I. Overview and Description

The broad curriculum goals of second grade Science are to help students continue to investigate and understand the world around them. This includes conducting scientific investigations where students collect data, make detailed observations, and draw conclusions. The course content of second grade Science focuses on the interdependency of living systems, the basic life processes of plants and animals, and the concept of change that is explored through units on weather, life cycles, and the states of matter. The test that has been created will be given during a unit on animal life cycles, which occurs after a unit on weather, and before a unit on plant life cycles and plant resources. The animal life cycle unit focuses on student exploration of the changes that occur during the frog and butterfly life cycles, which includes an understanding of the term “metamorphosis”.

The intended learning outcomes (ILO’s) assessed within this unit are located in a table of specifications in Appendix A. There are three ILO’s being tested within this unit, but only the first two ILO’s are assessed on this test. The two ILO’s that are being assessed on this test are located in a table of specifications in Appendix B. The first ILO in the unit table of specifications is the main focus of the unit and test, and requires students to use Bloom Taxonomy’s levels of knowledge and comprehension. Students have mastered this ILO if they are able to recall facts about the frog and butterfly life cycle, and can also describe the changes that occur between the stages in each animal’s life cycle. The second ILO assessed in this unit requires students to be able to identify the similarities and differences between the life cycles of the frog and butterfly. Although this ILO has a strong emphasis in the unit, it can only be assessed on the test through a supply-response question because it requires students to be at the analysis level of Bloom’s Taxonomy. The third ILO that is assessed during this unit requires
students to be able to construct a life cycle of the frog and butterfly, and also interpret the changes that occur during each life cycle when given a pre-made life cycle diagram. As previously stated, this ILO will not be assessed on this test, and instead will be assessed formatively through several different class activities. For example, students will construct both the frog and butterfly life cycle when learning about the different stages of each animal’s life. The “plant life cycle” portion of this ILO is assessed during the next unit on plant life cycles and plant resources.

The teacher will use several different types of assessments to gauge student learning throughout the unit. This includes formative assessments that occur through observation of classroom activities such as student discussions, and student work products. These formative assessments will inform the teacher’s classroom instruction, and allow the teacher to identify which concepts need to be reviewed before the summative test that occurs at the end of the unit. The summative test that has been created will be used by the teacher to assess student learning on the concepts studied in the unit. Student outcomes on the summative test will be used as a test grade. The students’ test results will also allow the teacher to assess the effectiveness of their teaching, and to also see which concepts should be reviewed before beginning the next unit.

The diverse students in the teacher’s class heavily influenced the teacher’s decisions when creating the test. The teacher’s school, Magruder Elementary, is a Title I school because of its high percentage of low-socioeconomic students. The teacher has several students in their class that receive free or reduced breakfast and lunch at school. The students in the teacher’s class are culturally diverse including African America, White, Asian, and Hispanic students. The teacher has one student that has an IEP for vision and speech impairments, and has several other students that are in the “Making Connections” program and “Reading Recovery” program.
for reading. In order to ensure that all students can be successful on the test, the teacher has only used vocabulary in the test questions that is explicitly taught during the unit. The teacher is also reading the test aloud to students so that the teacher can be sure that the test is assessing students’ knowledge of the life cycle unit, and not students’ reading ability.

I. Design Elements of the Assessment

The teacher began designing this assessment by choosing the standard, SOL 2.4, and then identifying the ILO’s for this standard. The teacher then analyzed each ILO for its explicit content, implicit content, and situational content to gain a thorough understanding of the ILO. Analyzing each ILO also included determining the cognitive level of the ILO based on Bloom’s Taxonomy. The cognitive level and emphasis of the two ILO’s that are being tested on this assessment can be found in the test table of specifications located in Appendix B. After the teacher identified the standard, ILO’s, and cognitive demand of each ILO, the teacher was able to formulate the instructional objectives for the life cycle unit. The major instructional objective of the unit is, “The student will identify the stages of the frog and butterfly life cycles, and determine the changes that occur between each stage of the frog and butterfly life cycles.”

After determining the standard and ILO’s for the test, the teacher created the test and then analyzed the test for both its construct validity and content validity. The test has high construct validity because there is a strong alignment between the test questions, the ILO’s for the standard, the cognitive level of the standard, and the standard itself. The teacher has ensured that each question on the test has high construct validity by checking its alignment to the ILO and also the cognitive level of the ILO as indicated in the test table of specifications. This allows the teacher to be confident that the test is measuring what the table of specifications shows it should assess. The teacher has also ensured high face validity for the test by planning to read the test
aloud to the students. As previously stated, this allows the teacher to assess students’ knowledge of the frog and butterfly life cycles, instead of students’ reading ability.

The test also has high content validity based on the sampling of questions for each ILO as indicated in the test table of specifications. Creating the test table of specifications is the most important step in ensuring content validity of the test. The first ILO in the test table of specifications has the strongest emphasis of the two ILO’s assessed on the test. The verb used in this ILO is “describe”, which indicates the comprehension level on Bloom’s Taxonomy.

However, the students in the teacher’s class do not have background knowledge on the stages in the frog and butterfly life cycle, which is needed to be able to describe the changes during each life cycle. Therefore, the teacher must also assess the students’ knowledge of this ILO, which is shown on the test table of specifications. The teacher has ensured an adequate sampling of the first ILO by creating a proportionate number of test questions for both the knowledge and comprehension cognitive levels. The test is only able to assess the second ILO through a supply-response question, but this question adequately assesses all parts of the second ILO.

The test uses a variety of different types of questions to assess student learning that includes multiple choice questions, true/false questions, fill in the blank questions, matching questions, and a supply-response question. The teacher has chosen to use a variety of question types to accommodate the different learning styles of the students in their class. All the questions on the test were created by the teacher, or the co-creator of the test, Pamela Evans, except for three of the fill-in-the-blank questions (#13, 14, 16). These three questions were taken from the second grade life cycle unit test that the second grade teachers developed at Magruder Elementary. The teacher chose to use true/false questions, fill-in-the-blank questions, and matching questions to assess the knowledge level of the first ILO. These questions assess basic
recall of the facts that students have been explicitly taught throughout the unit. The multiple choice questions on the test are used to assess recall, and are also used to assess the comprehension level of the first ILO. The multiple choice questions allow the teacher to assess a deeper understanding of the ILO than do the other types of the select-response questions. The supply-response question on the test is used to assess the second ILO, which is at the analysis level of Bloom’s Taxonomy. This ILO can only be assessed by a supply response question, and the teacher has used a Venn diagram format to assess students’ mastery of this ILO.

The teacher has taken several steps to increase the reliability of the test. This includes guarding against systematic error by reading the test aloud to students. The teacher has also attempted to decrease systematic error by using clear directions, formatting the test like the SOL, separating questions based on item type, and emphasizing the word “not” in questions. To decrease personal bias on the test, the teacher has only used vocabulary and concepts in the test questions that are explicitly taught during the unit. To prevent potential threats to reliability, the first portion of the test that includes the select-response items is collected before the teacher hands out the second portion of the test that includes the supply-response item. This is done to prevent students from using any information on the first part of the test when answering the supply-response question. Potential threats to reliability on this test include the chance that students do not understand the test question directions. In addition, there is always a chance of random error occurring during the test administration because this cannot be controlled for. To improve the reliability of the test, several colleagues have proof-read the test for possible issues including the co-creator of the test, and the cooperating teacher’s of the teacher and co-creator, Sylvia Mitchell and Laura Kindley. After the test is administered, the teacher will conduct an item analysis to identify any patterns in students’ answers, and identify whether systematic error
may have occurred that has decreased the validity and reliability of any test questions. The test will have low predictive validity because students’ do not take any high-stakes tests in the second grade, or any other type of science test that would assess similar content at a later date.

The scoring of each type of test item is based on the time and cognitive level required by the question. For example, the true/false questions are only worth one point because students’ have a 50% chance of guessing the item correctly which decreases the reliability of the question. The other types of select-response questions are worth two points each because of their higher reliability levels. The supply-response question is worth a considerable amount more because it requires students to answer at the analysis level of Bloom’s Taxonomy. The test will be scored using a test answer key that was created before administration of the test. This will allow the grading to be objective and consistent for all tests. To keep bias from affecting the teacher’s scoring on the supply-response question, a rubric has been created that shows how students’ will receive points on this question. In addition, sample answers for this question have been provided. The teacher will also guard for bias by using intra-rater reliability and inter-rater reliability. To ensure intra-rater reliability the teacher will score all tests at the same time, and score all of students’ select-response items before grading all of students’ supply-response items. The teacher will ensure inter-rater reliability by exchanging five students’ supply-response items with the co-creator, to verify that the teacher is using the rubric consistently. The test is weighted in the overall content area by the number of points on the assessment. Therefore, the test will have a higher weight on the students’ science grade for the quarter than classroom assignments.
Appendix A.

Unit Table of Specifications

2.4 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>Bloom’s Taxonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge</td>
</tr>
<tr>
<td>Describe changes in the life cycle of a frog and a butterfly.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Emphasis: S</td>
</tr>
<tr>
<td>Compare and contrast life cycles of a frog and a butterfly.</td>
<td></td>
</tr>
<tr>
<td>Construct and interpret models/diagrams of animal and plant life cycles.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B.

Test Table of Specifications

2.4 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>Emphasis: S # &amp; Type of Test Items: 2 Multiple Choice (#2, 5), 3 True/False (#10, 11, 12), 4 Fill in the blank (#13, 14, 15, 16), 1 Matching (#17)</td>
<td>Emphasis: S # &amp; Type of Test Items: 7 Multiple Choice (#1, 3, 4, 6, 7, 8, 9), 2 Matching (#18, 19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compare and contrast life cycles of a frog and a butterfly.</td>
<td></td>
<td></td>
<td>Emphasis: S # &amp; Type of Test Item: Supply-Response (#20)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Name______________________

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 \textbf{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 \textbf{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) Monarch butterflies lay their eggs on milkweed leaves.

   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>Pupa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polliwog</td>
<td>Flies</td>
<td>Leaves</td>
<td>Froglet</td>
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</table>

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.
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)
- Butterfly Life Cycle (2 points)
- Similarities of the Frog and Butterfly Life Cycles (2 points)
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?
   
   E. Frog
   
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   G. Butterfly
   
   H. Toad

2) Identify the order of the stages in the butterfly life cycle.
   
   E. larva, butterfly, chrysalis, egg
   
   F. chrysalis, egg, butterfly, larva
   
   **G. egg, larva, chrysalis, butterfly**
   
   H. butterfly, larva, egg, chrysalis

3) In which stage of the butterfly life cycle does it **NOT** eat?
   
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   F. Butterfly
   
   G. Caterpillar
   
   **H. Chrysalis**
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E. Froglet, egg, adult frog, tadpole
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   H. The tadpole begins to develop lungs

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   E. Gills
   F. Eyes
   **G. Lungs**
   H. Heart

9) Where do adult frogs lay eggs?
   E. In the woods
   F. In a tree
   G. In a hole
   **H. 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)

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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_.

15) After hatching, caterpillars eat _leaves_.

16) In the frog life cycle, the tadpole can also be called a/an _polliwog_.
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)

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.
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)
   - Butterfly Life Cycle (2 points)
   - Similarities of the Frog and Butterfly Life Cycles (2 points)

Frog Life Cycle
1. **Frogs are** ________ amphibians.
2. **Frogs hatch in** ________ water.

Butterfly Life Cycle
1. **Butterflies are** ________ insects.
2. **Both frogs and butterflies hatch from** ________ eggs.
2. **Butterflies can fly when they are in the adult stage.**

These answers are only a sample of correct answers students could provide.
Rubric for Supply-Response Question (#20):

<table>
<thead>
<tr>
<th></th>
<th>Satisfactory</th>
<th>Progressing</th>
<th>Needs Improvement</th>
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</thead>
<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. (1pt)</td>
<td>The student does not provide any accurate attributes of the frog life cycle. (0pt)</td>
</tr>
<tr>
<td><strong>Butterfly Life Cycle</strong></td>
<td>The student provides two accurate attributes of the butterfly life cycle. (2 pts)</td>
<td>The student provides one accurate attribute of the butterfly life cycle. (1 pt)</td>
<td>The student does not provide any accurate attributes of the butterfly life cycle. (0 pt)</td>
</tr>
<tr>
<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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