Frog and Butterfly Life Cycle Assessment

SOL 2.4

Pamela Evans

Assessment Created in Collaboration with Kelsey Everton

Spring 2012
Overview and Description

This assessment was created for a second grade class at Magruder Elementary School in York County School Division in Virginia. The curriculum goal of second grade science in Virginia is for students to continue to investigate and understand the natural world. During this course, students continue to develop their understanding of scientific investigation, logic, and reasoning. Students are exposed to concepts regarding force and energy, matter, life processes, living systems, interrelationships in earth and space systems, earth patterns, and natural resources.

The animal life cycles unit occurs during the month of March. Before animal life cycles unit, the students complete a weather unit in science. After completing the animal life cycle unit, the students begin a unit on plant life cycles. The animal life cycle unit focuses on developing an understanding of the basic needs and life processes of butterflies and frogs. Butterflies and frogs are used to show that animals go through a series of identifiable changes and stages throughout their life cycles. Students study these animals’ life cycles, physical characteristics, and physical adaptations. Through the study of this unit, students will understand the concept of metamorphosis. The unit takes place over a two week period of time. During this time, students will be exposed to concepts through various mediums; including discussions, research, and authentic activities.

All of the intended learning outcomes (ILO) for this unit are from the Virginia Science Standard of Learning 2.4. While the unit includes three ILOs, this particular assessment only assesses two of those ILOs. The ILOs of this unit can be found in the Unit Table of Specifications (See Table 1). The first ILO of this standard is to describe changes in the life cycle of a frog and a butterfly. Students are assessed on their knowledge and comprehension of
this ILO. To successfully exhibit knowledge of this ILO, students must be able to identify the basic life needs, life cycles, changes, and stages of the frog and butterfly life cycle. To show comprehension of this ILO, the students will be able to understand the changes which occur during and in between each stage of the butterfly and frog life cycle. The second ILO which is assessed in this assessment is that students will identify similarities and differences between the frog and butterfly life cycle. This ILO is assessed at the analysis level. Students will compare and contrast the two life cycles using a Venn diagram. The unit also includes a third ILO which is not assessed by this test. This ILO is that students will construct and interpret models/diagrams of animal and plant life cycles. This ILO is assessed at the application and synthesis levels. Students will be assessed on this ILO through formative assessment during unit study. The students will construct models of the butterfly and frog life cycles while learning the stages of each life cycle. Students will also interpret changes which occur between each stage of the life cycles using life cycle diagrams.

Throughout the unit, formative assessments will be used to gauge student learning and inform instruction. Formative assessment will be conducted through class discussions, verbal explanations, and student products. The test that has been created will be used as summative assessment of the frog and butterfly life cycle unit. It will show student understanding of the concepts of the unit. The assessment will also be used to identify any concepts that need to be reviewed before the class can begin their study of plant life cycles.

The assessment has been created for a diverse group of students. Magruder Elmentary School is classified as a Title I school because of the high number of students receiving free or reduced price meals. The second grade classroom in which this assessment will be used consists of 21 students, 11 males and 10 females. The classroom includes African American, Hispanic,
and Caucasian students. All of the students in the class have English as their first language. Most of the students in the class are from low to middle socio-economic statuses. Several students in the class are considered to be low level readers and receive reading intervention instruction. The test will be read aloud when administered to accommodate students with low reading levels.

**Design Elements**

This test assesses a portion of the Virginia Science Standard of Learning 2.4. It includes two specific ILOs, which can be found in the Test Table of Specifications (See Table 2). The test includes a total of twenty items. Ten of the items assess the students’ knowledge of the changes in the life cycle of a frog and butterfly, while nine items assess their comprehension of the ILO. One supply response question is used to assess the students’ ability to analyze the similarities and differences between the frog and butterfly life cycles.

This assessment exhibits high construct validity because the test items directly align with the intended standard, the corresponding ILOs of the standard, and the cognitive level of the ILOs as reflected in the Test Table of Specifications (Table 2). During the creation of the assessment, the creators used the Test Table of Specifications to guide the creation and selection of each test item. During this process, the teacher created each specific question to conform to the requirements shaped by the Test Table of Specifications. Without this alignment between the Test Table of Specifications, it is more likely that students would be tested on content at inappropriate cognitive levels. The test also provides face validity because it will be read aloud to the students. If the test was not read aloud, it is possible that it would assess the students’ reading abilities rather than their grasp of the ILOs.
The creation of the Test Table of Specifications is a key aspect to ensuring the content validity of the assessment. The Test Table of Specifications indicates the emphasis placed on each ILO. The first ILO assessed on the test receives the most emphasis. Although cognitive level indicated by the verb “describe” in the first ILO is comprehension, it is also necessary to also focus on the knowledge cognitive level. Without explicitly studying the content at the knowledge level, students may be unable to gain a comprehensive understanding of the ILO. The two cognitive levels of the first ILO are proportionally represented by the assessment and during unit instruction. The second ILO indicated in the Test Table of Specifications can only be assessed through a supply response item because of the intended cognitive level. The item appropriately assesses all parts of the second ILO and requires students to analyze their knowledge of the content to successfully respond to the test item.

This assessment contains a variety of item types, including select response items and one supply response item. The select response items assess the portions of the Test Table of Specifications which are at the knowledge and comprehension cognitive levels. The items included in this section are multiple choice, true/false, fill-in-the-blank, and matching. The assortment of select response items aims to accommodate different learning styles of the students. It also provides the opportunity to assess both basic recall of the students’ knowledge of ILO and their deeper understanding of the ILO. The multiple choice items are used to obtain the higher cognitive level of comprehension. The true/false items assess students’ knowledge of the frog and butterfly life cycles. The fill-in-the-blank style items assess the students’ knowledge of the ILO. Students are required to simply recall information to fill in the blanks.

The first part of the matched section shows that students can recall a visual representation of each stage of the butterfly life cycle. This is done at the knowledge cognitive level.
part of the matching section is used to show the students’ comprehension of what occurs during each stage of the butterfly life cycle. The final item on the test is a constructed response item. A Venn diagram is used to assess the students’ ability to analyze the similarities and differences between the frog and butterfly life cycle. This type of item is used because it is able to assess the analysis cognitive level appropriately. A majority of the items in this assessment were created by test creator and co-creator. The remaining questions (#13, 14, 16) are from the second grade unit test at Magruder Elementary School.

This test has been reviewed for potential threats to reliability and revised in attempt to eliminate systematic error. The most prominent threat to reliability in this assessment is in regards to the reading level of the students. To limit this threat, the test will be read aloud to the students. By reading the test aloud, it will ensure the test assesses the students’ understanding of the content and not their reading ability. The creators of the assessment also attempted to guard against systematic error by using clear directions, separating items based on item type, formatting the test like the third grade science SOL test, and emphasizing the word “not” when used in test items. The teacher will also verbally explain directions to help decrease systematic error due to misunderstanding directions. The test vocabulary reflects vocabulary used during instruction of the unit to lessen cultural bias. The format of the test, as it is, allows students to use the select response questions to complete the constructed response item. To increase reliability of the constructed response item, the assessment is split into part one and part two. Part one will be collected before students are given part two to reduce threats to reliability. Interrater reliability will be practiced when both teachers grade the same five tests and compare their scoring methods. After grading is completed, the scores will be re-analyzed for discrepancies in test item validity and reliability. This assessment was reviewed and revised by experienced
second grade educators, Laura Kindley and Sylvia Mitchell of Magruder Elementary School, to further reduce threats to reliability. This test has low predictive validity because second grade students in Virginia do not take any high stakes sciences tests, such as SOLs, at the end of the quarter or course.

This test will be scored using an answer key that was created before administration of the assessment. The purpose of the answer key will allow for consistent grading and objectivity of select response items. A predetermined rubric, which is included with the test answer key, will be used to score the responses to the Venn diagram. The selected response items and the constructed response item will be graded at different times. When grading the Venn diagram, each of the three parts (frog, butterfly, and similarities) for the entire class will be graded at same time before moving on to one of the other three parts. This will help to ensure intra-rater reliability. The teachers implementing this assessment will increase inter-rater reliability by each teacher grading five supply response questions. The teachers will then compare the grades assigned to each test item to analyze the application of the rubric. The weight of each test item type reflects their reliability and expectations. The true/false questions are worth one point due to their lack reliability because students have a 50% chance of getting the correct answer without knowing the content. All other select response questions are worth two points each. The supply response item is worth a total of six points. This item requires the student to both identify and produce the correct response on an analysis level. This test will be graded in using the S (100-80%), P (79-70%), and N (<70%) scale. It will be weighted as a test score in the students’ overall quarter science grade.
Test and Answer Key
Frog and Butterfly Life Cycle Test: SOL 2.4
(43 Points Total)

Part One:

Multiple Choice: Circle the correct answer. (2 points each)

1) Which animal does NOT go through metamorphosis after it is born?
   A. Frog
   B. White-Tailed Deer
   C. Butterfly
   D. Toad

2) Identify the order of the stages in the butterfly life cycle.
   A. larva, butterfly, chrysalis, egg
   B. chrysalis, egg, butterfly, larva
   C. egg, larva, chrysalis, butterfly
   D. butterfly, larva, egg, chrysalis

3) In which stage of the butterfly life cycle does it NOT eat?
   A. Larva
   B. Butterfly
   C. Caterpillar
   D. Chrysalis
4) Which of the following is NOT a way that adult butterflies protect themselves from predators?
   A. Hibernation
   B. Camouflage
   C. Poison
   D. Eye Spots

5) Identify the order of the stages in the frog life cycle.
   A. Froglet, egg, adult frog, tadpole
   B. Egg, froglet, tadpole, adult frog
   C. Tadpole, egg, adult frog, froglet
   D. Egg, tadpole, froglet, adult frog

6) In what stage of the frog life cycle does it live mostly on land?
   A. Tadpole
   B. Adult frog
   C. Egg
   D. Froglet
7) What does **NOT** happen as a tadpole changes to a froglet?
   A. The tadpole grows legs
   B. The tadpole begins to develop gills
   C. The tadpole’s tail begins to shrink
   D. The tadpole begins to develop lungs

8) Which is **NOT** fully developed until a frog is an adult?
   A. Gills
   B. Eyes
   C. Lungs
   D. Heart

9) Where do adult frogs lay eggs?
   A. In the woods
   B. In a tree
   C. In a hole
   D. In water
**True/False:** Circle true if the statement is correct. Circle false if the statement is incorrect. (1 point each)

10) Metamorphosis is when an animal resembles its parents when it is born.

   True  False

11) A chrysalis is made of silk.

   True  False

12) Adult frogs lay eggs.

   True  False

**Fill in the Blank:** Use the word bank provided below to fill in the blanks. **DO NOT** use any word more than once. You will **NOT** use all the words. (2 points each)

<table>
<thead>
<tr>
<th>Lungs</th>
<th>Larva</th>
<th>Gills</th>
<th>Pupae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polliwog</td>
<td>Flies</td>
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13) A tadpole breathes by using ______________.

14) In the butterfly life cycle, the chrysalis can also be called a/an ______________.

15) After hatching, caterpillars eat ______________.

16) In the frog life cycle, the tadpole can also be called a/an ______________.
17) **Matching:** Match the stage of the butterfly life cycle with its picture by drawing a line from the stage to its picture. (2 points)

Larva

Egg

Butterfly

Chrysalis

Use the stages listed above to do the following:
(2 points each)

18) Draw a rectangle around the stage of the butterfly life cycle in which it molts.

19) Draw a triangle around the stage of the butterfly life cycle that it can migrate.
20) Use the Venn Diagram below to compare and contrast the life cycles of the frog and butterfly.

Write two sentences describing each of the following,

- Frog Life Cycle (2 points)
- Butterfly Life Cycle (2 points)
- Similarities of the Frog and Butterfly Life Cycles (2 points)
Frog and Butterfly Life Cycle Test: SOL 2.4
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   - G. egg, larva, chrysalis, butterfly
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3) In which stage of the butterfly life cycle does it NOT eat?
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13) A tadpole breathes by using ____________gills__________.

14) In the butterfly life cycle, the chrysalis can also be called
    a/an_______pupa_________.

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![Diagram of butterfly life cycle stages]

**Use the stages listed above to do the following:**
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18) Draw a rectangle around the stage of the butterfly life cycle in which it molts.

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PART 2:
20) Use the Venn Diagram below to compare and contrast the life cycles of the frog and butterfly. Write two sentences describing each of the following,
- Frog Life Cycle (2 points)
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- Similarities of the Frog and Butterfly Life Cycles (2 points)

These answers are only a sample of correct answers students could provide.

Frog Life Cycle
1. **Frogs are** __________ __________ __________ __________
2. **Frogs hatch in** __________

Butterfly Life Cycle
1. **Butterflies are** __________
   - **Both animals** __________ __________
   - **Both frogs and butterflies** __________ __________
2. **Butterflies can** __________
   - **Fly when they are** __________
   - **Frogs hatch from** __________
   - **Eggs.**
   - **In the adult stage.**
Scoring Rubric for Constructed Response Question

<table>
<thead>
<tr>
<th></th>
<th>Satisfactory</th>
<th>Progressing</th>
<th>Needs Improvement</th>
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<tbody>
<tr>
<td><strong>Frog Life Cycle</strong></td>
<td>The student provides two accurate attributes of the frog life cycle. (2 pts)</td>
<td>The student provides one accurate attribute of the frog life cycle. (1 pt)</td>
<td>The student does not provide any accurate attributes of the frog life cycle. (0 pt)</td>
</tr>
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<td><strong>Butterfly Life Cycle</strong></td>
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<td><strong>Similarities of the Frog and Butterfly Life Cycles</strong></td>
<td>The student provides two accurate similarities between the frog and butterfly life cycles. (2pts)</td>
<td>The student provides one accurate similarity between the frog and butterfly life cycles. (1 pt)</td>
<td>The student does not provide any accurate similarities of the frog and butterfly. (0 pt)</td>
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The student will investigate and understand that plants and animals undergo a series of orderly changes in their life cycles. Key concepts include
a) some animals (frogs and butterflies) undergo distinct stages during their lives, while others generally resemble their parents; and
b) flowering plants undergo many changes, from the formation of the flower to the development of the fruit.

<table>
<thead>
<tr>
<th>Content</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe changes in the life cycle of a frog and a butterfly.</td>
<td>X</td>
<td>X</td>
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<td>Emphasis: S</td>
<td>Emphasis: S</td>
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<td>Compare and contrast life cycles of a frog and a butterfly.</td>
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<td>X</td>
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<td>Construct and interpret models/diagrams of animal and plant life cycles.</td>
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<td>X</td>
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<td>Emphasis: L</td>
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<td>Emphasis: M</td>
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<td></td>
</tr>
<tr>
<td>2 Multiple Choice (#2, 5), 3 True/False (#10, 11, 12), 4 Fill in the blank (#13, 14, 15, 16), 1 Matching (#17)</td>
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<td># &amp; Type of Test Item: Supply-Response (#20)</td>
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