Lesson Summary:
In this multi-day lesson, students explore multiplication concepts through skip counting, repeated addition and arrays. Using animal characteristics as a context, students solve problems using mathematical tools such as hundreds charts, number lines, counters and drawing arrays that represent the problem situation. The lesson concludes with an animal puppet project in which students create animal puppets and solve problems related to the characteristics of the puppets. Opportunities for differentiation are embedded through partner and small group discussion and work, the use of a variety of mathematical tools and strategies for assessing different modalities of learning.

Estimated Duration: Four hours

Commentary:
Students’ introductory experiences with multiplication concepts should include real-world contexts and problem situations, connections to multiple standards in mathematics and other content areas, and exposure to a variety of physical and visual representations. Students should be encouraged to develop their own computational strategies which may include skip counting, repeated addition, arrays and area models. Include a diversity of approaches and contexts to provide students of different learning modalities access to deep understanding of multiplication.

Pre-Assessment:
- Distribute How Many Legs?, Attachment A, to students. Read the story problems to the class, which require combining equal sets. For example: 
  _____’s favorite animal at the zoo is the zebra. In the zebra exhibit at the zoo, there were five zebras. How many legs does one zebra have? How many legs do five zebras have? Tell students to solve the problems. They may draw pictures, use numbers or count.
- Observe the method that each student uses to arrive at his/her answer. Possible methods include repeated addition, multiplication, skip counting, tally marks, arrays or acting out.
Ohio Standards Connection

Mathematical Processes

Benchmarks
A. Use a variety of strategies to understand problem situations; e.g., discussing with peers, stating problems in own words, modeling problems with diagrams or physical materials, identifying a pattern.
F. Draw pictures and use physical models to represent problem situations and solutions.
I. Communicate mathematical thinking by using everyday language and appropriate mathematical language.

Scoring Guidelines:
Use the rubric to determine the readiness level for each student. A checklist and anecdotal notes may be used to describe student performance and collect evidence to identify areas of strengths and weaknesses. Look for students who simply pull the numbers out of the story and add them together versus understanding groups of objects being combined. Observe how students draw the pictures or use tally marks. Pictures that seem to be organized into groups, suggest students understand the nature of the situation and combining of equal sets.

<table>
<thead>
<tr>
<th></th>
<th>Ready For Instruction</th>
<th>Intervention May Be Needed</th>
<th>Intervention Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate evidence of understanding of beginning multiplication concepts are shown when repeated addition statements are used, pictures showing equal groups are drawn or student explains a strategy of combining the groups.</td>
<td>Partial evidence is shown when repeated addition that contains errors in calculation or the number of groups is used. Pictures may be drawn but there is no evidence that the student is thinking about equal groups.</td>
<td>Inadequate evidence is shown when students add or draw pictures of the two numbers in the problem situation. For example; 5 worms + 4 groups = 9</td>
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</tbody>
</table>

Post-Assessment:
• Distribute *Zooin' Multiplication*, Attachment B. Present the following situations to the students. Tell students to use skip counting, arrays or repeated addition to solve the situations.
  1. Four elephants with two eyes. How many eyes in all?
  2. Ten butterflies, how many wings in all?
  3. Eight starfish in a tank. How many arms on the all of the starfish?
  4. Four birds in each cage. There are eight cages of birds. How many birds?
**Scoring Guidelines:**
Use the rubric to assess student progress. Students who demonstrate understanding will freely use different strategies to solve the problems. Provide intense intervention for students at the inadequate level.

<table>
<thead>
<tr>
<th>Inadequate Understanding</th>
<th>Partial Understanding</th>
<th>Adequate Understanding</th>
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</thead>
<tbody>
<tr>
<td>Demonstrates inadequate understanding of multiplication by adding the two numbers instead of recognizing equal groups. Major flaws contained in arrays and sequence of numbers representing skip counting.</td>
<td>Demonstrates partial understanding of multiplication by using one of the strategies or solutions contain minor errors. For example, may omit a row in the array or skip count incorrectly (4, 8, 11, 15, 19).</td>
<td>Demonstrates adequate understanding of multiplication by using skip counting, repeated addition and/or arrays to correctly answer the four situations.</td>
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**Instructional Procedures:**

**Part One**

1. Distribute a number line and a hundred chart to students. Ask students what it means to count by tens. Students may suggest that not all numbers are counted, some numbers are skipped or you say every tenth number. Have class count by tens. Repeat the activity counting by fives and twos. Tell the students when we count by numbers such as two, five and 10 in mathematics we call it “skip counting”.

2. Ask the class questions which they can use skip counting to solve. Allow students to work in pairs to solve the problem situation, discuss how to use skip counting to find the solution and to assist students. Sample questions include:
   - How many fingers do five monkeys have? Assume each monkey has 10 fingers.
   - The teacher bought seven gumballs from the gumball machine. Each gumball costs a nickel. What is the value of seven nickels?
   - Four silly penguins were wearing shoes. How many shoes are there in four pairs of shoes?

3. Model skip counting using the number line or hundreds chart. Have students work with partners using the hundreds chart of number line to skip count by different numbers. Have students write down the sequence of numbers. For example, if the students are counting by three, they write 3, 6, 9, 12, 15, etc. While walking around the room check the sequences of numbers written and informally assess student progress.

4. Ask students to share lists of number sequences and write them on the board. Ask students to observe the lists and look for patterns in the numbers. Students may notice that for every sequence the tenth number ends in a zero. Ask students if that would happen for every number. Allow time for students to discuss with a partner and share their ideas with the class. Students may also notice patterns in the list for two, four and five. Record the observations students make on a chart paper.
5. Play “Skip Counting Around the Room.” Place a hundreds chart on the overhead projector. Tell students that they will skip count by a number. They need to listen carefully to the student before them so they know what the next number in the sequence will be. Start with twos. Choose a student to begin and explain how the counting will go around the room. The first student says “two,” the second student says “four,” the third student says “six,” etc. Remind students that they can use the hundreds chart for help. Go around the room until someone makes a mistake. Start with a different number to skip count around the room.

6. Provide students with problem situations to practice skip counting with the number line or hundred chart. For example,
   - The zookeeper is placing signs on each side of the bear cages. There are 6 square bear cages at the zoo. How many signs does the zookeeper need?
7. To close the lesson, ask students to describe skip counting to their partners. Have them write a sequence of the first 10 numbers that show skip counting by six. (6, 12, 18, 24,…60). Collect the sequence as an informal assessment of student progress.
8. Distribute Skip Counting Animals, Attachment C. Have students complete in class or for homework. Use as an individual assessment.

Instructional Tip:
Reinforce skip counting through oral exercises as students line up, when there are a few minutes of down time, create songs or skip counting rhymes. Provide problem situations for students to practice solving using skip counting.

Part Two
8. Teach students a creative version of the song, “The Ants Go Marching.”

   The ants go marching two by two, hurrah! hurrah!
   The ants go marching two by two, hurrah! hurrah!
   The ants go marching two by two, they look for a way to get into the zoo,
   The ants go marching two by two, to get, into the zoo.
   
   The ants go marching three by three, hurrah! hurrah!
   The ants go marching three by three, hurrah! hurrah!
   The ants go marching three by three, as they climb up a tree,
   The ants go marching, three by three, as they climb, up a tree

9. Ask students how many ants marched into the zoo and climbed up a tree. Have students work with a partner or in small groups to solve the problem. Check students understanding of what two by two and three by three means. Observe for use of strategies like repeated addition, skip counting or drawing pictures. If students add two and two and three and three, explain what two by two and three by three means. Use students to make a model of two lines by two rows or three lines by three rows.
10. Ask students to share their strategies for solving the problem with the class. Record the different strategies on chart paper to keep posted in the room.
11. After sharing, reinforce the use of skip counting and repeated addition as strategies to solve the problems. If presented, highlight arrays. Show students what an array looks like and write the word array next to the example. If students do not share an array, introduce the array.

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  * *  * *  * *
  * *  * *  * *
  * *  * *  * *
```

2 by 2 array     3 by 3 array

Ask students to observe the arrays and explain what an array is. They should see rows and columns. Tell students they can use different symbols or pictures when creating arrays like dots, stars, smiley faces, etc. They also can use counters and make a physical model of the array too.

**Instructional Tip:**
Arrays are important tools in understanding multiplication and its connection to other concepts. Arrays are a concrete or visual representation for an abstract idea. Provide counters to make arrays for students experiencing vision problems or difficulty drawing. Include problem situations involving geometric shapes and objects. For example, if one cube has six faces, how many faces do three cubes have? This will reinforce the characteristics of geometric shapes and objects.

12. Have students draw ants marching four by four using an array. Observe students as they draw the array to check progress toward understanding.

13. Present the following problem situation to the class.

   At the zoo, one group of students stopped by the ice cream stand. There were 7 students in the group. Each student ordered three scoops of ice cream. How many scoops of ice cream did seven students order?

   Have students draw or use counters to make an array. Observe students as they work. Use peer assistance if needed.

14. Provide additional problem situations for students to practice making arrays and solving problems related to multiplication. Have groups of students make additional verses and arrays for “The Ants Go Marching” and share with the class.

15. Present the following scenario and ask students the questions that follow.

   Payton collected stuffed animals. She had a starfish, a teddy bear, a dog, a lady bug and an octopus. She wanted to know how many legs the animals have altogether.

   - Can Payton use skip counting or arrays to solve this problem?
   - When can you use skip counting and arrays?
   - When can’t you use skip counting and arrays?

   Have students discuss each question with partners. Select students to share their reasoning with the class. In their journal have students write the responses in their own words.

16. Distribute Animal Arrays, Attachment D. Have students complete in class or for homework.
Part Three

Instructional Tip:
In this lesson, students use a variety of ways to show multiplication concepts. Provide as many manipulatives as possible, homemade or commercial. Allow students to explore with manipulatives and work together in groups to assess student understanding of the concept and determine intervention assistance. Inviting students to verbally state their reasoning for grouping objects in a specific manner will reveal their thinking and understanding of the concept of multiplication. Students explore animals indigenous to Ohio. Use real buttons and felt for the puppets if your budget allows. Otherwise use paper plates and construction paper of appropriate colors.

17. Tell the students, *We are going to make puppets for a puppet show. We will be making five bat puppets with green eyes, three deer puppets with antlers made from construction paper hands, four butterfly puppets with six orange stripes, three on each wing, and six lady bugs puppets with three black dots on their backs.* Adjust the number of puppets to the number of students in the class.

18. Divide the class into four groups. Assign each group an animal. Each group discusses how many eyes/antlers/stripes/dots their animals will have all together using strategies related to multiplication concepts. If this lesson is used as an introduction to multiplication concepts, model strategies such as skip counting, repeated addition, creating arrays and using symbols to represent the problem situations.

19. Have students use the manipulatives or draw pictures to solve for the number of animal characteristics assigned to the group. Observe students as they solve and ask them to explain their thinking.
   - How did you solve your problem?
   - Did you find one way was easier for you than another? (skip-count versus array)
   - How do you know you are correct?

20. Have each group present its problem and solution on the overhead projector or board. Ask the class to determine other strategies that would be appropriate. Show students how to represent multiplication using symbols appropriate for the problem. For example, four butterflies times six stripes on each equals 24 stripes.

21. Have groups gather the materials needed and construct the animal puppets.

22. After completing the puppets, allow students to walk around the room to view the other puppets. While walking around, ask randomly selected students to use strategies to solve for the number of the characteristic and demonstrate. Use this to assess student understanding.

23. Gather students together for “talk-time” to reflect on what they have learned. This allows students to reflect on the concept of multiplication and how it applies to the completed project.

24. Ask students to add one more animal to their groups and determine the new number for the animal characteristic. Allow students to share their answers with the class. The class should evaluate the group’s solution. Connecting learning and teaching to authentic situations help students understand and grasp the idea or concept being taught.
Differentiated Instructional Support:
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- Instructional strategies address multiple learning styles. Kinesthetic students have the opportunity to move around the room to get into groups, collect materials and manipulate objects. Visual learners use the manipulatives to visualize sets and create representations of multiplication concepts using the number lines, hundred charts, arrays and puppets. Auditory learners benefit from small group and class discussions. Students interested in animals will find this activity motivating.
- Have students who need extra practice to skip counting by twos, fives, and tens with a buddy using manipulatives. Connect skip counting to joining two equal groups. Use pictures to show multiplication, or use counters to make equal groups. Use empty egg cartons for kinesthetic learners to assist counting by twos.

Extensions:
- Explore the commutative property of multiplication. Give each student a set of counters. Provide problem situations to solve such as,
  - Terry has four serving plates. He puts three cookies on each plate.
  - Bella has three serving plates. She puts four cookies on each plate.
  - Who has more cookies?
Have students work in pairs to solve the problem. Ask students to share their answer and strategy with the class. Ask students questions such as,
  - a. What do you notice about the answers?
  - b. What do you notice about the numbers in the problem? (They are switched.)
  - c. Do you think the same thing would happen if we changed the numbers?
- Use the puppets to present a puppet show. Students could research the animal they made and use the information to present a puppet show with the other animals about where they live in Ohio, what they eat, how the climate affects them etc. Provide problem situations such as,
  - a. If a butterfly flies 8 miles in one day, how many miles would a butterfly fly in 5 days?
  - b. If a cow eats 3 pounds of grass a day, how many pounds of grass does it eat in a week? How many pounds of grass do 9 cows eat in a day?
- Use other contexts such as music, art, sports or books to extend the concept of multiplication.
  - a. The team scored 5 touchdowns and extra-points. How many points did they score? How many points does the team score for one touchdown and extra-point? (7).

Home Connection:
Have students find examples of things at home that come in equal groups such as boxes of juice, shoes, curtains, gloves or cartons of eggs.

Materials and Resources:
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its
Multiplication: Building Models, Representations and Explanations – Grade Two

contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

For the teacher: chart paper, models of puppets, overhead projector

For the student: counters, hundreds charts, number lines (1-30), paper plates, construction paper, felt (optional), buttons (optional)

Vocabulary:
- array
- equal groups
- multiplication
- repeated addition
- skip counting

Technology Connection:
Teach students how to use the calculator to skip count by using a sequencing feature of a four function calculator. Press the addition key and then the eight key. Press the equal sign once. Eight should be displayed as the answer. Press the equal sign again. Sixteen should be displayed as the answer. Connect pressing the equal sign twice and two eights being 16. Students can practice multiplication facts using the sequencing activity.

Research Connections:


General Tip:
It is important at this grade level to build conceptual understanding of combining equal groups. The focus of this lesson is not to introduce symbolic multiplication or begin memorization of basic multiplication facts. Students should be able to use these strategies to develop understanding of real-world problem situations involving combining equal groups.
Multiplication: Building Models, Representations and Explanations – Grade Two

**Attachments:**
Attachment A, *How Many Legs?*
Attachment B, *Zooin' Multiplication*
Attachment C, *Skip Counting Animals*
Attachment D, *Animal Arrays*
Attachment A

How Many Legs?

Name________________________________

Directions: Read the story. Use words, pictures or numbers to find the answer.

______’s favorite animal at the zoo is the zebra. In the zebra exhibit at the zoo, there were five zebras. How many legs does one zebra have? How many legs do five zebras have?

______’s favorite exhibit at the zoo is the tarantula case. There were three tarantulas in the case. How many legs does one tarantula have? How many legs do three tarantulas have?
Name___________________________________

**Directions:** Read the problem. Solve the problem two ways, arrays, skip counting or repeated addition.

<table>
<thead>
<tr>
<th>There are 4 lions. How many eyes do the lions have altogether?</th>
<th>Ten butterflies in the exhibit. How many wings on all 10 butterflies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight starfish are in the tidal pool. How many arms do the starfish have altogether?</td>
<td>There are 7 bird cages at the zoo. In each cage there are 4 birds. How many birds are in all of the cages?</td>
</tr>
</tbody>
</table>
Directions: Read the story. Use pictures and skip counting to find the answer.

Sasha has an ant farm. She counted 7 ants in her farm. How many legs does 1 ant have? How many legs do 7 ants have?

Picture

Skip Count  ______. ______. ______. ______. ______. ______. ______.

Cameron loves to collect stuffed animals. His favorite is the octopus. He has 4 of them. How many legs does 1 octopus have? How many legs do 4 octopi have?

Picture

Skip Count  ______. ______. ______. ______.
Directions: Read the problem situations. Draw arrays to solve.

There were 7 starfish in the tidal pool exhibit at the zoo. How many arms does one starfish have? How many arms do 7 starfish have?

Tickets to see the “Amazing Birds” show cost 3 dollars for adults and 2 dollars for children. How much would 4 adult tickets and 5 student tickets cost?