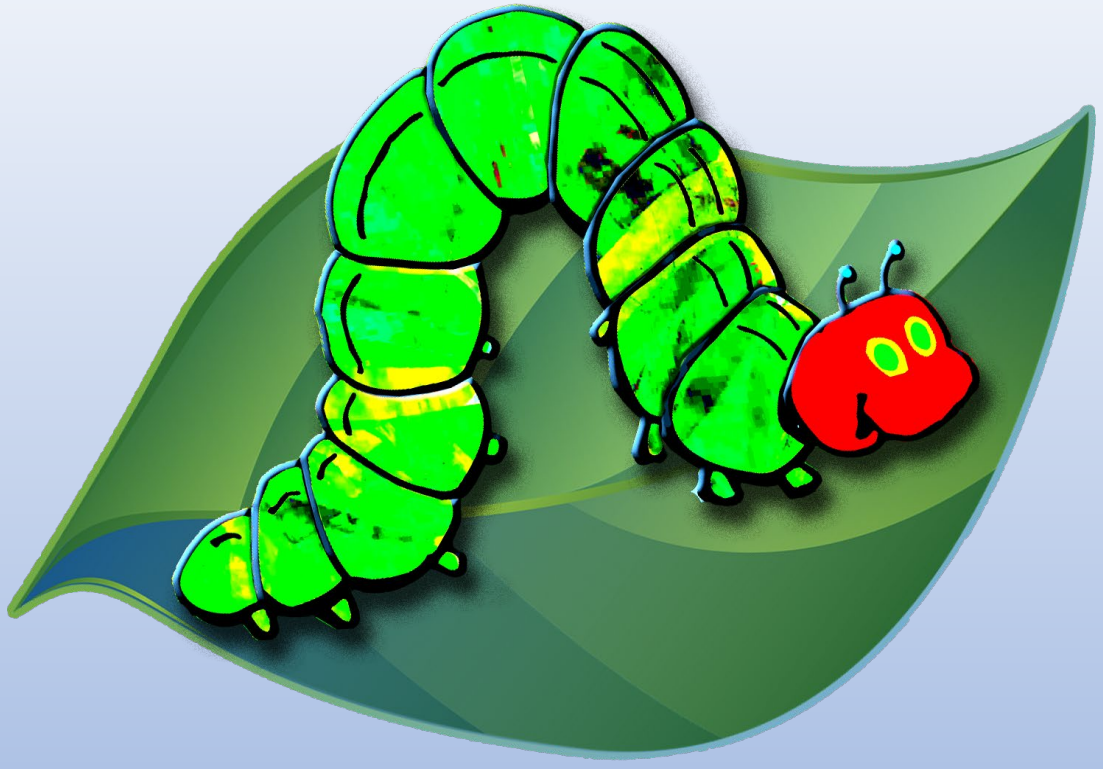
WEST VIRGINIA
DEPARTMENT OF EDUCATION



MATHEMATICS

GRADE 1

The Very Hungry Caterpillar

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Task Title: *The Very Hungry Caterpillar*
Grade or Content Area: 1st Grade Mathematics
Toolkit Author: Diane Thompson, JoAnn Nuzum, and Ashley Lawrence
Original Task Creator: Illustrative Mathematics
Quarter: 1

Rationale for Lesson and Associated Tasks

The purpose of this task is for students to solve word problems that call for the addition of three whole numbers, to relate *counting on* to addition, and to understand that the two digits of a two-digit number represent amounts of tens and ones. This task supports developing concepts of counting on and base-ten structure and is thus appropriate early in the school year.

First graders build on their previous knowledge of adding smaller numbers and taking advantage of more sophisticated strategies such as "making tens" to solve addition problems. They use this structure of numbers to recognize that numbers from 11 to 19 consist of a ten and some number of ones. They notice the same holds true for the numbers 21 to 29. These numbers are composed of two tens and some number of ones. This activity links their understanding of place value structure to numbers beyond ten.

The Very Hungry Caterpillar is a mathematical investigation that encourages students to talk about each other's thinking, in order to improve their own mathematical understanding. The task is designed to provide students with the opportunities to practice and refine their use of mathematical language. This is achieved through whole class, small group, and paired discussions. It includes a mathematical routine that reflects best practices to support students in accessing mathematical concepts. Additionally, this task provides students with the opportunity to record their thinking and problem solving, which not only supports their learning but helps the teacher see where the students are on the learning path. Finally, it provides opportunities to support students in connecting mathematical language with mathematical representations.

Lesson and Associated Tasks Overview

Illustrative Mathematics: (click here)
**Review all components thoroughly.*
**This lesson is designed to be completed in one session.

The Task

The teacher reads the book, *The Very Hungry Caterpillar* by Eric Carle to the class and asks, "How many things do you think the caterpillar ate in this story?" The students take a minute to share their estimates with a partner. Next, the teacher reads *The Very Hungry Caterpillar* again. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used. After each ten-frame is filled in, the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (Students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame.

If students create different, but correct, equations, discuss the different equations and ask students, "Can all of these be correct?"

Lesson Implementation Outline

1. Introduce/Read *The Very Hungry Caterpillar* to students (whole class)
2. Provide students with student view of *The Very Hungry Caterpillar*, three ten-frames for each student or pair of students, 30 counters or unifix cubes per pair of students, and dry erase boards, markers, and erasers
3. Students move to work groups
4. Teacher circulates
5. Small group share, discuss, and analyze
6. Whole group share, discuss, and analyze

West Virginia College- and Career-Readiness State Standard

M.1.1

Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).

M.1.6

Add and subtract within 20, demonstrating fluency for addition and subtraction within 10 and use strategies such as

- counting on;
- making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14);
- decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9);
- using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8= 4); and
- creating equivalent but easier or known sums (e.g., adding 6 +7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).

Mathematical Habits of Mind (MHM)

MHM1 - Make sense of problems and persevere in solving them.
MHM2 - Reason abstractly and quantitatively.
MHM7 - Look for and make use of structure.

Mathematics Teaching Practices to Support Student Growth

- Implement tasks that promote reasoning and problem solving.
- Use and connect mathematical representations.
- Build procedural fluency from conceptual understanding.

Essential Understandings

- An understanding of number structure to recognize that the numbers 11 through 19 consist of a ten and various numbers of ones.
- An understanding of number structure to recognize that the numbers 21 through 29 consist of two tens and various numbers of ones.
- An understanding of place value to numbers beyond ten.

Set-up Phase

1. Become an Expert Regarding All Lesson and Associated Task Content

It is essential that the teacher complete the task prior to classroom implementation to understand how the task works and clearly appreciate the mathematics embedded in the task. Completing the task

provides the opportunity to identify specific questions and challenges that may arise as students work through the task. It also allows the teacher to better understand the variety of opportunities embedded in the task to deepen student understanding of factors and multiples.

Students may benefit from additional tools designed to organize their thinking (i.e., a chart with the days of the week: Monday through Sunday). For students who struggle to record their findings in an organized manner, after a whole-group discussion in which students verify their results, the teacher may provide these students with a pre-created organized chart the includes the items eaten each day.

2. Establish Small Groups

The Very Hungry Caterpillar activity promotes both individual and small group thinking. Students explore their thoughts about patterns while gaining familiarity with the use of addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.

Skill levels, leadership skills, and personalities are all considered when creating small (e.g. three students) groups. Small group collaboration works best when students have been provided previous opportunities to work together on a regular basis. Weeks of teacher observation of student behavior will be extremely helpful when creating small groups for this lesson and associated tasks. Taking notes regarding leadership skills, personalities, the ability to take criticism, to question, and to think deeply about a task or problem will enable teachers to make sound decisions regarding small group placement. When creating the groups, all these factors help to eliminate the potential situation in which one student takes the lead and makes the decisions for the group. In this scenario, one student is gaining all the benefits of the task, while others do not. If a student is not engaged in conversation, this lesson and associated tasks will not be beneficial in helping all students to have meaningful discussions about the mathematics involved nor in analyzing the relationships inherent to the tasks. Students will be working both individually and together when placed in small groups (e.g. three students) to complete this lesson and associated tasks.

3. Develop Open-Ended Questions

Teachers should create a list of open-ended questions designed to support and scaffold the lesson and associated tasks for their students. These questions should purposefully direct students towards provided information, previously learned content, and similarities and differences in their work versus group members.

Making Sense of the Problem:

- What are you trying to find out?
- What is it asking you to do?
- What are the important key words or numbers in the problem?
- Where could you start?
- What are you trying to figure out?
- What do you already know that will help you?
- What information do you need to collect in order to answer the questions?
- What are the steps you have already used to this point?

Support or Contradict Their Ideas or the Ideas of Others:

- How did you show that your answer was correct?
- How can you explain it in a different way?

- Does _____'s answer make sense to you? Why or why not? What question can you ask about what is unclear?
- Do you agree or disagree with the way _____ solved it? Why or why not?
- Tell me about your thinking.
- How did you know this was a reasonable answer?
- Tell me about your calculation. How do you know what to do?

Reason Abstractly, Quantitatively, or Concretely:

- What do the numbers used in the problem represent?
- Show me what you mean so I can see it.

Restate or Explain Their Strategies:

- How did you solve the problem?
- What strategy did you use?
- What math words did you use or learn?
- What were the steps you used?
- What have you discovered?
- How are these similar?
- How are these different?
- How did you know what operation to use?

Predict, Invent, or Problem Solve:

- What would happen if _____?
- What other choices do you have?
- What if _____?
- I really like how you did _____. Explain to me what to do next.
- Is there another way to do that?
- What do you predict the answer will be?

Reflect on Their Work and Make Connections:

- What problem/strategy were you investigating today?
- What questions arose as you worked?
- What were you thinking when you made decisions or selected the strategies to solve the problem?
- How does knowing _____ help you to answer the questions?
- How is this like something you have done before?
- How can you represent this addition or subtraction problem?
- How can math facts help you solve problems?

List Generated From: "Guiding Questions for Math Tasks." *Create-abilities*, (click here).

4. Gather Materials

- Task – *The Very Hungry Caterpillar* student view: (click here)
- *The Very Hungry Caterpillar* by Eric Carle
- Three ten-frames for each student or pair of students – click here
- 30 counters or unifix cubes per pair of students
- One small dry-erase board, dry-erase marker, and eraser per pair of students

Optional materials for differentiated learning

- Chart with the days of the week for easy tracking (this is useful for organizational skills)

- Cut-outs of items eaten by the caterpillar (this is useful for students who have problems transferring the items eaten by the caterpillar to counters/unifix cubes)

5. Anticipated Common Student Misconceptions

- Many children misunderstand the meaning of the equal sign. While the equal sign means "is the same as," many primary students believe the equal sign tells you that the "answer is coming up" to the right of the equal sign. This misconception is reinforced when students only see examples of number sentences with an operation to the left of the equal sign and the answer on the right. First graders need to see equations written multiple ways, for example 5 + 7 = 12 and 12 = 5 + 7.
- Students ignore combinations they know to solve more difficult problems.
- Students struggle with inadequate part-part-total knowledge for the numbers 0 to 10 and/or an inability to trust the count.
- Students have little or no sense of numbers beyond 10 (e.g., fourteen is 10 and 4 more).
- Students fail to recognize the structural basis for recording 2-digit numbers (e.g., sees and reads 25 as "twenty-five", but thinks of this as 20 and 5 without recognizing the significance of the 2 as a count of tens, even though they may be able to say how many tens in the tens place).
- Students inaccurately record the data from the table to the picture graph or sorting categories. They might forget to apply one-to-one correspondence when comparing the data from different categories and/or incorrectly sort the data into categories.
- When counting the unifix cubes or counters, students may count 10, 1, 2, 3, etc. rather than 10, 11, 12, 13, etc.
- Students may read the number as 15 but when asked the value of the digits they say 1 and 5.
- Students may put items in the second ten-frame before completely filling the first.

Explore Phase

Prior to completing this task with students, the following content should have been reviewed (e.g., as warm-up activities one week prior to the introduction of this lesson):

- Counting: one-to-one correspondence
- Addition and subtraction facts to 10
- The meaning of equality
- Vocabulary: Number, Part, Add, Whole, Equals, =, Sum, Plus, +, Take Away, Subtract, Difference, Minus, −, Solve, Compare, Represent, Counting On, Addition Number Sentence, Subtraction Number Sentence
- Writing Addition Number Sentences for a given situation

Prior Instruction/Knowledge:

Prompting students' prior understanding of and skill with addition and subtraction facts to 10 and understanding of the meaning of equality contribute to their study of multiples and factors. Students extend the idea of decomposition of multiplication and learn to use the term multiple as well as prime and composite.

Educators Guide for Mathematics: Grade 1: (pages 8-top of 15 and 17-19) (click here)

Prerequisite Skills

- Know and use addition and subtraction facts to 10 and understand the meaning of equality.

Supporting Skills

- Use the commutative and associative properties to add or multiply numerical expressions.

Impending Skills

- Add 2- and 3-digit numbers with and without models for number and word problems that require regrouping.
- Use the identity properties for addition and multiplication and the zero property for multiplication.
- Subtract 2- and 3-digit numbers with and without models for number and word problems that do not require regrouping.
- Use the commutative and associative properties to add and multiply numerical expressions.
- Add 2- and 3-digit numbers with and without models and word problems that do not require regrouping.

Source: *The Quantile Framework for Mathematics*
https://metametricsinc.com/educators/quantile-for-educators/

Implementation Phase

Teacher Notes

**This lesson is designed to be completed in one session.

Classroom Environment:

1. Math rich - Promotes mathematical language through reading, writing, listening, speaking, and discussing
2. Leads to increased student engagement
3. Engaging setting (Encourages students to talk to each other about their thinking, in order to improve their own mathematical understanding.)

Lesson Implementation Outline

1. Introduce/Read *The Very Hungry Caterpillar* to students (whole class).
2. Provide students with student view of *The Very Hungry Caterpillar,* three ten-frames for each student or pair of students, 30 counters or unifix cubes per pair of students, and dry erase boards, markers, and erasers.
3. Students move to work groups
4. Teacher circulates
5. Small group share, discuss, and analyze
6. Whole group share, discuss, and analyze

Lesson Implementation

1. The teacher reads the book to the class and asks, “How many things do you think the caterpillar ate in this story?”
2. The students take a minute to share their estimates with a partner.
3. Next, the teacher reads *The Very Hungry Caterpillar* again.
   a. After each page, the teacher pauses so that the students can add counters or unifix cubes to the ten-frame to represent the number of things the caterpillar ate, and then write an equation on the dry-erase board connecting addition to the number of counters used.

b. After the apple, pears, plums, and strawberries are eaten, look for any ten-frames with answers other than 10 and facilitate a discussion about what the sum should be at this point so that all the ten-frames have 10.
c. Select students who have used the following equations to share so they can be recorded by the teacher for the whole class to see:

$$1 + 2 + 3 + 4 = 10$$
$$3 + 3 + 4 = 10$$
$$6 + 4 = 10$$

d. Ask students to look at each of the equations and ask, “What is the same in the equations?” and “What is different in the equations?”
e. After each ten-frame is filled in the students move to the next one. If the students are working in pairs, one student can add the counters/unifix cubes to the ten-frame while the other student writes the equation.
f. By the end of the story, there should be a total of 25 food items eaten and 1 leaf eaten. (The students can decide as a class whether to count the leaf as a food). There will be two ten-frames completed with 5 or 6 counters/unifix cubes on the third ten-frame.
g. If students come up with different, but correct, equations, then discuss the different equations and ask students, "Can all of these be correct?"
h. There is the possibility that students may write different, but correct, equations. If this happens, then the teacher should take the opportunity to ask students whether the different equations are correct and how they know. An appropriate classroom discussion can help support students' understanding of the equals sign. While the standard only calls for sums within 20, in instructional situations it is appropriate to go beyond that. This limit is most salient for assessment developers.

4. An example of what the students do as the story is read:
   a. After 1 apple and 2 pears are eaten, there are 3 counters on the ten-frame. The equation will be $1 + 2 = 3$.
   b. After 1 apple, 2 pears, and 3 plums are eaten, there are 6 counters on the ten-frame. The equation could be either $3 + 3 = 6$ or $1 + 2 + 3 = 6$.
   c. After 1 apple, 2 pears, 3 plums, and 4 strawberries are eaten, 4 more counters are added to the ten-frame for a total of ten counters. The equation could be $6 + 4 = 10$, $3 + 3 + 4 = 10$, or $1 + 2 + 3 + 4 = 10$.
   d. This continues throughout the book and as the number increases the connection to the structure of numbers also continues.

Assessment

1. Formative Assessment – collect information during the activity by the use of:
   a. Anecdotal notes
   b. Student interviews
   c. Debriefing
   d. Observations
   e. Questioning
   f. Hand signals
   g. Think-Pair-Share

Extension Questions

- On which day did the caterpillar eat the least amount of food?
- How do you know he ate the least amount of food on this day?
- On which day did the caterpillar eat the most food?
- How do you know he ate the most food on this day?
- After eating too much food, did the caterpillar get bigger or smaller?
- If the caterpillar is getting bigger, which operation do you think of, addition or subtraction?
- If the caterpillar is getting smaller, which operation do you think of, addition or subtraction?

Share, Discuss, and Analyze Phase

Essential Understanding #1:

An understanding of number structure to recognize that the numbers 11 through 19 consist of a ten and various numbers of ones.

Share: The investigation opens up with the students listening to *The Very Hungry Caterpillar*. The goal of the investigation task is for students to solve word problems that call for addition of three whole numbers, to relate counting on to addition, and to understand that the two digits of a two-digit number represent amounts of tens and ones.

Discuss: During the discussion, it is important to make the transition from the language of items eaten to mathematics. This transition is essential in developing mathematical language.

Students will work in pairs or small groups to answer the following questions with regards to The Very Hungry Caterpillar:

Q#1: After the apple, pears, plums, and strawberries are eaten by the caterpillar, how many ten-frames are filled? What do we call one group of ten ones?

Q#2: After the apple, pears, plums, strawberries, and oranges are eaten by the caterpillar, how many ten-frames are filled? How many items are in the second ten-frame?

Q#3: After the apple, pears, plums, strawberries, oranges, and the piece of chocolate cake are eaten by the caterpillar, how many ten-frames are filled? How many items are in the next ten-frame?

Repeat this with a few more through the slice of Swiss cheese (19^{th} item).

Analyze: Students will review, analyze, and respond to *The Very Hungry Caterpillar* questions:

Q#1: How many counters are in the first ten-frame?

Q#2: How many counters are in the second ten-frame?

Q#3: If we added the counters from both ten-frames, how many would we have? Explain your answer.

Q#4: What would our number sentence be if we added the counters in each of the ten-frames? Explain your answer.

Repeat this with a few of the teen numbers.

Essential Understanding #2:

An understanding of number structure to recognize that the numbers 21 through 29 consist of two tens and various numbers of ones.

Share: The investigation opens up with the students listening to *The Very Hungry Caterpillar*. The goal of the investigation task is for students to solve word problems that call for addition of three whole numbers, to relate counting on to addition, and to understand that the two digits of a two-digit number represent amounts of tens and ones.

Discuss: Students will work in pairs or small groups to answer the following questions with regards to The Very Hungry Caterpillar:

Q#1: After the hungry caterpillar has eaten the apple, pears, plums, strawberries, oranges, piece of chocolate cake, ice cream cone, pickle, slice of Swiss cheese, and salami, how many ten-frames are filled? What do we call two tens?

Q#2: After the hungry caterpillar has eaten the apple, pears, plums, strawberries, oranges, piece of chocolate cake, ice cream cone, pickle, slice of Swiss cheese, salami, and lollipop, how many ten-frames are filled? How many items are in the third ten-frame? What do we call 2-tens and 1-ones? Repeat this with a few more through the slice of watermelon (20th item).

Analyze: Students will review, analyze, and respond to *The Very Hungry Caterpillar* questions:

Q#1: How many groups of tens do you have shown?

Q#2: How many ones do you have shown?

Q#3: If we added the ten-frames, what is the number?

Q#4: What would our number sentence be if we added the counters in each of the ten-frames? Explain your answer.

Repeat this with a few more numbers through the 25th item (a slice of watermelon).

Essential Understanding #3:

An understanding of place value to numbers beyond ten.

Share: The investigation opens up with the students listening to *The Very Hungry Caterpillar*. The goal of the investigation task is for students to solve word problems that call for addition of three whole numbers, to relate counting on to addition, and to understand that the two digits of a two-digit number represent amounts of tens and ones.

Discuss: Students will work in pairs or small groups to answer the following questions with regards to *The Very Hungry Caterpillar*:

Q#1: After the apple, pears, plums, and strawberries are eaten by the caterpillar, how many ten-frames are filled? What do we call one group of ten ones?

Q#2: After the apple, pears, plums, strawberries, and oranges are eaten by the caterpillar, how many ten-frames are filled? How many items are in the second ten-frame?

Q#3: After the apple, pears, plums, strawberries, oranges, and the piece of chocolate cake are eaten by the caterpillar, how many ten-frames are filled? How many items are in the next ten-frame?

Repeat this with a few more through the slice of watermelon (25th item).

Analyze: Students will review, analyze, and respond to *The Very Hungry Caterpillar* questions:

Q#1: What is significant about the "teens" numbers? Explain your answer.

Q#2: How can the numbers 10 and higher be shown, counted read, and written? Explain your answer.

Q#3: What are ways to add with tens and ones? Explain your answer.

Q#4: How does using objects and drawings help you represent problems in multiple ways? Explain your answer.

Q#5: What does the "2" in 25 mean? What does the "5" in 25 mean? Explain your answer. This question can be repeated by changing the target number.