SOUTH CAROLINA SUPPORT SYSTEMS INSTRUCTIONAL GUIDE	
Content Area	**First Grade Mathematics**
Recommended Days of Instruction	**First Nine Weeks**

Standards/Indicators Addressed:

Standard 1-2: The student will demonstrate through the mathematical processes a sense of quantity and numerical relationships; the relationship among related basic facts; and the connections among numeric, oral, and written-word forms of whole numbers.

1-2.1 Translate between numeral and quantity through 100. (B2)
1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects. (B3)
1-2.3 Represent quantities in word form through *ten*. (A2)
1-2.4 Recognize whole-number words that correspond to numerals through *twenty*. (A1)
1-2.5 Compare whole-number quantities through 100 by using the terms *is greater than, is less than,* and *is equal to*. (B2)
1-2.6 Recall basic addition facts through 9 + 9 and corresponding subtraction facts. (A1)
1-2.7 Summarize the inverse relationship between addition and subtraction. (B2)
1-2.9 Analyze the magnitude of digits through 999 on the basis of their place values. (B4)

Standard 1-3: The student will demonstrate through the mathematical processes a sense of numeric patterns, the relationship between addition and subtraction, and change over time.

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)
1-3.2 Translate patterns into rules for simple addition and subtraction. (B2)
1-3.3 Illustrate the commutative property based on basic facts. (A2)
1-3.4 Analyze numeric relationships to complete and extend simple patterns. (B4)
1-3.5 Classify a number as odd or even. (B2)

Standard 1-5: The student will demonstrate through the mathematical processes a sense of the value of combinations of coins and the measurement of length, weight, time, and temperature.

1-5.8 Use analog and digital clocks to tell and record time to the half hour. (C3)
1-5.9 Illustrate past and future dates on a calendar. (A2)
1-5.10 Represent dates in standard form (June 1, 2007, for example) and numeric form (6-1-2007, for example). (A2)
1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)

* These indicators are covered in the following 4 Modules for this Nine Weeks Period.
Teaching time should be adjusted to allow for sufficient learning experiences in each of the modules.

Module 1-1 Number Structure and Relationships- Whole Numbers

Indicator	Recommended Resources	Suggested Instructional Strategies	Assessment Guidelines
Module 1-1 Lesson A: Representing Numbers Through Twenty 1-2.1 Translate between numeral and quantity through 100. (B2) 1-2.3 Represent quantities in word from through ten. (A2) 1-2.4 Recognize whole-number words that correspond to numerals through twenty. (A1) 1-2.9 Analyze the magnitude of digits through 999 on the basis of their place values. (B4)	NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series SC Mathematics Support Document Developing Number Concepts: Counting, Comparing, and Pattern, Kathy Richardson Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM) Hands On Standards Grade PreK-K and 1-2, Learning Resources	See Instructional Planning Guide Module 1-1A Introductory Lesson Representing Numbers Through Twenty See Module 1-1A Additional Instructional Strategies	See Instructional Planning Guide Module 1-1A Assessment
Module 1-1 Lesson B: Goldfish Estimation 1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to		See Instructional Planning Guide Module 1-1B, Introductory Lesson Goldfish Estimation	See Instructional Planning Guide Module 1-1B Lesson Assessment

100 objects. (B3)			
Module 1-1 Lesson C: Comparing Quantities 1-2.5 Compare whole number quantities through 100 using the terms greater than, is less than, and is equal to. (B2)		See Instructional Planning Guide Module 1-1C Introductory Lesson Comparing Quantities See Instructional Planning Guide Module 1-1C, Lesson Additional Instructional Strategies	See Instructional Planning Guide Module 1-1C Lesson Assessment
Module 1-2 Patterns, Relationships and Functions			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**

Module 1-2 Lesson A: Adding Patterns 1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)	NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series SC Mathematics Support Document Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM) Textbook Correlations – See Appendix A Hands On Standards Grade PreK-K and 1-2, Learning Resources Everyday Mathematics First Grade, McGraw Hill	See Instructional Planning Guide Module 1-2A Introductory Lesson Adding Patterns See Module 1-2A Additional Instructional Strategies	See Instructional Planning Guide Module 1-2A Lesson Assessment
Module 1-2 Lesson B: Subtracting Patterns 1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)		See Instructional Planning Guide Module 1-2B Introductory Lesson Subtracting Patterns See Module 1-2B Additional Instructional Strategies	See Instructional Planning Guide Module 1-2B Lesson Assessment

Module 1-2 Lesson C: Translate Patterns to Adding/Subtracting Rules 1-3.2 Translate patterns into rules for simple addition and subtraction. (B2)		See Instructional Planning Guide Module 1-2C Introductory Lesson Translate Patterns to Adding/Subtracting Rules See Module 1-2C Additional Instructional Strategies	See Instructional Planning Guide Module 1-2C Assessment
Module 1-2 Lesson D: Complete and Extend Simple Patterns 1-3.4 Analyze numeric relationships to complete and extend simple patterns. (B4)		See Instructional Planning Guide Module 1-2D Introductory Lesson Complete and Extend Simple Patterns See Module 1-2D Additional Instructional Strategies	See Instructional Planning Guide Module 1-2D Assessment

Module 1-2 Lesson E: Classify Odd and Even Numbers 1-3.5 Classify a number as odd or even. (B2)		See Instructional Planning Guide Module 1-2E Introductory Lesson Classify Odd and Even Numbers See Module 1-2E Additional Instructional Strategies	See Instructional Planning Guide Module 1-2E Assessment
Module 1-3 Operations – Addition and Subtraction Representations, Properties, and Proportional Reasoning			

Indicator	Recommended Resources	Suggested Instructional Strategies	Assessment Guidelines
Module 1-3 Lesson A: Recall Basic Facts 1-2.6 Recall basic facts through 9+9 and corresponding subtraction facts. (A1)	NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series SC Mathematics Support Document Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM) Hands On Standards Grade PreK-K and 1-2, Learning Resources	See Instructional Planning Guide Module 1-3A Introductory Lesson Recall Basic Facts See Module 1-3A Additional Instructional Strategies	See Instructional Planning Guide Module 1-3A Asessment

Module 1-3 Lesson B: Inverse Relationships (+ and -) 1-2.7 Summarize the inverse relationship between addition and subtraction. (B2)	Everyday Mathematics First Grade, McGraw Hill	See Instructional Planning Guide Module 1-3B Introductory Lesson Inverse Relationships (+ and -) See Module 1-3B Additional Instructional Strategies	See Instructional Planning Guide Module 1-3B Assessment

Module 1-3 Lesson C: Basic Commutative Property 1-3.3 Illustrate the commutative property based on basic facts. (A2)		See Instructional Planning Guide Module 1-3C Introductory Lesson Basic Commutative Property See Module 1-3C Additional Instructional Strategies	See Instructional Planning Guide Module 1-3C Assessment
Module 1-4 Time and Temperature			
Indicator	**Recommended Resources**	**Suggested Instructional**	**Assessment**

		Strategies	Guidelines
Module 1-4 Lesson A: Tell Time to the Half Hour 1-5.8 Use analog and digital clocks to tell and record time to the half hour. (C3)	NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series SC Mathematics Support Document Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM) Hands On Standards Grade PreK-K and 1-2, Learning Resources	See Instructional Planning Guide Module 1-4A Introductory Lesson Tell Time to the Half Hour See Module 1-4A Additional Instructional Strategies	See Instructional Planning Guide Module 1-4A Assessment
Module 1-4 Lesson B Dates on a Calendar 1-5.9 Illustrate past and future dates on a calendar. (A2) 1-5.10 Represent dates in standard form (June 1, 2008, for example) and numeric form (6-1-2008, for example). (A2)		See Instructional Planning Guide Module 1-4B Introductory Lesson Dates on a Calendar See Module 1-4B Additional Instructional Strategies	See Instructional Planning Guide Module 1-4B Assessment

Module 1-4 Lesson C 1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)		See Instructional Planning Guide Module 1-4C Introductory Lesson Dates on a Calendar See Module 1-4C Additional Instructional Strategies	See Instructional Planning Guide Module 1-4C Assessment

MODULE

1-1

Number Structure and Relationships – Whole Numbers

This module addresses the following indicators:

1-2.1 Translate between numeral and quantity through 100. (B2)
1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects. (B3)
1-2.3 Represent quantities in word form through *ten*. (A2)
1-2.4 Recognize whole-number words that correspond to numerals through *twenty*. (A1)
1-2.5 Compare whole-number quantities through 100 by using the terms *is greater than, is less than,* and *is equal to*. (B2)
1-2.9 Analyze the magnitude of digits through 999 on the basis of their place values. (B4) ***Year-long indicator***

This module contains __3__ lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

1.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students' prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

1-2.1 Translate between numeral and quantity through 100.

- In kindergarten, students recalled numbers, counting forward through 99 and backward from 10 (K-2.1). They translated between numeral and quantity through 31 (K-2.2).
- First grade students should build on that knowledge and be able to translate between number and quantity through 100 (1-2.1). Students also write numbers in word form through ten (1-2.3) and recognize whole number words through twenty (1-2.4).
- In second grade, students represent quantities in word form through twenty (2-2.2) and represent multiples of ten in word form through ninety (2-2.3).

1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects. (B3)

- In kindergarten, students recalled numbers, counting forward through 99 and backward from 10 (K-2.1). They translated between numeral and quantity through 31 (K-2.2) and compared sets of no more than 31 objects using the terms more than, less than and the same as (K-2.3).
- In first grade, students use estimation to determine the approximate number of objects in a set of 20 to 100 objects (1-2.2). Students also translate between numeral and quantity through 100 (1-2.1) and compare whole-number quantities through 100 by using the terms is greater than, is less than and is equal to (1-2.5).
- In second grade, students will generate estimation strategies to determine the approximate number of objects in a set of no more than 1000 objects (2-2.1).

1-2.3 Represent word quantities in word form through ten. (A2)

- In kindergarten, students recalled numbers, counting forward through 99 and backward from 10 (K-2.1). They also translated between numeral and quantity through 31 (K-2.2).
- In first grade, students represent quantities in word form through ten (1-2.3) and translate between numeral and quantity through 100 (1-2.1).
- In second grade, students will represent quantities in word form through twenty (2-2.2) and represent multiples of ten in word form through ninety (2-2.3).

1-2.4 Recognize whole number words that correspond to numerals through *twenty*. (A1)

- In kindergarten, students recalled numbers, counting forward through 99 and backward from 10 (K-2.1). They also translated between numeral and quantity through 31 (K-2.2).
- In first grade, students represent quantities in word form through ten (1-2.3) and translate between numeral and quantity through 100 (1-2.1).
- In second grade, students will represent quantities in word form through twenty (2-2.2) and represent multiples of ten in word form through ninety (2-2.3).

1-2.5 Compare whole number quantities through 100 by using the terms in greater than, is less than, and is equal to. (B2)

- In kindergarten, students compare sets of no more than 31 objects by using the terms more than, less than and the same as (K-2.3).
- In first grade, students compare whole number quantities through 100 by using the terms is greater than, is less than and is equal to (1-2.5).
- In second grade, students compare whole-number quantities through 999 by using the terms is less than, is greater than and is equal to and the symbols >, < and = (2-2.4).

1-2.9 Analyze the magnitude of digits through 999 on the basis of their place value (B4).

- In kindergarten, students analyzed the magnitude of digits through 99 on the basis of their place value (K-2.6) and represented the place value of each digit in a two-digit whole number (K-2.7).
- In kindergarten, students analyzed the magnitude of digits through 99 on the basis of their place value (K-2.6) and represented the place value of each digit in a two-digit whole number (K-2.7).
- In second grade, students will analyze the magnitude of digits through 9,999 on the basis of their place value (2-2.10).

- **Key Concepts/Key Terms**

***These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.**

- *Numeral
- *Quantity
- *Digit
- *More than
- *Less than
- *About
- *Closer to
- *Estimation
- *Word form

- *Is greater than
- *Is less than
- *Is equal to
- *Magnitude
- *Place value

II. Teaching the Lesson(s)

1. Teaching Lesson 1-1A Representing Numbers Through 20

1-2.1 Translate between numeral and quantity through 100.

For this indicator, it is **essential** for students to:
- Understand that the last work spoken when counting a set represents "how many" are in the set.
- Match the concrete objects with the correct numeral
- Match pictorial representation with the correct numeral
- Analyze patterns to develop strategies for representing quantities

For this indicator, it is **not essential** for students to:
- Represent numerals through 100 in words

1-2.3 Represent word quantities in word form through ten. (A2)

For this indicator, it is **essential** for students to:
- Connect the word form to the numeral
- Translate between and among words, quantities and numeral
- Count through 10
- Connect numerals and number words to the numerical order

For this indicator, it is **not essential** for students to:
None noted

1-2.4 Recognize whole number words that correspond to numerals through *twenty*. (A1)

For this indicator, it is **essential** for students to:
- Recall the words that corresponds to the numerals through twenty

For this indicator, it is **not essential** for students to:
- Connect quantities to numerals in order to recognize the word for the numeral

- Connect the multiple forms of numerals through twenty (quantities, word, picture, verbal, etc.)
- Develop strategies to help them recognize/recall these numerals

1-2.9 Analyze the magnitude of digits through 999 on the basis of their place value (B4).

For this indicator, it is **essential** for students to:
- Understand place value
- Understand that each place value ten times greater than the position to the right.
- Model place value relationships i.e. what does ten times one place look like, what does ten times the hundreds place look like, etc…
- Expand numbers in order to analyze place value

For this indicator, it is **not essential** for students to:
- None noted

Teacher Notes: Mathematics learning builds over the course of time. This is especially true with concepts such as number sense; equivalencies; weight, linear, and liquid measurement; time; money, just to name a few. As a result some topics are best acquired through repeated exposure in small on-going intervals of time. Therefore, while an introductory lesson has been provided for the concepts addressed in this Module, it is important to point out that students will need on-going formal and informal experiences throughout the year to ensure the automaticity and flexibility that is demonstrated with mathematical understanding.

As students enter first grade, most are able to count easily to 20 and beyond. Most are able to write the numerals 0-10. However, we want to make sure that children go beyond simply counting and develop a strong sense of number and number relationships. First grade children should not focus on the process of counting but instead focus on developing a sense of quantity and the relationships between quantities. Students should have numerous opportunities to use concrete items to "get a feel" for quantity and to develop a sense of number.

In order to develop an understanding of the concepts more and less, students need experiences that allow them to explore more/less relationships and to count, check and think about the results. Early experiences should focus on determining whether one quantity is more or less than another. Then move to determining how many more or how many less one number is than another. The goal is to move past this stage to knowing the relationship instantly. This

goal requires many experiences where the children focus on the relationships between numbers.

With minimal instruction, children can tell you that a digit is in the tens place or ones place. However, the child may be naming a learned position but have little understanding of place value. Many first graders rely on unitary (counting by ones) counting to understand numbers. Activities should be designed to help children integrate the grouping by tens concept with what they know about numbers from counting by ones. Using base ten language, such as five tens and three ones in conjunction with the standard language "53" will help children make connections between the two ways of naming numbers.

a. Indicators with Taxonomy

1-2.1 Translate between numeral and quantity through 100. (B2)
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

1-2.3 Represent quantities in word form through *ten*. (A2)
Cognitive Process Dimension: Understand
Knowledge Dimension: Factual Knowledge

1-2.4 Recognize whole-number words that correspond to numerals through *twenty*. (A1)
Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

1-2.9 Analyze the magnitude of digits through 999 on the basis of their place values. (B4)
Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson(s) 1-1A Representing Numbers Through Twenty

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006 p. 18-19.

Materials Needed

- base ten blocks
- counters
- index cards
- pencil

Suggested Literature Connection:
The Button Box by Margarette Reid

Introductory Lesson 1-1A Representing Numbers Through 20

Begin by posing the following problem. (You will model different ways to represent a number using this problem.)

Steven's birthday is in 11 days. How can we show the number of days before Steven's birthday in five different ways?

Before continuing with the problem, brainstorm (as a class) ways they might represent the number. Then, model the numerical form, word form, tally form, unitary counting form (using counters), and base ten form. Be sure to make a strong connection between base ten and numerical forms, giving emphasis to place value.

Divide students into groups of three or four. Give one student base ten blocks, one student counters, and remaining student(s) index cards and a pencil. Ask students to work within their groups to represent the number 11 using each of the materials.

As students work, circulate the room listening to the dialogue. This information will serve as formative data that may influence future instruction.

Once you have checked over each group's work, you may have students rotate their manipulatives and give them another number.

c. Misconceptions/Common Errors

1-2.1 Some students may have difficulty distinguishing different number words that start with the same initial sound such as five and four. Using the multiple representations simultaneously (numeral and concrete) may help reinforce the differences. Make sure students realize that one tens rod can be exchanged for 10 units and vice versa.

1-2.3 Some students may have difficulty distinguishing different number words that start with the same initial sound such as five and four. Using the multiple representations simultaneously (word, verbal, numeral and concrete) may help reinforce the differences.

1-2.4 None noted

1-2.9 As students write large numbers in expanded form to represent the magnitude of the digits, they should translate between number and expanded form. Some students can write the expanded form of a number but have difficulty writing the standard form of a number when given the expanded form. A common error is for students to forget to use zero to represent the value of a particular place. For example: students may write 300506 for 300 + 50 + 6. This can be avoided through the use of a Place Value Chart with marked columns.

d. Additional Instructional Strategies/Differentiation

You may extend the activity above to include numbers in decomposed form. (Ex. 11= a group of 5 and a group of 6). You may also go into expanded form (Ex. 11= 10 + 1 where you demonstrate the place value of the tens place and the ones place.)

1-2.1 Put students in pairs. The teacher calls out a numeral. Student A represents the spoken numeral as a concrete and pictorial representation and Student B represents it as a numeral then they switch roles.

1-2.3 The focus of this indicator is not for students to simply memorize and recall the words for numerals through ten. Students are asked to build a deeper understanding of these numerals by examining the relationships between quantity, word and numeral.
These connections between the multiple forms (quantity, number and words) allow students to find the answer through multiple entry points. For example, when given a picture representing the quantity of eight, the student can transition from quantity to number to word more easily because they have examined all three forms simultaneously during instruction. If given the word, some students may need to visualize the quantity before coming up with the numeral and so on.

1-2.4 The focus of the indicator is to recognize; therefore, students should simply recall the word form of numerals through twenty but examining the multiple representations of numerals (words, verbal, concrete, number) would be beneficial to support the long term retention of these facts. Students are developing conceptual knowledge of numerals through ten (1-2.3) and will develop a deeper conceptual understanding of numerals through twenty in second grade.

1-2.9 With large number it is difficult to model because physical models are not commonly available. One idea that should be extended is the idea that each place value position is ten times greater than the position to the right.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should be employed.

2. Teaching Lesson 1-1B Goldfish Estimation

1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects. (B3)

For this indicator, it is **essential** for students to:

- Able to make an estimate without finding the actual number.
- Able to make a reasonable estimate.
- Skip count by 10
- Translate between numerals and quantities

For this indicator, it is **not essential** for students to:

- Determine the exact quantity in the set

Teacher Notes: Mathematics learning builds over the course of time. This is especially true with concepts such as number sense; equivalencies; weight, linear, and liquid measurement; time; money, just to name a few. As a result some topics are best acquired through repeated exposure in small on-going intervals of time. Therefore, while an introductory lesson has been provided for the concepts addressed in this Module, it is important to point out that students will need on-going formal and informal experiences throughout the year to ensure the automaticity and flexibility that is demonstrated with mathematical understanding.

Estimation can be a very difficult task for young children. Students will need many experiences to help them understand the concept of about as in about how many. Questions such as "About how many footprints? Will it be closer to 5 footprints or closer to 20 footprints? About how many blocks will the apple weigh? Will the apple weigh closer to 10 blocks or closer to 30 blocks?" (Van de Walle, 2004) provide students with a format to learn what "about" means and then use it.

a. Indicators with Taxonomy

1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects. *(B3)*
Cognitive Process Dimension: Apply
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson 1-1B Goldfish Estimation

Materials Needed

- Picture of a large goldfish (shaped like a goldfish cracker) - 1 per pair of children
- Sealed bag with 10 goldfish - 1 per pair of children

Begin the lesson by asking the students to tell you what they think it means to estimate. Ask when do they think it would be good to estimate instead of actually count? Tell them you are going to practice estimating today by using the small bag of ten goldfish to estimate how many of them it would take to cover the large goldfish picture. Ask students to share strategies on how to use the small bag to estimate the number of goldfish needed. Depending on the strategies shared, you may demonstrate more than one. One strategy to share would be to use the small bag to determine the space ten goldfish need. Then, use that space to determine how many "tens" it would take to cover the large goldfish. That number would be the estimate. Have the students work with a partner to make their estimates.

When you return to whole group, have students share their estimates and how they got them. Use one or two of their strategies to make estimates. Then, use goldfish check the estimates.

c. Misconceptions/Common Errors

Students have difficulty understanding the concepts of estimate or about.

d. Additional Instructional Strategies/Differentiation

Estimation allows students to develop number sense. Students should have numerous opportunities to use concrete items to begin to "get a feel" for quantity.

Using the words more or less than, closer to or about can help students narrow down their estimated answer.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

Use a checklist that can be completed while observing a small group of children while in centers or with each child individually. A child should be able to consistently perform all the items on the checklist.

- Able to make an estimate without finding the actual number.
- Able to make a reasonable estimate.

3. Teaching Lesson 1-1C Comparing Quantities

1-2.5 Compare whole-number quantities through 100 using the terms is greater than, is less than, and is equal to. (B2)

For this indicator, it is **essential** for students to:

- Understand the concept of one more and one less
- Recall number through 100
- Understand the meaning of greater than, is less than and is equal to

For this indicator, it is **not essential** for students to:

- Tell how much more or how much less i.e. "this set has 15 more objects"
- Use the symbols <, > and =

a. Indicators with Taxonomy

1- 2.5 Compare whole – number quantities through 100 using the terms is greater than, is less than, and is equal to. (B2)

Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson 1-1C Comparing Quantities

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006, Pages 20-21.

Materials Needed

- Two color counters (7 per group)

Begin by asking the students to give examples of situations in which they might want to compare numbers. Give the two color counters to each group of students. Write the phrases "greater than" and "less than" on a board or chart for the students to reference. Tell the students that you are going to compare 3 and 4 with the counters. Ask each group to make a column of 4 counters. Then have each group line up another column of 3 counters beside 4 counters. Have the students compare the two columns of counters. Ask: Which group has a counter left over? Which group has more counters? Which group has a greater number of counters? Continue with a few more sets of numbers for the students to compare.

Teacher Note: This lesson is very introductory. It does need to be extended futher to cover "is equal to" or as they learned in Kindergarten "is the same as" More information in Additional instructional strategies.

c. Misconceptions/Common Errors

Watch for children who might be trying to make the two groups appear equal. Remind the children to make a one to one correspondence between the groups. Some children need to be reminded that greater than refers to larger numbers and less than refers to smaller numbers.

Students tend to have more difficulty with the concept of less than with the concept of more.

d. Additional Instructional Strategies/Differentiation

For students who are ready, you may move to asking them how many more or how many less one number is from another.

To help students better understand the concept of less, balance instructional questions by asking "which is less?" each time you ask "which is more?"
In kindergarten, students used the term "is the same as" instead of "is equals to". Students need to make the connection between the two terms. This is laying the foundation for the introduction of the = symbol in second grade.

To build deeper conceptual understanding, have students not only compare two given set of objects but also construct a set that are more than, less than or equal to a given set.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

Use a checklist that can be completed while observing a small group of children while in centers or with each child individually. A child should be able to consistently perform all the items on the checklist.

- Able to orally state if a group has more than
- Able to orally state if a group has less than

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module.

To assess the indicators in this module, create a checklist that includes the indicators from the module and administer through oral interview and performance assessment throughout the school year, noting the students' progress.

1-2.1 Translate between numeral and quantity through 100.

The objective of this indicator is to *translate* which is in the "understand conceptual" knowledge cell of the Revised Taxonomy. To understand means to construct meaning; therefore, students will develop the relationship between numerals and quantities by translating from one form to another. The learning progression to **translate** requires students to recall the numerical representation of numbers through 100. Students use multiple informal representations (1-1.8) such as concrete objects and pictorial representations to represent numerals. While using these representations, students discover relationships between and among numerals by analyzing patterns (1-1.4). They explain and justify (1-1.3) these relationships with their classmates and their teacher. Students translate from these informal representations to numerals and vice-versa to deepen their conceptual understanding of the connection between numerals and quantity.

1-2.2 Use estimation to determine the approximate number of objects in a set of 20 to 100 objects.

The objective of this indicator is to use which is in the "apply conceptual" knowledge cell of the Revised Taxonomy. Conceptual knowledge is not bound by specific problems; therefore, student will apply the concept of estimation to a variety of situations. The learning progression to **use** requires students to recall how to count from 0 to 100 and skip count by 10. Students generate conjectures (1-1.2) about the number of objects in the set by analyzing patterns (1-1.4) using their understanding of sets of 10. Students compare their conjectures with classmates and explain and justify their answers (1-1.3). Students understand the relationship between a given quantity and the number and translate those quantities to numeral form. Students understand that their answer is not the exact quantity and use words such as about or close to communicate their answer in written and verbal form (1-1.6).

1-2.3 Represent quantities in word form through *ten*.

The objective of this indicator is to represent which is in the "understand factual" knowledge cell of the Revised Taxonomy. Although this indicator requires student to represent a finite set of numbers, only through ten, it is not a simple memorization task because to understand means to construct meaning. The learning progression to **represent** requires students to recall the numeral form of number through ten. Student use multiple informal representations (1-1.8) such concrete manipulatives and pictorial forms to bridge the gap between numeral and word. Students examine the word, numeral and representation simultaneously and analyze (1-1.4) the relationship among the word, the numeral and the representation to construct a deeper understanding. Students use this understanding to represent quantities as words and vice-versa.

1-2.4 Recognize whole-number words that correspond to numerals through *twenty*.

The objective of this indicator is to recognize which is in the "remember factual" knowledge cell of the Revised Taxonomy. To remember is to retrieve knowledge from long term memory. The learning progression to *recognize* requires students to analyze patterns (1-1.4) between and among numerals through twenty to develop strategies for recognizing words for numerals. Students also connect the numerals and number words to the numerical order. Students should have numerous opportunities to develop strategies for recognizing these numerals as words.

1-2.5 Compare whole-number quantities through 100 by using the terms *is greater than*, *is less than*, and *is equal to*.

The objective of this indicator is to *compare* which is the "understand conceptual" knowledge cell of the Revised Taxonomy. To understand is to construct meaning; therefore, students are not just learning procedural strategies for comparing whole numbers but they are also building number sense. The learning progression to **compare** requires students to recall numbers through 100. Students generate conjectures (1-1.2) about which is more or which is less or equal. They exchange those conjectures with their classmates and the teachers. Student then analyze patterns (1-1.4) to compare sets of objects and explain and justify their answer (1-1.3) using a variety of forms of mathematical communication such as words and symbols.

1-2.9 Analyze the magnitude of digits through 999 on the basis of their place values.

The objective of this indicator is to analyze which is in the "analyze conceptual" knowledge cell of the Revised Taxonomy. To analyze means to determine relevant features and relationships. The learning progression to **analyze** requires students to understand place value and be able to locate the correct place value. Students represent the place value using concrete and/or pictorial models and generalize the connections (1-1.7) between place value and the multiple of ten. They write numbers in expanded form to examine the magnitude of the number. Students then use their observations to generate statements. Students explain and justify their answers (1-1.3) and use appropriate forms of mathematical communication (1-1.6) to share their answers with their classmates and teacher.

MODULE 1-2

Patterns, Relationships and Functions

This module addresses the following indicators:

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)
1-3.2 Translate patterns into rules for simple addition and subtraction. (B2)
1-3.4 Analyze numeric relationships to complete and extend simple patterns. (B4)
1-3.5 Classify a number as odd or even. (B2)

This module contains __5__ lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. ***Planning the Module***

The first bullet under the Continuum of Knowledge represents students' prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts.

- In Kindergarten students translated simple growing (K-3.1) and repeating (K-3.2) patterns into rules. Students so represent simple joining and separating situations through 10 (K-2.4) and understand that addition results in increase and subtraction results in decrease (K – 2.5).

- In first grade, students analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts (1-3.1), translate patterns into rules for simple addition and subtraction.(1-3.2) and analyze numeric relationships to complete and extend simple patterns (1-3.4).

- In second grade, students analyze numeric patterns in skip counting that use the numerals 1 through 10 (2-3.1), translate patterns into rules for simple multiples (2-3.2) and analyze relationships to complete and extend growing and repeating patterns involving numbers, symbols, and objects (2-3.3).

1-3.2 Translate patterns into rules for simple addition and subtraction.

- In Kindergarten students translated simple growing and repeating patterns into rules.

- In first grade, students analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts (1-3.1), translate patterns into rules for simple addition and subtraction.(1-3.2) and analyze numeric relationships to complete and extend simple patterns (1-3.4).

- In second grade, students analyze numeric patterns in skip counting that use the numerals 1 through 10 (2-3.1), translate patterns into rules for simple multiples (2-3.2) and analyze relationships to complete and extend growing and repeating patterns involving numbers, symbols, and objects (2-3.3).

1-3.4 Analyze numeric relationships to complete and extend simple patterns.

- In Kindergarten students translated simple growing and repeating patterns into rules.
- In first grade, students analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts (1-3.1), translate patterns into rules for simple addition and subtraction.(1-3.2) and analyze numeric relationships to complete and extend simple patterns (1-3.4).
- In second grade, students analyze numeric patterns in skip counting that use the numerals 1 through 10 (2-3.1), translate patterns into rules for simple multiples (2-3.2) and analyze relationships to complete and extend growing and repeating patterns involving numbers, symbols, and objects (2-3.3).

1-3.5 Classify a number as odd or even.

- Students have not worked with even and odd numbers prior to first grade.
- In first grade, students classify a number as odd or even.

- **Key Concepts/Key Terms**

  *These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

  - *Pattern
  - *Basic facts
  - Commutative property
  - *Fact family
  - *Turn-around facts
  - Consecutive numbers
  - Skip Counting
  - *Even
  - *Odd

II. Teaching the Lesson(s)

1. Teaching Lesson A: Adding Patterns

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)

For this indicator, it is **essential** for students to:

- Recognize a numeric pattern
- Understand one more or one less than a number

- Understand the concept of commutative property
- Discover fact families through inquiry
- Use number relationships to develop strategies to help them recall these facts

For this indicator, it is **not essential** for students to:

- Analyze numeric patterns involving addition and subtraction beyond 9 + 9 (as per Indicator 1-2.6)

Teacher Notes: When analyzing numeric patterns, students should be allowed to develop strategies that lead to the acquisition of basic addition and subtraction facts with sums and differences through 18. For example, a pattern that students may notice that is linked to addition is 4 is "one more than" 3, 5 is "one more than" 4, etc. and for subtraction 3 is "one less than" 4, 2 is "one less than" 3, etc. Students should also analyze patterns to acquire basic facts by looking for "fact families". A relationship/pattern that students may recognize is that 3+4 = 4+3, etc. Student experiences should include but not be limited to analyzing patterns on a number line, number chart, grid, and calendar - all in ascending and descending order (high to low, low to high). Also, student experiences should include opportunities to compose and decompose numbers (sums and differences through 18). An example would be students making tens such as 7+3 = 4+3+2.

a.Indicators with Taxonomy

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. → B4
Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

b.Introductory Lesson

Adapted from: Teaching Student-Centered Mathematics Grades K-3, Van de Walle, John A. and Lovin, LouAnn, Pearson Learning, 2006, Page 289.

Materials Needed

- Paper or white boards (1 per pair)
- Pencils or markers (1 per pair)
- Chart paper/board

Begin the lesson by writing the number 6 on the chart/board. Tell the children to explore how many different ways there are to add two numbers to make 6. The children may use numbers, words, and pictures to

illustrate their thinking on the paper/white boards. Have the children share their ways and record them on the chart/board. Discuss the ways that were used. If needed remind the children about combinations with 0. How are they similar? How are they different? Let the children decide if turn-around facts will counts as one way or as two. Write another number on the chart/board and repeat the activity. After working with several numbers, ask the children if they notice any patterns in the numbers used to make the larger number. Record the children's observations on the chart/board.

Note: Manipulatives can be added for this lesson.

c.Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d.Additional Instructional Strategies/Differentiation

- This indicator is designed to deepen the student's understanding of basic facts beyond just rote memorization
- Students should use their work with patterns as the basis for their work with addition and subtraction
- When analyzing numeric patterns, students should be allowed to develop strategies that lead them to the acquisition of basic addition and subtraction facts with sums and differences through 18. For example, a pattern that students may notice that is linked to addition is 4 is "one more than" 3, 5 is "one more than" 4, etc. and for subtraction 3 is "one less than" 4, 2 is "one less than" 3, etc.
- Student experiences should include but not be limited to analyzing patterns on a number line, number chart, grid, and calendar - all in ascending and descending order (high to low, low to high).
- Students should also analyze patterns to acquire basic facts by looking for "fact families". A relationship/pattern that students may recognize is that 3+4 = 4+3, etc.

e.Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual

understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)" (PSSM page 24). Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

2. Teaching Lesson B Subtracting Patterns

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. (B4)

For this indicator, it is **essential** for students to:

- Recognize a numeric pattern
- Understand one more or one less than a number
- Understand the concept of commutative property
- Discover fact families through inquiry
- Use number relationships to develop strategies to help them recall these facts

For this indicator, it is **not essential** for students to:

- Analyze numeric patterns involving addition and subtraction beyond 9 + 9 (as per Indicator 1-2.6)

Teacher Notes: When analyzing numeric patterns, students should be allowed to develop strategies that lead to the acquisition of basic addition and subtraction facts with sums and differences through 18. For example, a pattern that students may notice that is linked to addition is 4 is "one more than" 3, 5 is "one more than" 4, etc. and for subtraction 3 is "one less than" 4, 2 is "one less than" 3, etc. Students should also analyze patterns to acquire basic facts by looking for "fact families". A relationship/pattern that students may recognize is that 3+4 = 4+3, etc.

a. Indicators with Taxonomy

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts. → *B4*
Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006, Pages 38-39.

Materials Needed

- Interlocking cubes (40 cubes in two colors per group)
- Paper or white board/slates (1 per child)
- Pencils or markers (1 per child)

Ask each group of children to make a train of 10 cubes using two different colors. Children may use any combination of the two colors as long as the total number of cubes is 10. Instruct the children to write a number sentence that describes their train. Have the children make a second train exactly like the first one. Then flip that train so it shows the reverse numbers and write the fact that describes that train. For example, the first train might be 7 blue and 3 red with a number sentence of 7+3=10 and the second train would be 3 red and 7 blue with a number sentence of 3+7=10. Remind students that these are turn around facts.

Next help the children write subtraction number sentences for each of the addition sentences by showing what happens when you remove one color from your train. For example, if you have 10 total and remove the 3 red, you have 7 left so the number sentence would be 10-3=7. Repeat this process with the second train, removing the other color (remove the blue cubes 10-7=3).

Ask the children if they notice anything about the numbers that were used in all four number sentences. Have them share what they noticed. If no one shares, point out that the same three numbers were used to make all 4 number sentences. Tell the children, the group of numbers they used is called a fact family. Using the interlocking cubes, have the children practice making fact families by writing the 4 number sentences for other combinations of 10.

c. Misconceptions/Common Errors

Watch for common errors of reversing the numbers for subtraction, such as 3-7=10 or 7-3 = 10. It may be a good idea to dialogue with students about how subtraction does not show "turn around facts" as in addition.

d. Additional Instructional Strategies/Differentiation

- This indicator is designed to deepen the student's understanding of basic facts beyond just rote memorization
- Students should use their work with patterns as the basis for their work with addition and subtraction
- When analyzing numeric patterns, students should be allowed to develop strategies that lead them to the acquisition of basic addition and subtraction facts with sums and differences through 18. For example, a pattern that students may notice that is linked to addition is 4 is "one more than" 3, 5 is "one more than" 4, etc. and for subtraction 3 is "one less than" 4, 2 is "one less than" 3, etc.
- Student experiences should include but not be limited to analyzing patterns on a number line, number chart, grid, and calendar - all in ascending and descending order (high to low, low to high).
- Students should also analyze patterns to acquire basic facts by looking for "fact families". A relationship/pattern that students may recognize is that 3+4 = 4+3, etc.

e.Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

3. Teaching Lesson C: Translate Patterns to Adding/Subtracting Rules

1-3.2 Translate patterns into rules for simple addition and subtraction. (B2)

For this indicator, it is **essential** for students to:

- Verbalize patterns into rules for addition and subtraction
- Recognize patterns in addition and subtraction

For this indicator, it is **not essential** for students to:

- Developed formalized mathematical rules

Teacher Notes: When analyzing numeric relationships to complete and extend simple patterns, student experiences should include skip counting by 2, 5, and 10 through 100. As a result of rote skip counting (which is a pattern), students should analyze the numeric relationship between elements created as a result of the skip counting. For example, when skip counting by 10, students should examine the relationship between the numbers being counted (10 to 20 or 20 to 30). The difference between each element is also a pattern – a difference of ten each time. While this seems to be obvious to the adult learner, it is a numeric relationship that must be analyzed by students in order to develop number sense and comprehension.

a. Indicators with Taxonomy

1-3.2 Translate patterns into rules for simple addition and subtraction. → *B2*
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Adapted from Everyday Mathematics First Grade, McGraw Hill, 2009, Pages 225.

Materials Needed

- Chart paper/board
- Number grids – 1 per pair

On the chart/board, write a set of numbers that represent a simple skip count such as 5, 10, 15, 20, 25, 30. Ask the children to be detectives and find out how many hops it would take to move from one number to the next. Ask the children to share their answers and how they got them. Students should share the number 5. Tell the children that this is the "rule" the numbers must follow to keep the pattern. Address any misconceptions the children share.

Write another set of numbers on the board such as 1, 3, 5, 7, 9 and ask the children to find out how many hops it takes to move from one number to the next. Have the children share their answers. It is appropriate for the responses to be phrased differently (such as count up by 2's or add 2).

Continue to share sets of numbers for the children to find the rule. Depending on the needs of your children, you may include counting back and use larger numbers.

c. Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d. Additional Instructional Strategies/Differentiation

- This indicator is a continuation of indicator 1-3.1 where students analyze patterns to develop strategies. Students develop strategies and create rules for addition and subtraction based on those strategies.
- Student experiences should include but not be limited to analyzing patterns on a number line, number chart, grid, and calendar - all in ascending and descending order (high to low, low to high).

e.Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

4. Teaching Lesson D Complete and Extend Simple Patterns

For this indicator, it is **essential** for students to:

- Recognize if a sequence of numbers is a pattern or not
- Identify which part of the pattern repeats
- Identify the relationship between consecutive terms within the pattern
- Determine the next term in a pattern
- Skip count by 2, 5 and 10

For this indicator, it is **not essential** for students to:

- Skip count by numbers other than 2, 5, and 10
- Extend patterns beyond 100

Teacher Notes: When analyzing numeric relationships to complete and extend simple patterns, student experiences should include skip counting by 2, 5, and 10 through 100. As a result of rote skip counting (which is a pattern), students should analyze the numeric relationship between elements created as a result of the skip counting. For example, when skip counting by 10, students should examine the relationship between the numbers being counted (10 to 20 or 20 to 30). The difference between each element is also a pattern – a difference of ten each time. While this seems to be obvious to the adult learner, it is a numeric relationship that must be analyzed by students in order to develop number sense and comprehension.

a. Indicators with Taxonomy

1-3.4 Analyze numeric relationships to complete and extend simple patterns. → B4
Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Adapted from Everyday Mathematics First Grade, McGraw Hill, 2009, Pages 195-196.

Materials Needed

- Number grids (1 per child)
- Markers or crayons (2 different colors per child)
- Large number grid (for demonstration)
- Markers for large number grid
- Chart paper or board

Explain to the children that they will be finding patterns on the number grid by making skip counts with colored dots. Have the children make a colored dot beside the number five on the number grid. You will mark the large number grid, too, as the children are marking their grid to create a model for those children who need one. Ask the children, when counting by 5's what number comes next? Some children may need to count 5 hops on the number grid to find the answer. Make a colored dot beside the number 10. Continue counting by 5's and marking those numbers with a colored dot. Once a pattern begins to emerge, ask the children if they can continue the pattern without counting. Some children will see that the numbers in the 5's and 10's columns are the ones being marked. Continue marking the 5's count to the end of the number grid.

On chart paper or board, make a list of the first few 5's counts number and circle the digit in the ones place. Ask the children to describe the

pattern they see in ones place (the number you circled). They should tell you that the numbers 5 and 0 alternate.

Using a different color crayon, repeat this procedure with the 10's counts. After marking the number grid, ask the children what they observed about the 10's counts. Make a list of the first few 10's counts. Ask the children what they notice about the 10's numbers.

c. Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d. Additional Instructional Strategies/Differentiation

- The focus of the indicator is on simple patterns; therefore, the patterns will be patterns with which the students have had experience. For example, student can skip count by 5; therefore, a pattern could involved larger numbers such as 65, 70, 75, ___.
- Students should analyze the numeric relationship between elements created as a result of skip counting. For example, when skip counting by 10 students should examine the relationship between 10 and 20 or 20 and 30.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

5. Teaching Lesson E Classify Odd and Even Numbers

1-3.5 Classify a number as odd or even

For this indicator, it is **essential** for students to:

- Understand that pattern of numbers are even, odd, even, odd,…
- Recognize even and odd numbers through 100 using patterning

For this indicator, it is **not essential** for students to:

- Recognize even and odd numbers beyond 100

Teacher Notes: Skip counting by 2 and analyzing the relationship among those numbers recited and not recited allows for an in-depth class discussion that leads to classifying numbers as odd or even, which is also a first grade expectation. When classifying a number as odd or even, students should also look for number patterns by pairing quantities of objects for "none left over/even" and "one left over/odd".

a. Indicators with Taxonomy

1-3.5 Classify a number as odd or even. → B2
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Adapted from Everyday Mathematics First Grade, McGraw Hill, 2009, Pages 189-190.

Materials Needed

- Children
- Chart paper/board

For this lesson, children will come to the front of the room one at a time as you call them. Before the lesson, on chart paper or board, draw a table with 2 columns labeled *All in Pairs* and *Not All in Pairs*.

At the beginning of the lesson, ask two children to come to the front of the room. Tell the students that two children make a pair; they have a partner and write a 2 in the *All in Pairs* column. Invite another child to

come to the front of the room. Ask if there is someone to pair with the 3rd child. Tell the children, "No, (name) cannot be paired because he/she does not have a partner so he/she is temporarily the odd person out." Write a 3 in the *Not All in Pairs* column. Call another child to the front of the room. This child can be paired with the 3rd child so now each child has a partner. Write a 4 in the *All in Pairs* column. Continue calling children one at a time and recording numbers in the appropriate column until you have used all your children.

Discuss the chart with the children. Tell them that when each child can be paired with another child, the total number of children is an even number. Add the word even to the *All in Pairs* column. When one child cannot be paired with another child, the total number of children is an odd number. Add odd to the *Not All in Pairs* column.

c. Misconceptions/Common Errors

Students need to understand **why** a number is odd or even not just memorize that numbers ending in 0,2,4,6,8 are even and 1,3,5,7,9 are odd.

d. Additional Instructional Strategies/Differentiation

- When classifying a number as odd or even, students should look for number patterns by pairing quantities of objects for "none left over/even" and "one left over/odd".
- Skip counting by 2 and analyzing the relationship among those numbers recited and not recited allows for an in-depth class discussion that leads to classifying numbers as odd or even, which is also a first grade expectation.
- Students see visual patterns emerge when they mark numbers on the 100 chart as even and odd
- A connection can be made with previous knowledge of one more and one less from kindergarten by pointing out that even numbers are one more than a odd number, etc…
- Since the focus of the indicator is not understand not recall, students Students need to understand why a number is odd or even not just memorize that numbers ending in 0,2,4,6,8 are even and 1,3,5,7,9 are odd.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module.

1-3.1 Analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts

The objective of this indicator is to analyze which is in the "analyze conceptual" knowledge cell of the Revised Taxonomy. Analyze requires students to determine how parts within a structure fit and related to each other; therefore, students should be examining how various basic facts are related through the use of patterns. The learning progression to **analyze** required students to examine the basic facts using multiple informal and formal representations (such as manipulatives, the number line, etc..) Student should work cooperatively to explore these representations. They should recognize pattern relationships and use those relationships to make generalizations (1-1.5) as 2 + 5 is the same as 5 + 2. As students explain and justify

(1-1.3) their generalizations, they should develop strategies beyond just rote memorization that will help them to remember their basic facts.

1-3.2 Translate patterns into rules for simple addition and subtraction

The objective of this indicator is to translate which is in the "understand conceptual" knowledge cell of the Revised Taxonomy. To understand means to construct meaning; therefore, students will develop an understanding of addition and subtraction by translating their observations into rules. The learning progression to **translate** requires students to recognize pattern relationships and use those relationships to make generalizations (1-1.5) as 2 + 5 is the same as 5 + 2 or 4 is one more than 3. As students explain and justify (1-1.3) their generalizations, they translate these generalization into rule that relate to addition and subtraction. Students use a variety of forms of mathematical communication (written, verbal, etc…) to express their rules (1-1.6).

1-3.4 Analyze numeric relationships to complete and extend simple patterns

The objective of this indicator is to analyze which is in the "analyze conceptual " knowledge cell of the Revised Taxonomy. Analyze required students to determine how the components of the pattern relate to each other. Conceptual knowledge is not bound by specific examples; therefore, students should analyze a variety of patterns. The learning progression to analyze requires student to identify which part of the pattern repeats or how the numbers within the pattern relate to each other. When appropriate, students may use concrete representations as a systematic way to reason (1-1.4) out how they should extend their pattern. Students should then generate conjectures (1-1.2) about what is the next term in the pattern. They can also work with a partner to exchange mathematical ideas (1-1.2) and use a variety of forms of mathematical communication (1-1.6) to explain their answer (1-1.3) to the teacher and their classmates.

1-3.5 Classify a number as odd or even

The objective of this indicator is to classify which is in the "understand conceptual" knowledge cell of the Revised Taxonomy. Understand requires student to construct meaning; thereby, applying the concept to numbers. The learning progression to **classify** requires students to identify the relationship between even and odd numbers by examining a variety of representations (number line, hundreds chart, etc...). Student should then generate conjectures (1-1.2) about what other numbers can be classified as even or odd and exchange those mathematical ideas (1-1.2) with their classmates and teacher. They should explain and justify their answer (1-1.3) using a variety of forms of communication (verbal, symbolic, etc…) (1-1.6).

The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

Checklists can be completed while observing a small group of children, while observing children in centers or with each child individually. A child should be able to consistently perform all the items on the checklist.

- Able to orally explain how they find all the combinations to make a set number.
- Able to orally explain the rule for the set of numbers.
- Able to compete a skip counting pattern on the number grid.
- Able to orally explain the pattern the numbers create.
- After counting a set number of objects, tell if set number of objects would be odd or even number.
- Able to orally explain why the number would be odd/even.

MODULE

1-3

Operations – Addition and Subtraction
Representations, Properties, and Proportional Reasoning

This module addresses the following indicators:

1-2.6 Recall basic addition facts through 9 + 9 and corresponding subtraction facts. (A1)
1-2.7 Summarize the inverse relationship between addition and subtraction. (B2)
1-3.3 Illustrate the commutative property based on basic facts. (A2)

This module contains __3__ lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students' prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

1-2.6 Recall basic addition facts through 9+9 and corresponding subtraction facts.
- In kindergarten, students represented simple joining and separating situation through 10 (K-2.4) and developed the understanding that addition results in increase and subtraction results in decrease (K-2.5).
- In first grade, students recall basic addition facts through 9 + 9 and corresponding subtraction facts (1-2.6) and summarize the inverse relationship between addition and subtraction (1-2.7). They also generate strategies to add and subtract without regrouping through two-digit numbers (1-2.8) and analyze numeric patterns in addition and subtraction to develop strategies for acquiring basic facts (1-3.1).
- In second grade, students will generate strategies to add and subtract pairs of two-digit whole numbers with regrouping (2-2.7). They also generate addition and subtraction strategies to find missing addends and subtrahends in number combination through 20 (2-2.8).

1-2.7 Summarize the inverse relationship between addition and subtraction.
- In kindergarten, students represented simple joining and separating situation through 10 (K-2.4) and developed an understanding that addition results in increase and subtraction results in decrease (K-2.5.)
- In first grade, students summarize the inverse relationship between addition and subtraction (1-2.7) and generate strategies to add and subtract without regrouping through two-digit numbers (1-2.8). They also recall basic addition facts through 9 + 9 (1-2.6).
- In second grade, students will generate strategies to add and subtract pairs of two digit whole numbers with regrouping (2-2.7) and they generate addition and subtraction strategies to find missing addends and subtrahends in number combination through 20 (2-2.8).

1-3.3 Illustrate the Commutative Property based on basic facts.
- In kindergarten, represent simple joining and separating situations through 10 (K-2.4).
- In first grade, students illustrate the commutative property based on basic facts.

- **Key Concepts/Key Terms**

  ***These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.**

  - *Addition
  - *Subtraction
  - *Fact Families
  - Inverse
  - Commutative
  - *Basic facts
  - Reverse addends

II. Teaching the Lesson(s)

1. Teaching Lesson 1-3A Recall Basic Facts

1-2.6 Recall basic addition facts through 9+9 and corresponding subtraction facts.

For this indicator, it is **essential** for students to:
- Discover fact families through inquiry
- Use number relationships to develop strategies
- Develop strategies to help them recall these facts
- Write number sentences to represent fact families

For this indicator, it is **not essential** for students to:
- None noted

Teacher Notes: Kindergarten students experienced addition and subtraction by representing simple joining and separating situations through 10. That was accomplished in a problem solving context on the concrete and pictorial levels only, using such tools as ten frames, Part-Part-Whole mats, and number stories with objects to manipulate. Therefore, it is important that students have experiences that will enable them to make the connection between their previous concrete/pictorial experiences and the symbolic (numbers only) expectations of first grade. This will support students as they progress to recall of basic addition facts through 9+9 and the corresponding subtractions facts presented in symbolic form (numbers only). In second grade the connection between the concrete/pictorial models and the symbolic (numbers only) form must be made when working with two-digit numbers that do not involve regrouping.

When learning to recall basic facts, it is critical that teachers do not introduce drill too soon because premature drill introduces no new information and encourages no new connections (Van de Walle, 2004). Children can memorize or learn basic facts without fully understanding what it means to add and subtract. They need experiences to help them discover and internalize basic relationships between numbers. Drill activity is appropriate for children who have a strategy they understand and know how to use but haven't become fluent with it yet. Drills should only be used when an efficient strategy is in place.

It is also very important for children to read and write equations as the connection between hands on experiences and the symbols used for them. Word problems and mathematical games involving adding or subtracting are excellent ways both to build number concepts and to provide repeated practice to ensure automatic recall of addition/subtraction facts.

a. Indicators with Taxonomy

1-2.6 Recall basic addition facts through 9+9 and corresponding subtraction facts. → A1
Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson

Adapted from Teaching Student-Centered Mathematics: Grades K-3, Van de Walle, John A. and Lovin, LouAnn, Pearson Learning, 2006, Pages 63-64.

Materials Needed

- Dot cards (numbers 1-8) 1 set to use with whole or small group (These cards can be accessed by the following site: www.ablongman.com/vandewalleseries)
- Counters (10 per pair)
- Chart paper or board

Show the children a dot card. Ask them to make a set that has one more than the dots on the card. Have the children share how they can decide if the set has one more. Write their ideas on the chart/board and work them as a group to see if they work. Show another dot card and ask the children to make a set that has one more. Then ask the children to check their set using one of the methods shared. Show another dot card and repeat activity. While the children are working observe the methods they are using to count the dot on the cards and to create their sets.

Show the children a dot card and ask them to make a set that has one less than the dots on the card. Ask the children how they can decide if the set has one less and record their ideas on the chart/board. Show another dot card and ask the children to make a set that has one less. Then ask the children to check their set using one of the methods shared. Show another dot card and repeat activity. As with the one more, observe the children working to see how they are counting dots and creating sets.

If your children are ready you may repeat the activity using two more and two less.

c. Misconceptions/Common Errors

- Students may find difficulty selecting an appropriate strategy when they are not prompted. For example, to find 8 + 7, not all students will know right away that doubles would be an efficient strategy and may just choose to count on their fingers.
- Students may not recognize that 4 + 5 is the same as 5 + 4. Helping students discover this property will minimize the numbers of facts that need to be recalled.
- Students may think that the commutative property is also true for subtraction.

d. Additional Instructional Strategies/Differentiation

- It is important that students have experiences that will enable them to make the connection between their previous concrete/pictorial experiences in kindergarten and the symbolic (numbers only) expectations of first grade.
- It may be easily to simply tell students a strategy and then have them practice. This strategy may work for some students but others will not internalize the strategy because it was not developed in a framework that makes sense to them. Encourage students to continue to explore strategies.
- Having a variety of strategies allows that teacher to provide multiple entry points to students. Every student does not need to master every strategy.

- To support retention, repetitive activities such as flash cards, matching games, etc… should be used in corporation with concept building strategies.
- To help students think through which strategy is more efficient for them, provide students with a list of facts and have them explain which strategy they would use for each and why.
- Have students verbalize their strategies for recalling subtraction facts.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

2. Teaching Lesson 1-3B Inverse Relationship (+ and -)

1-2.7 Summarize the inverse relationship between addition and subtraction.

For this indicator, it is **essential** for students to:

- Apply basic addition and subtraction facts
- Use concrete representations of addition and subtraction facts to build conceptual understanding

- Understand that subtraction can be used to check addition problems and addition can be used to check subtraction

For this indicator, it is **not essential** for students to:

- None noted

Teacher Notes: In kindergarten, students represented simple joining and separating situations through 10, and developed an understanding that addition results in increase and subtraction results in decrease. As a result, first grade students should be able to summarize the inverse relationship between addition and subtraction. In second grade students will use their knowledge to find missing addends and subtrahends in combinations to 20.

Children develop the understanding that addition and subtraction are directly related to one another through modeling and meaningful connections. Fact families are one way for children to see the relationship among numbers and between operations. While building the fact families, children should be given opportunities to explore the inverse relationship between addition and subtraction.

a. Indicators with Taxonomy

1-2.7 Summarize the inverse relationship between addition and subtraction. → B2
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge.

b. Introductory Lesson 1-3B Inverse Relationship (+ and -)

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006, Pages 36-37.

Materials Needed

- Connecting cubes (5 yellow and 3 red per pair)
- Paper and pencil (1 each per pair)
- Chart paper or board

Share the following story problem with the children: *At recess, 5 children are playing tag. Then 3 more join the game. How many children are playing tag?*

Tell the children you are going to use the cubes to solve this problem. Instruct the children to make two trains: one with 5 yellow cubes and another with 3 red cubes. Ask the children to "add" the red train to the yellow train by connecting them together. Tell the children now that you have one train of 5 yellow cubes and 3 red cubes. Ask: How many cubes does the train have in all? Instruct the children to write an addition sentence that shows how you added the 5 yellow and 3 red cubes. Write the number sentence on the chart paper or board for the children to see. Re-read the story problem and use the number sentence to answer the question. The 5 yellow cubes (children playing) plus the 3 red cubes (children joining) equal 8 cubes (children) in all.

Now tell the children you have more information for the story problem. *The bell rings and 5 children have to line up to go inside. How many children are playing tag now?*

Instruct the children to take the train you made and "subtract" by taking away 5 yellow cubes. Ask: How many cubes does the train have left? Tell the children to write a subtraction sentence that shows how you took away 5 yellow cubes from the train. Write the number sentence on chart paper or board for the children to see. Re-read the last part of the number story and use the subtraction number sentence to answer the question. The 8 cubes (children playing) minus 5 yellow cubes (children leaving) equal 3 cubes (children left).

Compare the two number sentences you created. Ask: What is the same in both number sentences? What is different? Take this a little further with them using the statement, "I wonder if…" Give a few more problems for children to investigate.

c. Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d. Additional Instructional Strategies/Differentiation

- Tell the children that for every addition sentence you write, you can find a related subtraction sentence. Ask questions like "What is the same in both number sentences? What is different?" Also emphasize that they can use addition to check our subtraction and subtraction to check our addition.
- Students can develop a deeper understanding of these inverse relationships by exploring them in context i.e. story problems.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

3. Teaching Lesson 1-3C Basic Commutative Property

1-3.3 Illustrate the commutative property based on basic facts.

For this indicator, it is **essential** for students to:

- Determine the sum of two numbers using an appropriate strategy (number line, manipulatives, etc.)
- Complete a number sentence such as 2 + 7 = □
- Understand that reversing the addends does not change the answer

For this indicator, it is **not essential** for students to:

- Have computational fluently with recalling their basic addition and subtraction facts

Teacher Notes: First grade students are not expected to know the commutative property by name. However, they should recognize that if they know one fact in addition, they can reverse the addends and make another fact. Students should also be given experiences that allow them to determine that such relationships only apply to addition and not to subtraction.

A relationship/pattern that students may recognize is that 3+4 = 4+3, etc. If students are able to recognize and give examples of that relationship, they have met the expectations of indicator 1-3.3.

It is essential that a strong connection be made between these indicators and the related Algebra standard indicators 1-3.1, 1-3.2, 1-3.3 and 1-3.4 that deal with patterns and the relationships between/among numbers.

a. Indicators with Taxonomy

1-3.3 Illustrate the commutative property based on basic facts. (A2)
Cognitive Process Dimension: Understand
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson 1-3C Basic Commutative Property

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006, Pages 92-93.

Materials Needed

- Connecting cubes (3 blue and 3 red per pair)
- Paper
- Crayons (1 red, 1 blue, and 1 black per pair)
- Chart paper or board

Explain that they are going to use the cubes to model two addition sentences. Instruct the children to build a train of two blue and then three red cubes. It may be helpful to some children for you to model the train with one you have made. Then have the children write the number sentence that the train models (2+3 = 5) below the train using the crayon color to match the cubes in the model. For example, the 2 is blue and the 3 is red. Use the black crayon to write the + and + signs. Write the number sentence in the correct colors on a large chart or board for the children to see if needed.

Ask the students to flip their cube train over and then write the new number sentence being shown below it. The number model should now be 3+2 = 5 with the 3 in red and 2 blue.

Examine the number sentences and compare the sums. Ask the children how the number sentences are different and how they are alike. Repeat the procedure with more examples as time permits. Each time be sure to examine and compare the number sentences.

c. Misconceptions/Common Errors

Students may think that the commutative property also applies to subtraction.

Some children may need to make two trains and compare side by side to understand both number sentences have the same sum.

Also watch for children who want to interchange all the numbers in the number sentence, not just the addends. You will need to stress that the sum never changes, just the addends. It may be helpful to see the number sentence written as: 3+2=2+3.

d. Additional Instructional Strategies/Differentiation

- First grade students are not expected to know the commutative property by name. However, they should recognize that if they know one fact in addition, they can reverse the addends and make another fact. The focus of the indicator is to encourage students to find patterns and relationships among the basic facts.
- Since the focus of the indicator is on finding patterns (commutative property) and relationships (pairs of commutative facts), students do not have to be fluent in recalling their basic facts. Although knowing their facts would be beneficial, exploring these relationships will give students additional strategies by which to remember their basic facts.
- Students should also be given experiences that allow them to determine that such relationships only apply to addition and not to subtraction.
- When examining certain basic facts, encourage students to make connection with their knowledge of skip counting. For example, when examining 4 + 2 they should start at 4 and notice that adding two is like skipping the next number and going to the following number.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

g. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.
Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module.

1-2.6 Recall basic addition facts through 9 + 9 and corresponding subtraction facts.

The objective of this indicator is to *recall* which is in the "remember factual" knowledge cell of the Revised Taxonomy. Although the indicator requires students to recall the fact families; instruction should balance procedural and conceptual knowledge to support retention. The learning progression to **recall** requires students to build on their prior experiences of separating and joining through 10. Students apply a variety of problem solving strategies (1-1.1) to analyze patterns (1-1.4) with basic addition facts. As students explore these strategies, they exchange strategies (1-1.2) with their classmates and explain and justify their answers (1-1.3). Students use multiple informal representations such as manipulatives and dot paper to support and verify basic addition and subtraction facts. Once efficient strategies have been established, students reinforce retention through repeated practice.

1-2.7 Summarize the inverse relationship between addition and subtraction

The objective of this indicator is to summarize which is in the "understand conceptual" knowledge cell of the Revised Taxonomy. To summarize means to extract the major theme or points; therefore, the focus should be on students generalizing the inverse relationship between addition and subtraction not memorizing specific addition and subtraction facts. The learning progression to **summarize** requires students to use basic addition and subtraction facts to represent joining and separating situations in story problems. Students analyze pattern (1-1.4) in these problems to generalize

connections between addition and subtraction. They explain and justify their answers (1-1.3) to their classmates and teacher. Students then apply these generalizations (1-1.1) to simple number problems to verify that their generalization holds true. Students summarize the inverse relationships using an appropriate form of communication (1-1.6).

1-3.3 Illustrate the commutative property based on basic facts

The objective of this indicator is to illustrate which is in the "understand factual" knowledge cell of the Revised Taxonomy. Understand requires students to construct meaning; therefore, students should develop an understanding of the commutative property by finding a variety of examples to describe this concept. The learning progression to **illustrate** requires students to compute the value of a number sentence using an appropriate strategy. Students should then generate a conjecture (1-1.2) about what might happen if they addends are reversed. They should explore these conjectures by exchanging their ideas with their classmates and teacher. Once students have tested their conjecture, they should explain and justify their answers (1-1.3). They should use these generalizations to provide the teacher with additional examples of the commutative property.

The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

Checklists can be completed while observing a small group of children, while observing children in centers or with each child individually. A child should be able to consistently perform all the items on the checklist.

- Able to recognize dot patterns.
- Able to create one more sets.
- Able to create one less sets.
- Able to orally explain how to check sets to see if they are correct.
- Able to model, illustrate or write addition sentences and inverse subtraction sentences.
- Able to orally explain how the two number sentences are related.
- Able to recognize examples of commutative property.
- Able to orally explain why examples are commutative property.
- Able to give examples of commutative property.

MODULE

1-4

Time and Temperature

This module addresses the following indicators:

1-5.8 Use analog and digital clocks to tell and record time to the half hour. (C3)
1-5.9 Illustrate past and future dates on a calendar. (A2)
1-5.10 Represent dates in standard form (June 1, 2008, for example) and numeric form (6-1-2008, for example). (A2)
1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)

All of these are year long indicators.

This module contains __3__ lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students' prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

1-5.8 Use analog and digital clocks to tell and record time to the half hour. (C3)

- In kindergarten, students use analog and digital clocks to tell time to the hour. (K-5.6)
- In first grade, students use analog and digital clocks to tell and record time to the half hour. (1-5.8)
- In second grade, students use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval. (2-5.7)

1-5.9 Illustrate past and future dates on a calendar. (A2)

- In kindergarten, students use a calendar to identify dates, days of the week, and months of the year. (K-5.7)
- In first grade, students illustrate past and future dates on a calendar. (1-5.9)

1-5.10 Represent dates in standard from (June 1, 2008, for example) and numeric form (6-1-2008, for example). (A2)

- In kindergarten, students use a calendar to identify dates, days of the week, and months of the year. (K-5.7)
- In first grade, represent dates in standard form (June 1, 2007, for example) and numeric form (6-1-2007, for example). (1-5.10)

1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)

- In kindergarten, students identify digital and standard thermometers as devices used to measure temperature (K-5.4). Students understand which measure-length, weight, time, or temperature-is appropriate for a given situation (K-5.5).
- In first grade, students use Celsius and Fahrenheit thermometers to measure temperature (1-5.11).
- In second grade, students use appropriate tools to measure temperature on Celsius and Fahrenheit thermometers (2-5.3).

- **Key Concepts/Key Terms**

  *****These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

  - *Analog
  - *Digital
  - *Hour
  - *Half hour
  - *Standard form
  - *Numeric form
  - *Calendar
  - *Date
  - *Days of the week
  - *Months of the year
  - *Past
  - *Present
  - *Future
  - * Celsius
  - *Fahrenheit
  - *Thermometer
  - *Temperature
  - *Degrees
  - *Scale
  - *Measure

II. Teaching the Lesson(s)

1. Teaching Lesson A: Tell Time to the Half Hour

1-5.8 Use analog and digital clocks to tell and record time to the half hour. (C3)

For this indicator, it is **essential** for students to:

- Tell time to the hour
- Understand that 30 minutes is a half hour
- Record time to the half hour in multiple ways
- Identify location of the minute hand at the half hour
- Identify location of the hour hand at the half hour

- Understand the difference between analog and digital clocks
- Understand that the little hand indicates broad, approximate time (nearest hour)
- Understand that the big hand indicates time (minutes) before or after an hour

For this indicator, it is **not essential** for students to:

- Tell time to the quarter hour or to the nearest five minutes

Teacher Notes: Time is different than the other attributes commonly measured in school because it cannot be seen and it is more difficult for students to comprehend units of time and how they are matched against a given time period or duration. The common instrument for measuring time is the clock. However, learning to tell time has little to do with time measurement and more to do with learning to read a dial type instrument.

Reading analog clocks can be confusing especially for children who do not have them in their homes. Children need many opportunities to gain hands on experience with real clocks in order to master this life skill.

a. Indicators with Taxonomy

1-5.8 Use analog and digital clocks to tell and record time to the half hour. → C3
Cognitive Process Dimension: Apply
Knowledge Dimension: Procedural Knowledge

b. Introductory Lesson A: Tell Time to the Half Hour

Adapted from Hands-On Standards Grades 1-2, Learning Resources, 2006, Pages 126-127.

Materials Needed

- Large demonstration clock
- Geared clocks (or any clock the children can manipulate) 1 per child
- sheet with clock faces (1 per child) (These can be accessed at the following site: www.ablongman.com/vandewalleseries.com)

In whole group, review the hour and minute hands on the large demonstration clock. Point out the hour hand and discuss that it is the shorter hand and tells you the hour. Count by 1's around the clock. Point out the minute hand and discuss that it is the longer hand and tells you the minutes. Count by 5's around the clock.

Give each child a clock and ask them to show 8:00 on the clock. Tell the children to turn the minutes hand clockwise slowly around the clock face to make a complete circle. Demonstrate with the large clock so all the children can see the hands moving and model their clock movements after your movements. Ask the children, what time does the clock say now? Have the children draw the clock hands on the recording sheet and write the time beneath the clock. Demonstrate as needed.

Have children rotate the minute hand halfway around the clock. Demonstrate with the large clock so all the children can see and model their clock movements if needed. Ask the children, where is the hour hand when the minute hand is on the 6? Ask the children, what time does the clock show now? Ask the children, what does 9:30 look like? Have the children draw the hands on the recording sheet and write the time beneath the clock.

Ask the children to show you 10:00 on their clocks. Demonstrate with the large clock so all children can see and model their clock movements as needed. Ask the children, what they think the clock will look like at 10:30? Have the children move the hand clockwise on their clocks to show 10:30. Demonstrate with the large clock so all children can see and model their clock movements as needed. Ask the children, does the clock look like you thought it would? Have children draw the hands on the recording sheet and write the time beneath the clock. Repeat the activity with other times to the hour and half hour.

c. Misconceptions/Common Errors

- Students often confuse 12:30 or half past 12 as 6 o'clock.

- Children may be unsure of why the long hand points to the number 6 to show 30 minutes. Explain that 30 minutes is half of an hour and the long hand is halfway around the clock. Reinforce this by counting by 5's from the top of the hour. You may additionally point out that the hour hand is also halfway between the hours when the minutes hand is pointing at the 6 – halfway around the clock.

d. Additional Instructional Strategies/Differentiation

- Have student demonstrate times using a large analog and digital clock.
- Children are usually taught first to read the time to the hour, then the half and quarter hours and then to the 5- and 1- minute intervals. In

the early stages of this sequence, children are shown clocks set exactly to the hour or half hour. Many children who can read a clock at 7:00 or 2:30 have no idea what time it is at 6:58 or 2:33. Digital clocks permit students to read times easily but do not relate times very well.

- The following suggestions can help students understand and read analog clocks.
- Begin with a one-handed clock. A clock with only an hour hand can be read with reasonably accuracy. Use lots of approximate language: "It's about 7 o'clock." It's a little past 9 o'clock." "It's half way between 2 o'clock and 3 o'clock."
- Discuss what happens to the big hand as the little hand goes from one hour to the next. If the hour hand is pointing exactly at 12, the hour hand is pointing exactly at a number. If the hour hand is a little past or before an hour (10 to 15 minutes), about where would the minute hand be?
- Use two real clocks, one with only an hour hand and one with two hands. Cover the two-handed clock. Periodically during the day, direct attention to the one-handed clock. Discuss the time in approximate language. Have students predict where the minute hand should be. Uncover the other clock and check. (Van De Walle 2006)

Children need time to practice the skill of moving the hands on clocks and writing the time. Many opportunities should be provided for children to practice these skills with hands on materials.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

2. Teaching Lesson B: Dates on a Calendar

1-5.9 Illustrate past and future dates on a calendar.

For this indicator, it is **essential** for students to:
- Understand the structure of a calendar
- Recall the days of the week and the months of the year
- Locate a past or future dates on a calendar
- Record dates using standard and numeric form
- Understand terms such yesterday, tomorrow, one week ago, etc…

For this indicator, it is **not essential** for students to:
- understand elapsed time on a calendar

1-5.10 Represent dates in standard form (June 1, 2008, for example) and numeric form (6-1-2008, for example).

For this indicator, it is **essential** for students to:
- recall the days of the week and the months of the year
- know their numbers
- be able to count
- distinguish between standard and numeric form.

For this indicator, it is **not essential** for students to:
- None noted

Teacher Notes: As the verb "Illustrate" implies in indicator 1-5.9, students in first grade are expected to give an example of past and future dates. For example, the teacher may say "today is June 5th, what was yesterday, what is tomorrow" OR "Christmas was in the past, now we are getting ready for spring break" OR "today is March 5th, what was last Monday's date?"

Indicator 1-5.10 is self-explanatory. Students simply represent dates in standard and numeric forms.

a. Indicators with Taxonomy

1-5.9 Illustrate past and future dates on a calendar. → A2
Cognitive Process Dimension: Understand
Knowledge Dimension: Factual Knowledge

1-5.10 Represent dates in standard form (June 1, 2008, for example) and numeric form (6- 1- 2008) → A2
Cognitive Process Dimension: Understand
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson

Adapted from Everyday Mathematics First Grade, McGraw Hill, 2009, Pages 53-54.

Materials Needed

- Calendar
- Chart paper/board

Discuss some uses of calendars such as helping keep track of time, appointments and special days like birthdays and holidays. Point to and discuss the parts of the calendar such as the months and days of the week. Record on the chart paper or board the children's answers to the following questions. What is the name of this month? What day of the week is today? What number tells the year? What number tells the day? Tell the children you are going to put all that information together to write today's date. Write the date in standard form using a sentence starting with "Today is". For example, "Today is Tuesday, August 18, 2009". Also record the date in numeric form using a sentence such as "Today's date is 8/18/09."

After you have written today's date in both forms, ask the children to use the calendar to tell you yesterday's date. Record the date on the chart/board using a sentence starting with "Yesterday was". Ask the children to tell you what tomorrow's date will be and record that on the chart/board using a sentence starting with "Tomorrow will be".

As the children become familiar with the concept of past and future dates, use the calendar to answer questions such as: What will the date be one week from today? What was the date one week ago? What was the last Monday's date? What will be the date on Friday?

c. Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d. Additional Instructional Strategies/Differentiation

The focus of the indicator is for students to find examples of present and future dates. It does not require them to write the day using standard or numeric notation which is addressed in indicator 1-5.9.

Put students in pairs. Read out a date. Student A writes the date using standard notation. Student B writes it out using numeric notation. Each pair turns and shares their answer with another pair. On the next problem, student A and B exchange roles.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

f. Assessing the <u>Lesson</u>

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Formative assessment is embedded within the lesson through questioning and observation. However, other formative assessment strategies should also be used.

3. Teaching Lesson 1-4C – Reading a Thermometer

1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)

For this indicator, it is **essential** for students to:

- Understand the meaning of temperature
- Understand that Celsius and Fahrenheit are used to measure temperature as opposed to length, weight, etc.
- Measure temperature using thermometers that progress by increments of one.
- Read thermometers from pictorial and concrete models
- Make connection between pictorial models and the actual thermometer
- Understand the Celsius and Fahrenheit are two ways to measure the same temperature

For this indicator, it is **not essential** for students to:

- Measure temperature using thermometers that progress increments of more than one.

a. Indicators with Taxonomy

1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature. (C3)

Cognitive Process Dimension: Apply
Knowledge Dimension: Procedural Knowledge

b. Introductory Lesson

Materials Needed

- Poster of Fahrenheit thermometer in increments of one
- Red Ribbon, about 1 in wide
- Cut a 1 inch slit in the bottom of the thermometer

Tape the red ribbon on the back of the poster, just under the slit and feed the ribbon through the slit. One the free end of the ribbon, adhere to sticky tack. Review the thermometer as a device that measures temperature. Discuss and brainstorm situations where a thermometer might be used. Chart student input. Make a strong connection between the actual thermometer and the thermometer poster. Ask what the thermometer might look like if we placed it in hot chocolate. What might happen if we place the thermometer in ice water? Then point students' attention to the numbers on the thermometer poster. Tell students that the thermometer's numbers are represented by a number line that has been tunred. Point to the zero at the bottom and show how the numbers increase as you go up the thermometer. Then, pull the ribbon up on the poster and ask students to tell you what temperature you are showing. Repeat as necessary. Once students understand how to measure temperature using the Fahrenheit scale, you will introduce the Celsius scale (later in the year).

c. Misconceptions/Common Errors

No typical student misconceptions noted at this time.

d. Additional Instructional Strategies/Differentiation

- Tell students that the thermometer's numbers are represented by a number line that has been turned.
- Sufficient and varied hands-on experiences with pictorial and concrete models of Celsius and Fahrenheit thermometers will be necessary for conceptual understanding.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.
http://www.beaconlearningcenter.com/WebLessons/BeAScientist/default.htm estimate temperature using a Celsius thermometer

http://www.beaconlearningcenter.com/WebLessons/HotStuff/default.htm estimate temperature using a Fahrenheit thermometer

http://www.ies.co.jp/math/java/geo/therm/therm.html compare temperatures between two days

f. Assessing the Lesson

"When done well, assessment that helps teachers make decisions about the content or form of instruction (often called formative assessment) can also be used to judge students' attainment (summative assessment)." PSSM page 24 Therefore, for the purposes of this work no distinction will be made between formative and summative assessment. Instead, emphasis will be placed on assessment techniques/strategies that may be used to gather information about student understanding that will support instructional decisions both during individual lessons and at the end of a major concept/module.

Show thermometers at various temperatures and ask students to read the temperature. Student responses should determine needs for future instruction.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module.

1-5.8 Use analog and digital clocks to tell and record time to the half hour.

The objective of this indicator is to apply, which is in the "apply procedural" cell of the Revised Taxonomy table. Procedural knowledge is knowledge of specific steps; therefore, students should use a specific set of steps to record and tell time to the half hour. The learning progression to apply requires students to recognize if the clock is digital or analog. Students analyze patterns (1-1.4) by reasoning where the positions of the hands are on a given clock. They also demonstrate their understanding by using concrete and models to represent time. They explain and justify their answer (1-1.3) to their classmates and their teacher. As students explore time, they explain how recording and telling time with a digital clock is different from using an analog clock. After applying procedures to determine the time, student use a variety of forms of mathematical communication (1-1.6) (written and oral) to record and tell time.

1-5.9 Illustrate past and future dates on a calendar.

The objective of this indicator is to illustrate which is in the "understand factual" knowledge of the Revised Taxonomy. To understand is to construct meaning and to illustrate is to find specific examples of a concept; therefore, construct an understanding of the methods needed to locate past and future dates. The learning progression to **illustrate** requires students to recall dates, days of the week, and months of the year on a calendar. They analyze patterns on the calendar to determine the month, day and year. Students locate dates on the calendar based on a given description such as yesterday or one week from now. They explain and justify their answers to their classmates and their teacher (1-1.3).

1-5.10 Represent dates in standard form (June 1, 2007, for example) and numeric form (6-1-2007, for example).

The objective of this indicator is to represent which is in the "understand factual" knowledge cell of the Revised Taxonomy. To represent means to translate from one form to another and the factual knowledge component is the format in which standard and numeric dates are written. The learning progression to **represent** requires students to recall the days of the week and months of the year and the corresponding

number for each month. Students also understand the format for standard and numeric form and how to convert the month, day and year to numeric form when required. Given a verbal description and/or written description of a date, students represent dates in standard form and numeric form. Students also translate from standard to numeric form. They explain and justify their answers (1-1.3) to their classmates and their teacher.

1-5.11 Use Celsius and Fahrenheit thermometers to measure temperature.

The objective of this indicator is to use which is in the "apply procedural" cell of the Revised Taxonomy. Procedural knowledge is knowledge of specific steps; therefore, students should use a specific set of steps to measure temperature using Celsius and Fahrenheit. The learning progression to **use** requires students to understand the attribute (temperature) being measured. Student count by increments of one to determine the temperature indicated on a pictorial or concrete model and explain and justify how their found their answer (1-1.3). They also mark a given temperature on a blank thermometer to demonstrate understanding and explain their reasoning.

The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

Checklists can be completed while observing a small group of children, while observing children in centers or with each child individually. A child should be able to consistently perform all the items on the checklist.

- Able to show/read time to the hour.
- Able to show/read time to the half hour.
- Able to write digital time to the hour.
- Able to write digital time to the half hour.
- Able to orally state the date in standard form.
- Able to orally state the date in numeric form.
- Able to name a date in the past using the calendar.
- Able to name a date in the future using the calendar.
- Able to read Fahrenheit thermometer…and eventually, Celsius.