley
Screw	Wedge	Wheel and Axle

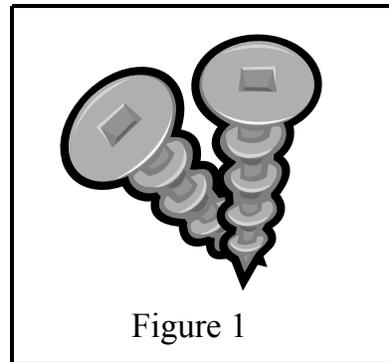
Directions: Read the following questions and circle the correct answer.

8. Which is the correct pair of a common household item and the type of simple machine used for the item?

- A. knife, lever
- B. nail clippers, wedge
- C. nutcracker, lever
- D. staircase, wedge

9. The job of the simple machine shown in Figure 1 is to _____.

- A. cut apart
- B. hold together
- C. move a heavy load
- D. raise a heavy load



10. Which two simple machines are made up of an inclined plane?

- A. lever and pulley
- B. wedge and screw
- C. screw and pulley
- D. lever and wedge

11. If Bob needs to move a large heavy box, which machine would NOT help him?

- A. screw
- B. pulley
- C. inclined plane
- D. wheel and axle

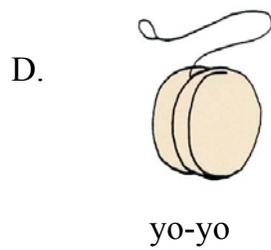
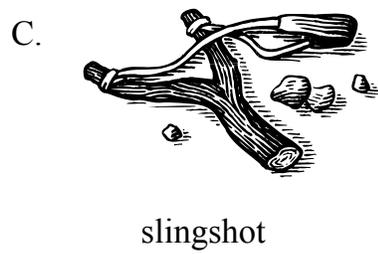
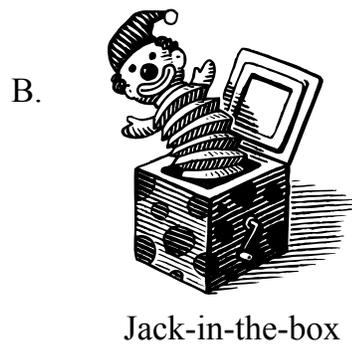
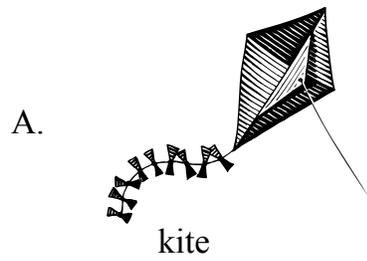
12. Jill wants to go to the playground at the park. When she gets there, she sees a slide, a seesaw, swings, and a sandbox where two boys were digging with shovels. She also sees bikes parked on the bike rack. Which of the following machines did Jill NOT see on the playground?

- A. lever
- B. pulley
- C. inclined plane
- D. wheel and axle

13. Which of the following items does NOT belong in the group?

- A. knife
- B. pliers
- C. ramp
- D. wooden screw

14. Which of these toys uses a lever?



Use the following passage to answer questions 15 and 16.

Ms. Goode needed to cut paper in long, thin strips. First, she started tearing paper in strips one at a time. This was taking a long time and the strips were uneven. Mrs. Simon told Ms. Goode to go to the office and use the paper cutter to cut strips of paper. In the office, Ms. Goode used both the paper cutter and the shredder.

To use the paper cutter, Ms. Goode pushed down on a long, sharp bar, which when pressed against the paper, cut the paper in strips. Ms. Goode fed paper through an opening when using the electric paper shredder. Ms. Goode found that it was much easier to use the shredder and paper cutter to cut paper than when she was tearing it with her hands.

15. Which sentence from the story best tells the purpose of simple machines?

- A. Mrs. Simon told Ms. Goode to go to the office and use the paper cutter to cut strips of paper.
- B. To use the paper cutter, Ms. Goode pushed down on a long, sharp bar, which when pressed against the paper, cut the paper in strips.
- C. Ms. Goode fed paper through an opening when using the electric paper shredder.
- D. Ms. Goode found that it was much easier to use the shredder and paper cutter to cut paper than when she was tearing it with her hands.

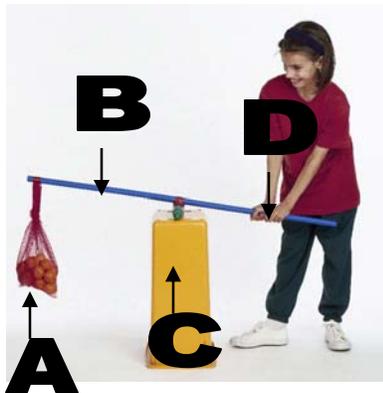
16. What item and simple machine was used in this story?

- A. paper cutter, a lever
- B. paper cutter, a an inclined plane
- C. shredder, a lever
- D. shredder, an inclined plane

17. One of the morning jobs for 5th graders is to raise the American flag on the flagpole in front of the school. Which machine helps them do this job?

- A. lever
- B. pulley
- C. screw
- D. wheel and axle

Use the picture to answer questions 18 and 19.



18. What kind of simple machine is shown in the picture?

- A. lever
- B. pulley
- C. screw
- D. wedge

19. In the picture, which item is the fulcrum?

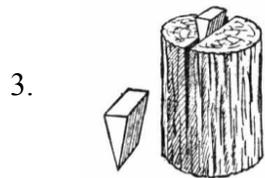
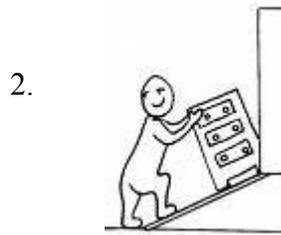
- A. A
- B. B
- C. C
- D. D

Name: _____ Date: _____

Simple Machines Test

Directions: Draw a line matching the picture to the type of machine used. Use the dots to start and end your line. You will not use all of the machine choices.

(1 point each – 5 points)

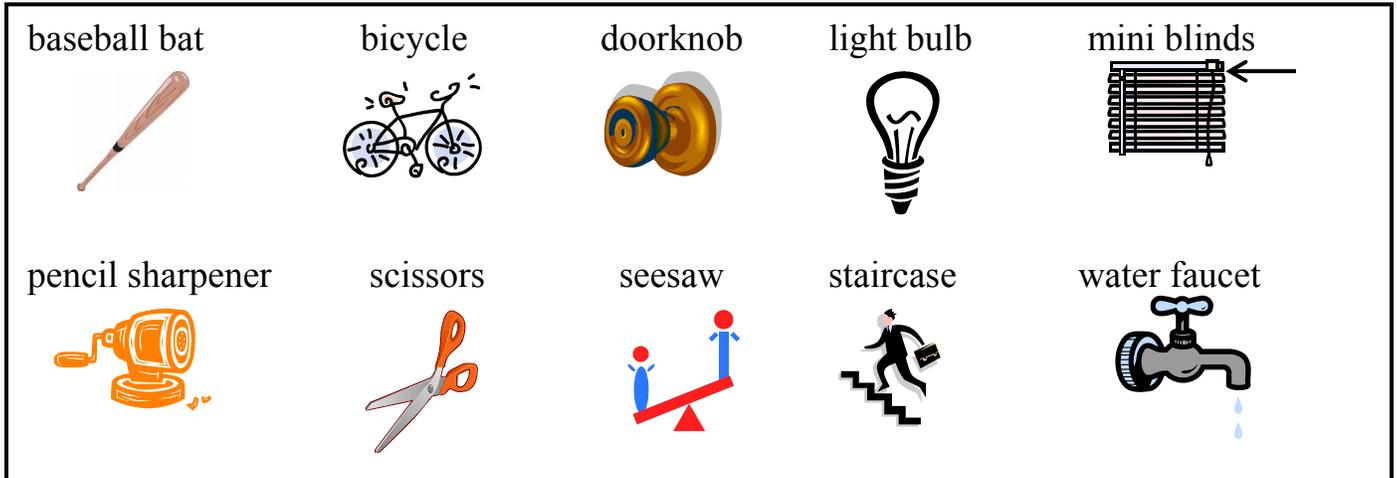


- INCLINED PLANE
- LEVER
- PULLEY
- SCREW
- WEDGE
- WHEEL AND AXLE

Directions: Identify the following ten items as simple machines or compound machines by writing the name of the item in the correct column. Pictures of the items are given to help you.

(1 point each - 10 points)

6.



SIMPLE MACHINE

COMPOUND MACHINE

baseball bat

bicycle

doorknob

pencil sharpener

lightbulb

scissors

miniblinds

water faucet

seesaw

staircase

Directions: Using the same list (look back at the pictures if needed), classify the items by which simple machine(s) is/are used. Write the item in the correct simple machine column. Some items may be written more than once.

(1 point each - 14 points)

7.	baseball bat	bicycle	doorknob	lightbulb	mini blinds
	pencil sharpener	scissors	seesaw	staircase	water faucet

Inclined Plane	Lever	Pulley
staircase	baseball bat	miniblinds
	bicycle	
	seesaw	
	scissors	
Screw	Wedge	Wheel and Axle
lightbulb	pencil sharpener	bicycle
water faucet	scissors	doorknob
		pencil sharpener
		water faucet

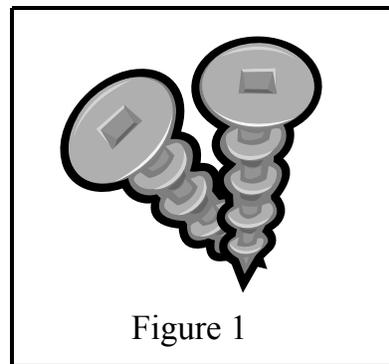
Directions: Read the following questions and circle the correct answer.
(2 points each – 24 points)

8. Which is the correct pair of a common household item and the type of simple machine used for the item?

- A. knife, lever
- B. nail clippers, wedge
- C. nutcracker, lever
- D. staircase, wedge

9. The job of the simple machine shown in Figure 1 is to _____.

- A. cut apart
- B. hold together
- C. move a heavy load
- D. raise a heavy load



10. Which two simple machines are made up of an inclined plane?

- A. lever and wedge
- B. pulley and screw
- C. screw and pulley
- D. wedge and screw

11. If Bob needs to move a large heavy box, which machine would NOT help him?

A. screw

B. pulley

C. inclined plane

D. wheel and axle

12. Jill wants to go to the playground at the park. When she gets there, she sees a slide, a seesaw, swings, and a sandbox where two boys were digging with shovels. She also sees bikes parked on the bike rack. Which of the following machines did Jill NOT see on the playground?

A. lever

B. pulley

C. inclined plane

D. wheel and axle

13. Which of the following items does NOT belong in the group?

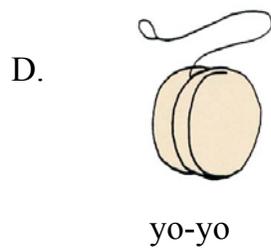
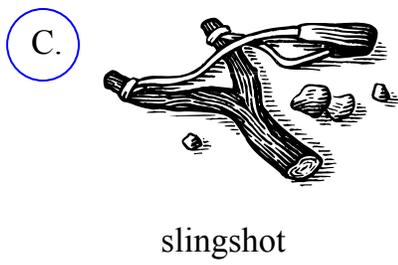
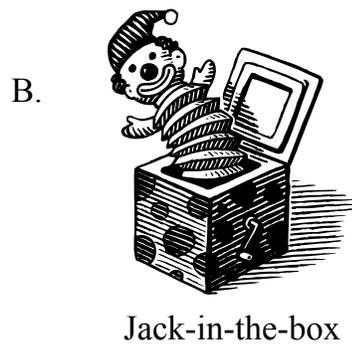
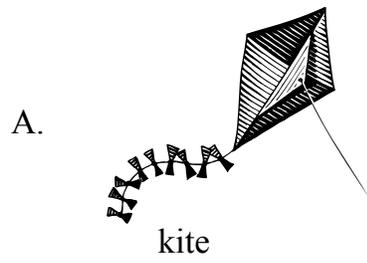
A. knife

B. pliers

C. ramp

D. wooden screw

14. Which of these toys uses a lever?



Use the following passage to answer questions 15 and 16.

Ms. Goode needed to cut paper in long, thin strips. First, she started tearing paper in strips one at a time. This was taking a long time and the strips were uneven. Mrs. Simon told Ms. Goode to go to the office and use the paper cutter to cut strips of paper. In the office, Ms. Goode used both the paper cutter and the shredder.

To use the paper cutter, Ms. Goode pushed down on a long, sharp bar, which when pressed against the paper, cut the paper in strips. Ms. Goode fed paper through an opening when using the electric paper shredder. Ms. Goode found that it was much easier to use the shredder and paper cutter to cut paper than when she was tearing it with her hands.

15. Which sentence from the story best tells the purpose of simple machines?

- A. Mrs. Simon told Ms. Goode to go to the office and use the paper cutter to cut strips of paper.
- B. To use the paper cutter, Ms. Goode pushed down on a long, sharp bar, which when pressed against the paper, cut the paper in strips.
- C. Ms. Goode fed paper through an opening when using the electric paper shredder.
- D. Ms. Goode found that it was much easier to use the shredder and paper cutter to cut paper than when she was tearing it with her hands.

16. What item and simple machine was used in this story?

- A. paper cutter, a lever
- B. paper cutter, a an inclined plane
- C. shredder, a lever
- D. shredder, an inclined plane

17. One of the morning jobs for 5th graders is to raise the American flag on the flagpole in front of the school. Which machine helps them do this job?

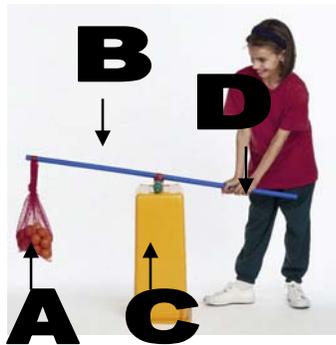
A. lever

B. pulley

C. screw

D. wheel and axle

Use the picture to answer questions 18 and 19.



18. What kind of simple machine is shown in the picture?

A. lever

B. pulley

C. screw

D. wedge

19. In the picture, which item is the fulcrum?

A. A

B. B

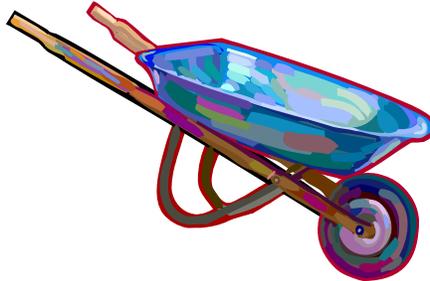
C. C

D. D

Be sure to use your best handwriting. Write in complete sentences.

(12 points)

20. Look at the picture of the wheelbarrow. It is used to help move objects from one place to another place.



Think about what you have learned about simple machines. Write down two simple machines that make up this compound machine. Then explain how each simple machine is used to help the job of the wheelbarrow.

The two simple machines used in the wheelbarrow are a lever and a wheel and axle.

an inclined plane. The lever is used to push or move the wheelbarrow to another place.

The wheel and axle is also used to help the wheelbarrow move more easily.

RUBRIC:

	3 points (each)	1.5 points (each)	0 points
Identifying a Simple Machine	Named a simple machine used in the wheelbarrow	n/a	Named a simple machine not used in the wheelbarrow
Explaining the Job of the Simple Machine	Explained/defined the job of the simple machine <i>in terms of the wheelbarrow</i>	Explained/defined the job of the simple machine <i>without relating it to the wheelbarrow</i>	Unsatisfactory or no description of the simple machine's job

Constructive Reflection

The following test demonstrates my ability to design and create a valid and reliable classroom assessment. The process began with unpacking the curriculum standard and the intended learning outcomes. I was able to analyze the content and the demanded cognitive levels in order to align the curriculum with the instruction of the unit, the curriculum with the assessment, and the instruction with the assessment. This continuous alignment is visually represented through the table of specifications.

After unpacking the curriculum and creating a table of specifications, it is important to determine which types of assessment items will be used. This unit shows that I understand the difficulties behind assessing all learning outcomes on a paper and pencil assessment and my willingness to use authentic assessments and cooperative learning projects to assess students' higher level thinking. In addition, the test demonstrates my belief in using of multiple types of questions to adequately sample the content and cognitive levels.

When putting together the test, I was cautious of the layout and visual design of the test in order to prevent introducing error to the test. Another technique employed to reduce error was to follow multiple tips for creating a reliable test item for each question. These tips ensure that a correct answer most likely represents mastery of the intended learning outcome. By reducing the chance of answer choice patterns and other systematic error that enhances strong test-takers ability to perform well, I have created a valid and reliable assessment that allows me to trust the data collected and draw inferences on student learning based on the performance data.

The process is still incomplete at this phase. The process will come to a close when the performance results are analyzed through a class, student, and item analysis. It will be important to perform this analysis to reveal any gaps in student learning and any faulty, unreliable test questions that should be corrected before giving the assessment again. This will be the last step in collecting evidence to prove an aligned curriculum, instruction, and assessment.