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

Standards/Indicators Addressed:

Standard K-2: The student will demonstrate through the mathematical processes an emerging sense of quantity and numeral relationships, sets, and place values.

K-2.1* Recall numbers, counting forward through 99 and backward from 10. (A1)
K-2.2* Translate between numeral and quantity through 31. (B2)
K-2.3* Compare sets of no more than 31 objects by using the terms *more than, less than*, and *the same as.* (B2)
K-2.6* Analyze the magnitude of digits through 99 on the basis of their place values. (B4)
K-2.7* Represent the place value of each digit in a two-digit whole number. (B2)
K-2.8* Identify ordinal positions through 31st. (A1)

Standard K-5: The student will demonstrate through the mathematical processes an emerging sense of coin values and the measurement concepts of length, weight, time, and temperature.

K-5.2* Compare the lengths of two objects, both directly and indirectly, to order objects according to length. (B2)
K-5.3* Use nonstandard units to explore the measurement concepts of length and weight. (B3)
K-5.4* Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)
K-5.5* Understand which measure—length, weight, time, or temperature—is appropriate for a given situation. (B2)
K-5.7* Use a calendar to identify dates, days of the week, and months of the year. (A3)
K-5.8* Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year. (A1)

Standard K-6: The student will demonstrate through the mathematical processes an emerging sense of organizing and interpreting data.

K-6.1* Organize data in graphic displays in the form of drawings and pictures. (B4)
K-6.2* Interpret data in graphic displays in the form of drawings and pictures. (B2)

* These indicators are covered in the following 3 Modules for this Nine Weeks Period.
Teaching time should be adjusted to allow for sufficient learning experiences in each of the modules.

Module 3-1 Number Structure and Relationships- Whole Numbers / Calendar			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**
Module 3-1 Lesson A: Counting K-2.1 Recall numbers, counting forward through 99 and backward from 10. (A1)	NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series SC Mathematics Support Document Teaching Student-Centered Mathematics Grades 5-8 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle Website for Van de Walle resources: www.ablongman.com/vandewalleseries	See instructional Planning Guide Module 3-1 Introductory Lesson A See Instructional Planning Guide Module 3-1, Lesson A Additional Instructional Strategies	See Instructional Planning Guide Module 3-1 Lesson A Assessment
Module 3-1 Lesson B: Matching Numeral and Quantity K-2.2 Translate between numeral and quantity through 31. (B2)		See instructional Planning Guide Module 3-1 Introductory Lesson B See Instructional Planning Guide Module 3-1, Lesson B Additional Instructional Strategies	See Instructional Planning Guide Module 3-1 Lesson B Assessment
Module 3-1 Lesson C: Comparing Sets K-2.3 Compare sets of no more than 31 objects by using the terms *more than, less than*, and *the same as.* (B2)	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 3-1 Introductory Lesson C See Instructional Planning Guide Module 3-1, Lesson C Additional Instructional Strategies	See Instructional Planning Guide Module 3-1 Lesson C Assessment

Module 3-1 Lesson D: Ordinal Numbers K-2.8 Identify ordinal positions through 31st.		See instructional Planning Guide Module 3-1 Introductory Lesson D See Instructional Planning Guide Module 3-1, Lesson D Additional Instructional Strategies	See Instructional Planning Guide Module 3-1 Lesson D Assessment
Module 3-1 Lesson E: Place Value K-2.6 Analyze the magnitude of digits through 99 on the basis of their place value. K-2.7 Represent the place value of each digit in a two-digit whole number. (B2)		See instructional Planning Guide Module 3-1 Introductory Lesson E See Instructional Planning Guide Module 3-1, Lesson E Additional Instructional Strategies	See Instructional Planning Guide Module 3-1 Lesson E Assessment

Module 3-1 Lesson F: Using a Calendar K-5.7 Use a calendar to identify dates, days of the week, and months of the year. **(A3)** K-5.8 Recall equivalencies associated with time: 7 days=1 week and 12 months=year. **(A1)**		See Module 3-1, Lesson F Additional Instructional Strategies See Instructional Planning Guide Module 3-1, Lesson F Additional Instructional Strategies	See Module 3-1, Lesson F Additional Instructional Strategies

Module 3-2 Data Collection and Representation / Data Analysis			
Indicator	**Recommended Resources**	**Suggested Insructional Strategies**	**Assessment Guidelines**
Module 3-2 Lesson A: Organizing Data in Graphic Displays K-6.1 Organize data in graphic displays in the form of drawings an pictures. **(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 Website for Van de Walle resources: www.ablongman.com/vandewalleseries NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 3-2 Introductory Lesson A See Module 3-2, Lesson A Additional Instructional Strategies	See Instructional Planning Guide Module 3-2 Lesson A Assessment

Module 3-2 Lesson B: Interpreting Data from a Graph K-6.2 Interpret data from a graph **(B2)**	Hands On Standards Grade PreK-K and 1-2, Learning Resources	See Instructional Planning Guide Module 3-2 Introductory Lesson B See Module 3-2, Lesson B Additional Instructional Strategies	See Instructional Planning Guide Module 3-2 Lesson B Assessment

Module 3-3 Measurement Concepts: Length, Weight, Time and Temperature			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**
Module 3-3 Lesson A: Length K-5.2 Compare the lengths of two objects, both directly and indirectly, to order objects according to length (B2) K-5.3 Use nonstandard units to explore the measurement concepts of length and weight (B3) K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as	NCTM's Online Illuminations http://illuminations.nctm.org/ NCTM's Navigations Series SC Mathematics Support Document Teaching Student-Centered Mathematics Grades 5-8 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle Website for Van de Walle resources: www.ablongman.com/vandewalleseries NCTM's Principals and Standards for School Mathematics (PSSM) Hands On Standards Grade PreK-K and 1-2, Learning Resources Sizing Up Measurement K-2, Vicki Bachman	See Instructional Planning Guide Module3-3 Introductory Lesson A See Module 3-3, Lesson A Additional Instructional Strategies	See Instructional Planning Guide Module 3-3 Lesson A Assessment

devices used to measure temperature (A1)			
Module 3-3 Lesson B: Exploring Weight K-5.3 Use nonstandard units to explore the measurement concepts of length and weight. (B3)		See Instructional Planning Guide Module 3-3 Introductory Lesson B See Module 3-3, Lesson B Additional Instructional Strategies	See Instructional Planning Guide Module 3-3 Lesson B Assessment
Module 3-3 Lesson C: Temperature K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature		See Instructional Planning Guide Module 3-3 Introductory Lesson C	See Instructional Planning Guide Module 3-3 Lesson C Assessment

(A1)			
Module 3-3 Lesson D: Attributes of Measurement K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature (A1) K-5.5 Understand which measurement-length, weight, time, or temperature- is appropriate for a given situation. (B2)		See Instructional Planning Guide Module 3-3 Introductory Lesson D	See Instructional Planning Guide Module 3-3 Lesson D Assessment

MODULE

3-1

Number Structure and Relationships - Whole Numbers

Calendar

(Year-long Indicators)

This module addresses the following indicators:

K-2.1 Recall numbers, counting forward through 99 and backward from 10. (A1)
K-2.2 Translate between numeral and quantity through 31. (B2)
K-2.3 Compare sets of no more than 31 objects by using the terms *more than, less than*, and *the same as.* (B2)
K-2.6* Analyze the magnitude of digits through 99 on the basis of their place values. (B4)
K-2.7* Represent the place value of each digit in a two-digit whole number. (B2)
K-2.8 Identify ordinal positions through 31st. (A1)
K-5.7 Use a calendar to identify dates, days of the week, and months of the year. (A3)
K-5.8 Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year. (A1)

Module 3-1 consists of 6 lesson(s) that continue to develop the concepts introduced in Module 1-1 and Module 1-4.
These lessons are **INTRODUCTORY ONLY**. Lessons in S^3 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 student's prior knowledge and/or skills related to the standard. It is recommended that students are pre-assessed on this prior knowledge.

Continuum of Knowledge

K-2.1 Recall numbers, counting forward through 99 and backward from 10.

- Pre-Kindergarten students have some foundation for counting. They are motivated to count everything from the treats they eat to the stairs they climb.
- In First grade, students will use estimation to determine the approximate number of objects in a set of 20 to 100 objects (1-2.2) and compare whole-number quantities through 100. (1-2.5)

K-2.2 Translate between numeral and quantity through 31.

- Pre-Kindergarten students come to school counting up to five using a one-to-one correspondence as they share items during playtime (i.e., sharing cookies as they count 1,2,3,4 and 5). They may not understand the standard numeral 5 to represent the number of cookies shared.
- In First grade, students will translate between numeral and quantity to 100(1-2.1) and represent quantities in word form through ten. (1-2.3)

K-2.3 Compare sets of no more than 31 objects by using the terms *more than*, *less than*, and *the same as*.

- Pre-Kindergarten students have beginning concepts of size with sets of objects. They understand when someone has more cookies than they do, more blocks than they have, etc…
- In First grade, students will compare whole number quantities through 100, *is greater than, is less than,* and *is equal to* (1-2.5) and use estimation to determine the approximate number of objects in a set. (1-2.2)

K-2.6 Analyze the magnitude of digits through 99 on the basis of their place values.

- Pre-kindergarten students come to school rote counting and have very little understanding of numbers having an assigned place.
- In First grade, students will represent quantities in word form through 10 (1-2.3), recognize whole-number words (1-2.4) and analyze the magnitude of digits through 999 on the basis of their place values. (1-2.9)

K-2.7 Represent the place value of each digit in a two-digit whole number.
No continuum of knowledge is included in the support document at this time.

K-2.8 Identify ordinal positions through 31st.
No continuum of knowledge is included in the support document at this time.

K-5.7 Use a calendar to identify dates, days of the week, and months of the year. (A3)

- Pre-kindergarten students experience marking birthdays on calendars, singing songs about the days of the week and months of the year.
- In First grade, students will illustrate past and future dates on a calendar (1-5.9) and represent dates in standard form (i.e., June 1, 2009) and numeric form (i.e., 6-1-2009). (1-5.10)

K-5.8 Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year

- Pre-kindergarten students experience counting days on a calendar while singing rote songs for the days of week and months of the year.
- In First grade, students will illustrate past and future dates on a calendar (1-5.9) and represent dates in standard form (i.e., June 1, 2007) and numeric form (i.e., 6-1-2007). (1-5.10)

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.*

Number Structure and Relationships

Quantity	More than*	Less than*
The same as*	Digit	Forward
Backward	After*	Before*
Numeral	Counting	Quantity
Compare	Sets	Place Value
Tens*	Ones*	Size

Calendar

Dates	Days*	Week*
Months *	Year*	Equal*
Yesterday*	Today *	Tomorrow*

7 days= 1 week* 12 months=1 year*

Days of the week (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday)*

Months of the year (January, February, March, April, May, June, July, August, September, October, November, and December)*

II. Teaching the Lesson(s)

These lessons continue to develop the concepts that were introduced in Module 1-1 and Module 1-4.

1. Teaching Lesson A: Counting

Teacher Notes

Since there is a developmental progression from counting to understanding place value, it is important to break the numbers 0-99 into smaller, more manageable groups for students to work with. It is for this reason that the first nine weeks has been designated to working with 0-10, the second nine weeks 1-20, **the third nine weeks 0-99.** The fourth nine weeks will focus on joining and separating

a. Indicators with Taxonomy

K-2.1 Recall numbers, counting forward through 99 and backward from 10. (A1)
Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

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

- Understand how to count using a number line or number chart.
- Recognize the counting numbers and be able to rote count.
- Say the counting words in order and then connect this sequence with a one-to-one match of the items being counted.
- Recognize counting objects in a different order does not alter the result.
- Recognize the next number in the counting sequence is one more than the number just named.

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

- Recognize three digit numbers, which students will translate in first grade.
- Add and subtract two digit numbers.

b. Introductory Lesson

(Adapted from Teaching Student Centered Mathematics Grades K-3, Van de Walle, John A. and Lovin, LouAnn, Pearson Learning, 2006, Pages 57.)

Materials Needed

- Hundreds chart

Suggested Literature Connection*:*
Miss Bindergarten Celebrates the 100th Day of Kindergarten by Joseph Slate. Children bring one hundred of something to school.

Introductory* Lesson A: *Counting

In Module 1-1, students counted up to a target number between 0-10 and then counted back down to zero.
In Module 2-1, students counted up to 20 objects and then counted back from ten to zero.
In this module, students will count up to 99 objects and use the hundreds chart.

In this module, have students count up to 99 using a hundreds chart. Provide students a large group of objects to count (this could be a set of counters or unifix cubes greater than 20). Students are to count the objects and then locate the number on the hundreds chart. Ask questions that will help students gain an understanding of the size of the number. For example, if the number of objects is 73, ask "Is the number closer to 0 or 100?" "Is it closer to 10 or 80?" "Name a number that is far away from 73." "Name another number that 73 is close to." Questions could also use the positional words: "What number is *next to* 73?" "What number is *below* 73?" What number is *above* 73?"

c. Misconceptions/Common Errors

- Students who are able to count forward easily may have difficulty counting on and counting back.
- Students may omit numbers when counting objects and struggle to recount them for accuracy.

d. Additional Instructional Strategies/Differentiation

- **Enrichment:** For more advanced students, cover random numbers on a hundreds chart and have them use strategies to determine what the covered numbers are.
- **Remediation**: For students using random counting strategies with larger groups of objects and having frequent miscounts, have the students group the objects as they count in groups of 5 or 10. Students may also find it helpful to use ten frames and place objects in the cells of the ten frames as they count.
- Students should have a fair understanding of counting, but children must construct this idea. It cannot be forced. Only the counting sequence is a rote procedure. There should be *meaning* attached to

counting. That is the key concept upon which all other number concepts are developed.
- Saying the counting words in order with a one-to-one correspondence takes a lot of practice and should be done with a variety of concrete items.
- Teachers should use frequent short practice drills to develop counting on and counting back with their students and use naturally occurring opportunities to help them develop number concepts. Teachers may pose questions; such as, "How many pencils do we need at this table?" "How many students are in line ahead of you?"

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.apples4theteacher.com/math/games/100-number-chart-one.html
  An interactive hundreds chart. Teacher or student can color cells to show patterns or mark numbers the children can name.

f. Assessing the Lesson

As the children work in centers, individually observe for the following areas:

- ability to count in correct sequence forwards to 99 and backwards from 10
- use one to one correspondence when counting.

2. Teaching Lesson B: Numeral and Quantity

Teacher Notes

Beginning number concepts encompass much more than rote memorization of words and symbols. Since kindergarten students have generally had experiences with things they can see and feel, developing a concept of number sense requires a new dimension of thinking as numbers are an idea that can't be seen or felt.

To develop these concepts, kindergarten students need repeated exposures to activities with authentic materials and given extensive opportunities to count in meaningful situations, match numbers to their quantities, and explore number decomposition.

a. Indicators with Taxonomy

K-2.2 Translate between numeral and quantity through 31. (B2)
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

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

- Understand that number words refer to a quantity.
- Recognize numerals through 31.
- Say the counting words in order and then connect this sequence with a one-to-one match of the items being counted.

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

- Recognize three digit numbers, which students will translate in first grade.
- Add and subtract two digit numbers for this indicator.

b. Introductory Lesson

Materials Needed

- Blank index cards
- Stickers
- Teacher-made puzzle pieces for numerals 1-25

Introductory Lesson B: Numeral and Quantity

In Module 1-1, students represented the numerals 1-10 with cubes.
In Module 2-1, students represented the numerals 0-20 with cubes.

In this module, students will match number puzzles for 1-25 made in advance by the teacher.
Advanced preparation: Create individual number puzzles by using pieces of cardboard. Cut out 25 squares. Cut each square in half. On one piece of the puzzle, put one sticker. On the second piece of the puzzle write the number one. Do this for each number up to 25. One half of the puzzle has a number and the other half has the corresponding number of stickers or dots.
During the lesson, have students work with partners to match a numeral with the half that has the same amount of stickers or dots.

c. Misconceptions/Common Errors

- Students who are able to count forward easily may have difficulty counting on and counting back because these are difficult skills for many.
- Although, many children come to school with the ability to rote count and recognize some numbers, they may not have developed a good sense of number.

d. Additional Instructional Strategies/Differentiation

Enrichment: To differentiate for students who are able to easily match numeral and quantity, have them arrange the numerals in order. Students may use a number grid or number line to assist them in ordering the numbers.

Teachers should continue to represent numbers in multiple ways: by pictures, objects, or models to help students develop conservation of numbers.

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://illuminations.nctm.org/ActivityDetail.aspx?ID=73
Illuminations: Concentration Games. Students uncover frames to match numeral to dots. Also, match different representations using ten frames patterns, dots, and numerals. There are two levels of play: numerals 1-6 and numerals 1-10.

f. Assessing the Lesson

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

As the students are matching numeral and quantity cards, listen to see that they are counting with one-to-one correspondence and are not omitting numbers as they count. If students have difficulty counting stickers or dots, provide cubes or counters and see if they can count the correct amount to represent a number card.

3. Teaching Lesson C: Comparing Sets

Teacher Notes

When comparing sets of objects teachers using the terms *more than, less than, and the same as,* teachers need to provide many opportunities for children to construct sets using concrete items and help them make comparisons of the sets each containing 31 or fewer items.

a. Indicators with Taxonomy

K-2.3 Compare sets of no more than 31 objects by using the terms *more than, less than*, and *the same as.* (B2)

Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

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

- Recognize the counting numbers and connect them to the number of objects
- Compare whole number quantities and sets of objects using the comparative vocabulary *more than, less than,* or *the same as*.
- Select which set of objects has more than or less than a number

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

- Identify how much more or how much less than a number. (Ex. Teacher asks, "Which group has more?" showing a group of 5 objects and a group of 15. The child does not need to say the group of 15 has 10 more than the group of 5.)

b. Introductory Lesson

(Adapted from Hands On Standards Grades PreK-K, Learning Resources, 2006, Pages 30-31.)

Materials Needed

- Interlocking cubes (25 per pair of students)
- Paper or white boards (1 per pair of students)

Suggested Literature Connection (if any):

More, Fewer, Less by Tana Hoban. Photographs of everyday objects and familiar animals suggest many questions for comparing sets.

Introductory Lesson C: Comparing Sets

In Module 1-1, students compared sets with 5 or fewer objects and identified which sets had more or less.
In Module 2-1, students compared sets with 0-15 objects.

In this module, students will compare sets that contain 0-25 objects. Give each student a set of 25 or fewer colored counters (Suggested counters include teddy bears, chips, pattern blocks, etc). Have them sort their counters by color. Ask students to count how many they have of each color. Ask a student how many red bears he/she has, then ask another. Ask the class who has more, who has less, or do they have the same (=). Continue with all colors. [Anderson 5]

c. Misconceptions/Common Errors

- Some children may confuse the terms more, fewer and equal. Reinforce these terms throughout the day by pointing out real life experiences such as that more children are in their chairs than are sitting on the floor.
- Students have more difficulty comparing sets using the term "less than" and may have more difficulty counting back
- Although many children come to school with the ability to rote count and recognize some numbers, they may not have developed a good sense of number.
- Students may omit numbers when counting objects and struggle to recount them for accuracy.

d. Additional Instructional Strategies/Differentiation

- Teachers need to provide many opportunities for children to construct sets using concrete items and help them make comparisons of the sets each containing 31 or fewer items. This involves counting groups using one-to-one correspondence. It is especially helpful to connect this concept to everyday situations in the lunch room, bathroom breaks, lining up and so forth.
- Students should have a fair understanding of counting, but children must construct this idea. It cannot be forced. Only the counting sequence is a rote procedure. There should be *meaning* attached to counting. That is the key concept upon which all other number concepts are developed.
- Saying the counting words in order with a one-to-one correspondence takes a lot of practice and should be done with a variety of concrete items.
- Students need opportunities to help them develop number concepts. Teachers may pose questions; such as, "How many pencils do we need at this table?" "How many students are in line ahead of you?"
- Students have difficulty selecting a set when asked, "Which is less?". Teachers can help by asking students which is less immediately after which set is more. Ask students why is this set less than the other set? Begin by asking students to compare sets that are obviously different in number, then proceed to closer values.

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.

As students are comparing sets, watch for students who are still making errors when counting the objects, either skipping a number or counting an object twice. When students compare two groups of objects or stacks of cubes, observe that students are correctly matching the objects in one-to-one correspondence to know which group has more or less. Since students have more difficulty in understanding the concept of "less" ask questions similar to these:
"Which group has less than the other?"
"Which group has fewer objects?"

4. Teaching Lesson D: Ordinal Numbers

Teacher Notes

Ordinal numbers are primarily taught through the tenth place especially when using straws and other objects to represent base ten numerals. The calendar, however, is a great tool for exploring ordinal numerals beyond ten and through 31 as the students learn to identify the days of the week / month.

a. Indicators with Taxonomy

K-2.8 Identify ordinal positions through 31st. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson

(Adapted from Hands On Standards Grades PreK-K, Learning Resources, 2006, Pages 34-35)

Materials Needed

- Learning links or interlocking cubes (1 red, 1 orange, 1 yellow, 1 green and 1 blue per child)

Introductory Lesson D: Ordinal Numbers

In Module 1-1, students worked with the first through fifth positions. In Module 2-1, students worked with the first through twelfth positions.

In this module, students will identify the position of objects or people through the twentieth position.

Have 20 students or the entire class form a line. Ask questions that provide practice with the 1st -20th positions.

"Who is tenth in line?"
"Sally is in the fifth position, so what position is _____in?" (name the person next to Sally, either before or after).
"Where is Joe's place in line?" Have students count using ordinal number until they get to Joe's position.
After a few questions, have students rearrange themselves and ask more questions or allow students to ask questions using ordinal numbers.

c. Misconceptions/Common Errors

Children may be confused about which link/cube is the beginning and which is the end. Encourage children to work from left to right similar to the way they read a sentence.

d. Additional Instructional Strategies/Differentiation

While additional learning opportunities are needed, no suggestions are included at this time.

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.

As the teacher questions the students about ordinal positions of students standing in line, observe whether students know where to

start as they begin to count. Listen to see if students are saying the ordinal numbers in the correct order.

Suggested questions:
Which person is tenth? Show me how you know that.
What place is Sally?
Who comes after the fifteenth person? What place is that?

5. Teaching Lesson E: Place Value

Teacher Notes

Kindergarteners must develop the concept of place value only after they have secured a firm understanding of number. They should not be expected to understand place value until they have mastered the one-to-one correspondence and matching numerals to groups of objects less than 10.

With regard to place value students need to understand that the digit to the left in a two-digit number is representing groups of ten and the digit to the right is representing how many are in the ones place that have not yet made a group of ten. It can take the entire school year for many kindergarten students to grasp this concept. The concept should be taught everyday and especially taught with manipulatives that the students can use to demonstrate their understanding. For example, a child may show a tower of ten cubes and a tower of three cubes to represent the numeral 13 or 3 towers of ten and a single cube to represent 31. Do not expect students to understand this concept until after mastering the one-to-one correspondence and matching numerals to groups of objects.

To allow time for students to develop a solid understanding of place value, it is recommended that students work with the numerals 0-25 during the first nine weeks, numerals 25-50 during the second nine weeks, numerals **50-75 during the third nine weeks**, and numerals 75-99 during the fourth nine weeks.

a. Indicators with Taxonomy

K-2.6 Analyze the magnitude of digits through 99 on the basis of their place values. (B4)
Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

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

- Develop *meaning* attached to their counting.
- Recognize sets of tens in objects.
- Understand the one to one correspondence of numbers.

- Understand the digit to the left in a two-digit number is representing groups of ten and the digit to the right is representing how many are in the ones place that has not yet made a group of ten.
- Recognize and understand the meaning of "ten-ness".
- Determine how greater numbers in the tens place increase the value of the total number regardless of the numeral in the ones place being of less value.

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

- Analyze digits beyond 100 because it will later be addressed in first grade.
- Compute the numbers to increase place values (i.e., 34 plus one more ten is equal to 44).

K-2.7 Represent the place value of each digit in a two-digit whole number (B2)

Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Materials Needed

- Unifix cubes
- Place Value boards (tens/ones)
- Hundreds chart

Introductory Lesson E: Place Value

In Module 1-1, students worked with understanding the place value using the number 0-25.
In Module 2-1, students worked with place value using the numbers 25-50.

In this module, students will use the numbers 50-75 to further develop their understanding of place value and the magnitude of digits.

Begin the lesson by reviewing where numbers are located on the hundreds chart. Ask students to locate a number that…

Is near the top of the Hundreds Chart
Is near the bottom of the Hundreds Chart
Is close to 50
Is close to 25
Is far away from 10

Is less than 25
Is more than 60

Have the students work in pairs. Give each pair as pile of 26 cubes. Count your cubes. How many do you have? (26) Ask students to snap together 10 of their cubes. How many tens do you have? (1) How many leftovers? (16) How many cubes do you have altogether? *Record notes on any students who do not realize they still have 26 cubes.* Let's try to make another ten. How many tens do you have now? (2) How many leftovers? (6) How many cubes do you have altogether? (26)

26
1 ten 16 leftover cubes
2 tens 6 ones

Give each pair of students a Ziploc bag with a random number of cubes inside. Go through the same process. Form one group of ten. How many tens are there? How many leftover cubes? How many total? Form another train of ten. How many leftover cubes are there now? Repeat until all possible tens are made.

On another day, have students use beans and cups to work with groups of tens. Students are given a pile of beans. Place ten beans in a cup. If they can make another group of ten, have them place the next group of ten beans in another cup.How many tens (cups) are there? How many leftover beans?

c. Misconceptions/Common Errors

- Although, many children come to school with the ability to rote count and recognize some numbers, they may not have developed a good sense of number
- Some students do not know that a quantity remains unchanged when it is regrouped.
- Students may not understand the concept of place value until after mastering the one-to-one correspondence and matching numerals to groups of objects.
- Students who have not yet developed sense of number might hold the misconception that the number 16 is made up of one and six rather than one ten and six ones.

d. Additional Instructional Strategies/Differentiation

- Teachers may use the hundreds mat to show how numbers change in the tens and ones place.
- The concept should be taught daily using the number of days in school with a variety of manipulatives that the students can use to demonstrate their understanding (i.e., a student may show a tower

of ten cubes and a tower of three cubes, or sticks and bundles) to represent the numeral 13 or 3 towers of ten and a single cube to represent 31.)

- Students that struggle to understand numbers and operations concepts often just need another approach coupled with repetition. Using different manipulatives and connecting the learning to individual interests can help.
- **Enrichment:** Have students keep a record of the different groupings they make for a given number. (Ex: 57 = 1 ten 47 ones, 2 tens 37 ones, 3 tens 27 ones, 4tens 17 ones, 5 tens 7 ones) Some may even be able to describe any patterns they notice.
- **Remediation:** Have students represent a number in as many ways as they can using counters, tally marks, finding it on the hundreds chart, unifix trains, etc. This will help students begin to think more flexibly about the meaning of a 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.

http://www.ictgames.com/sharknumbers.html
Interactive game for students to play and practice matching numerals to ten-trains and leftover cubes

f. Assessing the Lesson

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

As students make groups of ten with their unifix cubes, observations should note which students need to recount after each regrouping, which students continue to miscount, and which students are able to explain the different ways to represent a number with groups of tens and leftover cubes.

6. Teaching Lesson F: Using the Calendar

Teacher Notes

Kindergarten students should use a calendar to identify dates, days of the week, and months of the year. While students can learn these facts from rote memory, they need to understand the deeper meaning of connections between these larger amounts of time.

Teachers must connect the repetition of the days and months so that students can understand the continual cycle of weeks and years. By doing so, students will be able to understand transitions Saturday to Sunday and December to January.

K-5.7 Use a calendar to identify dates, days of the week, and months of the year.

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

- Understand the order of the months and days of the week.
- Recognize the vocabulary used to indicate positional days (i.e., Today is ___, tomorrow will be _____, and yesterday was _____).
- Recognize a row on the calendar is one week.
- Understand that each box on a calendar represents a day.
- Name and locate the month on a calendar.

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

- Determine the number of months between to given ones (i.e., "How many months are there before December, if this month is April?")
- Illustrate past dates using the calendar (i.e., "If today is June 2, what day was it three months ago?") In first grade, they will illustrate past and future dates on a calendar.

K-5.8 Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year.

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

- Understand what equal means when it applies to time.
- Recognize the vocabulary as it relates to equivalency (i.e., all 12 months equals a year).
- Recognize a row on the calendar is one week.
- Recognize that some calendars begin on different days of the week.

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

- Recognize the number of days in several weeks or number of months in several years.
- Determine smaller amounts of time (i.e., 1 day = 24 hours, etc.).

a. Indicators with Taxonomy

K-5.7 Use a calendar to identify dates, days of the week, and months of the year. (A3)
Cognitive Process Dimension: Apply
Knowledge Dimension: Factual Knowledge

K-5.8 Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson

Materials Needed:

- *A variety of 12-month calendars (enough for each pair of students to have a calendar)*

Suggested Literature Connection:
All about the Months by Joanne Randolph uses photographs and rhyming text to introduce the twelve months of the year.

Introductory Lesson F: Using a Calendar

In Module 1-1, students went through the process of building a calendar for the month, placing the days of the week in order, identifying and labeling the month, and identifying dates.
In Module 2-1, students dismantled the calendar as they continued to develop an awareness of the calendar.

In this module, students will explore the organization of a 12-month calendar.
Begin the lesson by singing a calendar song:

The Months of the Year

(To the Tune of "Three Blind Mice")

January, February, March,
April, May, June.

July, August, September,
October, November, December.
These are the twelve months of the year.
Now sing them together so we can all hear.
How many months are there in a year?
Twelve months in a year.

Show students a twelve month calendar. How does a calendar help us? Have a student locate the current month in the calendar. Ask the class to compare this calendar to the class calendar. How are they alike? (both show dates, days of the week, have numbers) How are they different? (one month / twelve months) Tell students that they are going to spend some time exploring 12-month calendars. Divide the students into small groups with 3 or 4 calendars to view. Give students a few minutes to flip through the calendars to look at the photographs, say the months, etc.
Gather the students together and ask questions to guide further exploration. Students should be using their calendars to find the answers to these questions.

- How many months are in your calendar? (some may have 13 months)
- Find the current month. How many days are in this month? How many weeks?
- Which month comes after this month? How many days does it have? How many weeks?
- What is the first month? The fourth month? The eighth month?
- Find a month that has 30 days.
- Find February. On what day does February begin?
- Find a month that begins on Monday.
- Find a month that ends on Monday.
- Find your birthday month.

Conclude the lesson by asking students to share ways they can use a 12-month calendar. How does a calendar help your family? How does a calendar help our class?

c. Misconceptions/Common Errors

- Students may have difficulty understanding the concept of week, month or year.
- Students may have difficulty recognizing days before and after a certain date on a calendar (i.e., "Yesterday was __.", etc…).
- Students may have difficulty associating whole numbers with ordinal numbers. For example, the number 1 is dated on a calendar as the 1st.

d. Additional Instructional Strategies/Differentiation

- Teachers must connect the repetition of the days and months so that students can understand the continual cycle of weeks, months and years. By doing so, students will be able to understand transitions Saturday to Sunday and December to January.
- Refer to Module 1-1 for songs and poems related to the days of the week and months of the year
- Teachers may color code every other week on the calendar to help students understand the concept of a week
- Incorporate calendar activities daily
- Give the students a copy of a blank calendar. Tell what day the month begins on and allow the children to fill in the calendar. As a whole group, ask the children questions about the month.
- To differentiate for more advanced students: Allow the children to create story problems centered on a month of the year. For example, "Today is December 5, how many more days until Christmas?"

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.jmeacham.com/calendar/calendar.htm
A resource page for teachers. Calendar songs, SMART Notebook monthly calendar lessons, and other ideas for teaching the calendar.

f. Assessing the lesson:

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

As students explore 12-month calendars, record observations about their responses to questions that are asked. Particularly note the following:
Can students easily locate a month near the end or beginning of the year?
Which students think the first day of the month is the same as the first day of the week?
Which students do not understand how a 12-month calendar is organized?

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.

Assessment Guidelines

K-2.1 Recall numbers, counting forward through 99 and backward from 10.

The objective of this indicator is recall, which is in the "remember factual" knowledge cell of the Revised Taxonomy table. Remember requires students to retrieve relevant knowledge from long-term memory. Factual knowledge is having the knowledge of specific details and elements. Students should recall numbers, counting forward through 99 and backward from 10. The learning progression to **recall** requires students to recognize the counting numbers and recall their order in the sequence. Students should analyze (K-1.4) patterns by reasoning and use (K-1.8) multiple informal representations as they apply (K-1.1) substantive mathematical problem-solving strategies to explore hands-on activities.

K-2.2 Translate between numeral and quantity through 31.

The objective of this indicator is translate, which is in the "understand conceptual" knowledge cell of the Revised Taxonomy table. Understand requires students to construct meaning from instructional messages. Conceptual knowledge is having the knowledge of classifications and categories. The learning progression to **translate** requires students to recall counting numbers through 31, recognize the one-to-one correspondence as they count and determine the numeral and quantity of the objects given. They use these multiple informal representations (K-1.8) as they apply mathematical problem-solving strategies (K-1.1). Students should use a variety of forms of mathematical communication (K-1.6) as they explain and justify their answers (K-1.3)to their classmates and their teacher..

K-2.3 Compare sets of no more than 31 objects by using the terms *more than, less than*, and *the same as.*

The objective of this indicator is compare, which is in the "understand conceptual" knowledge cell of the Revised Taxonomy table. Understand requires students to construct meaning from instructional messages, including oral, written, and graphic communication. Conceptual knowledge is having the knowledge of theories, models, and structures. The learning progression to **compare** requires students to recognize the counting numbers and recall their order in the sequence. Students should understand sets and categorize groups by quantity. Students should use multiple

informal representations (K-1.8) as they apply (K-1.1) mathematical problem-solving strategies to compare objects.

K-2.6 Analyze the magnitude of digits through 99 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 table. Analyze requires students to break material into its constituent parts and determine how the parts relate to one another and to the overall structure. Conceptual knowledge is having the knowledge of finding the interrelationships among the basic elements within a larger structure that enable them to function together. The learning progression to **analyze** requires students to remember the counting numbers and differentiate between the larger and smaller numbers. Students analyze patterns (K-1.4) in the place value of the number and generalize (K-1.7) connections about the size of digit in the tens place versus digits in the ones place.

K-2.7* Represent the place value of each digit in a two-digit whole number.
No assessment guidelines are available at this time.

K-2.8 Identify ordinal positions through 31st.
No assessment guidelines are available at this time.

K-5.7 Use a calendar to identify dates, days of the week, and months of the year.

The objective of this indicator is use, which is in the "apply factual" knowledge cell of the Revised Taxonomy table. Apply requires students to carry out or use a procedure in a given situation. Factual knowledge is a knowledge of terminology, specific details and elements. Students should use a calendar to identify dates, days of the week, and months of the year. The learning progression to **use** requires students to recognize the days in a week and months in a year, and execute specific information to solve real-world problems focused around the use of the calendar. Students should use a variety of forms of mathematical communication (K-1.6) to generalize connections (K-1.7) among the calendar, the environment, and other subjects. As students identify dates, days and months on the calendar, they explain and justify their answers (K-1.3) to their classmates and their teacher.

K-5.8 Recall equivalencies associated with time: 7 days = 1 week and 12 months = 1 year.

The objective of this indicator is recall, which is in the "remember factual" knowledge cell of the Revised Taxonomy table. Remember requires students to retrieve relevant knowledge from long-term memory. Factual knowledge is having the knowledge of specific details and elements. Students should recall

equivalencies associated with time: 7 days = 1 week and 12 months = 1 year. The learning progression to **recall** requires students to identify the number of days in a week and months in a year, and recall another representation or name for them. Students should use multiple informal representations (K-1.8) such as calendars to support retention of these facts. They also use these informal representations to explain answers (K-1.3) to simple problems as they apply mathematical problem-solving strategies (K-1.1).

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.

At the end of the module, use this checklist to assess students' progress toward mastery of the indicators. For the third 9 weeks, teachers should complete the section for Numbers 0-20. There may be students who are ready to be assessed on all 4 sections.

For Numbers 0-5, the student is able to:		**For Numbers 11-20, the student is able to:**	
recall numbers forward and backward		recall numbers (forward only)	
Translate between numeral and quantity		Translate between numeral and quantity	
Compare sets of no more than 5 objects		Compare sets of no more than 20 objects	
Identify ordinal numbers through 5th		Identify ordinal numbers through 20th	
For Numbers 6-10, the student is able to:		**For Numbers 21-99, the student is able to:**	
recall numbers forward and backward		recall numbers (forward only)	
Translate between numeral and quantity		Translate between numeral and quantity (through 31)	
Compare sets of no more than 10 objects		Compare sets of no more than 31 objects	
Identify ordinal numbers through 10th		Identify ordinal numbers through 31th	

Calendar Checklist

Use the checklist below to assess a student's understanding of the organization of a calendar and ability to use a calendar to locate information. Insert notes or a rating in each of the 9 weeks columns to indicate progress towards mastery.

TASK	1st 9 Weeks	2nd 9 Weeks	3rd 9 Weeks	4th 9 Weeks
Names Days of Week in Order				
Correctly uses the vocabulary: "Today is ____, Yesterday was _____, Tomorrow will be _____."				
Names Months of Year in Order				
Identifies a week on a calendar				
Uses a calendar to locate a date				
Finds the name of the month on a calendar				
Answers questions about the monthly calendar: **How many Fridays?** **How many days during the month?** **What day is (*name a date)?*** **What is the date for the third Monday?**				

MODULE

3–2

Data Collection and Representation/Data Analysis

This module addresses the following indicators:

K-6.1 Organize data in graphic displays in the form of drawings and pictures.(B4)

K-6.2 Interpret data from a graph. (B2)

This module contains 2 lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S^3 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 student's prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

Continuum of Knowledge

K-6.1 Organize data in graphic displays in the form of drawings and pictures.

- Pre-Kindergarten students are introduced to organizing information with the teacher's guidance. Human body graphs and people graphs are introduced, since they are simple graphs for children to understand.
- In first grade, students organize (1-6.2) and interpret (1-6.3) picture graphs, bar graphs, object graphs, and tables.

K-6.2 Interpret data from a graph.

- Pre-Kindergarten students are exposed to some interpreting data in graphic displays which is mostly led by the teacher (i.e., Teacher may ask students to draw a picture of a pet and organize them in a floor graph. The teacher may ask, "How many dogs do we have? Which animal has the most pictures?").
- In First grade, students will interpret data in picture graphs, object graphs, bar graphs, and tables by using the comparative terms, more, less, greater, fewer, greater than, and less than. (1-6.3) They predict on the basis of data whether events are likely or unlikely to occur. (1-6.4)

.

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.*

bar graph	picture graph	object graph
Graph*	More *	Less*
Equal*	Most*	Least*
Data	Interpret	Attributes
Record		

II. Teaching the Lesson(s)

1.Teaching Lesson A: Organizing Data in Graphic Displays

Teacher Notes

Kindergarten students' prior experiences with data were focused on collecting data related to familiar experiences. Beginning early in the kindergarten

year, students can begin to sort and classify the objects and pictures in the form of graphic displays. These displays can include, but may not be limited to, object graphs and picture graphs. The teacher will model various graphic displays and guide students as they use them. As the year goes on, students should be expected to independently organize data in graphic displays.

a. Indicators with Taxonomy

K-6.1 Organize data in graphic displays in the form of drawings and pictures. (B4)

Cognitive Process Dimension: Analyze
Knowledge Dimension: Conceptual Knowledge

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

- Recognize that each object represents a quantifiable part of data.
- Recognize different attributes used in data.
- Identify where objects belong on the graph.
- Rote count (K-2.1) to the given amount in a certain set.
- Classify the data to be graphed (K-3.4).

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

- Survey information for graphing
- Interpret information
- Predict information

b. Introductory Lesson:

(Adapted from Navigating through Data Analysis and Probability in Prekindergarten-Grade 2. For the National Council of Teachers of Mathematics, 2004, Pages 25-26.)

Teacher Note:

During the lesson, it is important to ask the children questions pertaining to the graph. For future lessons, it is important to gather data based on the students' interests. When the students are given opportunities to formulate the questions they want to ask, the data they gather is more meaningful to the students. Continue to make graphs throughout the year.

Materials Needed:

- *One shoe from each child*
- *One-half-inch-wide masking tape*
- *A floor graph with two columns (Use making tape on the floor or bulletin board paper. Make each square about 8 inches by eight inches.*
- *Write each child's name on a sticky note*

Suggested Literature Connection

The Great Graph Contest by Loreen Leedy is about Chester and his animal friends entering a graphing contest to see who can make the best graph.

Introductory Lesson A: Organizing Data in Graphic Displays

During the lesson:

This lesson should be done in a whole group setting. The students will contribute one shoe to form a collection of shoes. Begin by telling the students that a shoe company would like to know what type of shoes kindergarten students wear. Tell the students that this information will help the shoe company decide which type of shoes to make. Ask the students to brainstorm some important questions the shoe company might be interested in knowing.

Examples:
Which shoes are most comfortable?
What colors do you like to wear?
Which shoes are easier to take on and off?
Do you prefer laces or Velcro?
Do you prefer shoes with designs?

Ask, how can we use the shoes they are wearing to collect data for the shoe company? Instruct the students to take off their right shoe and place them in a pile. (Please label their shoes with a sticky note or tape.) Pick up one of the shoes and ask the students to describe the shoe. The students might say, "It's a tennis shoe," or "It has a rubber sole or shoestrings." Chose an attribute stated and ask the students to identify other shoes that have the same attributes. Continue this process for shoes that have other attributes-for examples, hard soles, velcro…etc. Place all the shoes in piles based on their attributes. For example, place all of the shoes with Velcro in the same pile. As a class observe the piles and decide which one attribute to graph. Ask, "What is a bar graph and why are they important?" State, "Today, we are going to construct a 3-dimensional graph using our shoes." Have the students separate the shoes that have that one attribute from those they don't. For example, shoes with laces and shoes without laces. Label the column for the bar graph for each category laces or no laces. As a class, allow the children to select a shoe and place it in the appropriate column. After the 3-D bar graph is constructed, begin a discussion about the graph:

- What information does this bar graph give us?
- Which column has more shoes?
- Which column has fewer shoes?
- How many students have shoes on the graph?

At this point in the lesson, ask the students how could we represent our data without taking off our shoes? Tell the students that most bar

graphs are not 3-D, but they are shown in pictorial illustrations. Instruct the students to draw a replica of the 3-D graph on the board or chart paper. Ask the students, "Thinking about today's lesson, what did we learn about bar graphs?"

c. Misconceptions/Common Errors

When working on a graph, students need to understand where a graph starts – bottom to top, or left to right.

d. Additional Instructional Strategies/Differentiation

Early in the kindergarten year, students can begin to sort and classify the objects and pictures in the form of graphic displays. These displays can include, but may not be limited to, object graphs and picture graphs. Teachers may introduce various graphs (i.e. picture graph, body graph, bar graph, Venn diagram) so that students can see many ways to organize information. As the year progresses, students should be expected to independently organize and interpret data using different displays.

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.abc123kindergarten.com/graphmka2001.html
This site has lists of graphing ideas for teachers.

http://illuminations.nctm.org/LessonDetail.aspx?ID=L754
Illuminations lessons on sorting by attributes and graphing.

http://www.harcourtschool.com/activity/counting_objects/
Students count the objects in a picture and create a graph by clicking the correct number of squares for each row.

f. *Assessing the Lesson:*

Ask the children to choose their favorite ice cream. The choices are chocolate, vanilla and strawberry. Create a chart (see below) for the children's choices . As the children vote place the tally marks on the chart.

Ask the children to take the information from the chart and organize it in a graphic display. Provide the children with counters, beans, cut outs of ice cream cones, and any other necessary supplies to create their graphs.

Chocolate	***III***
Vanilla	***II***
Strawberry	***I***

Observe whether students make connections between the number of tallies and the number of objects in their graphic display.
The teacher may ask questions similar to the ones below to assess students; understanding of their graphic display:
What is your graph about?
How many pictures of cones will you need to place beside chocolate?
Which flavor needs to have one cone beside its name?

2. Teaching Lesson B: Interpreting Data from a Graph

Teacher Notes

Prior to and early during the kindergarten year, students' exposure to interpreting data in graphic displays is mostly teacher led. As the students take more responsibility in organizing data, the teacher should use questioning strategies that lead students to understand what the graph represents. Eventually, students should begin to take responsibility for explaining simple graphs and interpreting data from a graph.

a. Indicators with Taxonomy

K-6.2 Interpret data from a graph. (B2)

Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

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

- Identify likenesses and differences in the groups of data.
- Represent and classify objects used in the data (i.e., collection of shapes are organized in groups and lined up on the floor graph in some order identified by the students).
- Recall the definition of a graph.
- Explain information in the data.

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

- Predict outcomes when interpreting data. (This concept will be addressed in first grade.)
- Compute differences in the data.

b. Introductory Lesson:

(Adapted from Hands on Standards, PreK-K 2006, Pages 132-133.)

Materials Needed:

- *Color Tiles-blue, red, green and yellow (10 of each color per pair of students)*
- *Graphing Grid (see attached)*
- *Crayons- 1 box per child*
- *1 Index card (3x5) for each student*
- *A bar graph large enough to hold the index cards (can be on bulletin board paper or the chalk board)*

Introductory Lesson B: Interpreting Data from a Graph

Before Lesson*: Create a simple bar graph on the board including the four favorite pets listed on the bottom. Use the Graphing Grid worksheet as an example.*

During Lesson: Tell the children that they will gather some data today to determine the class' favorite pet. The choices are frog, fish, turtle, and hamster. Ask the students what is the best way to gather this information? Listen to the responses and have a discussion. Tell the students that once the information is gathered, they will create a graph. Write the pet choices on the board and give each student an index card. Instruct the students to write their favorite pet on their index card. Allow the students to come up and place their index card in the appropriate column. After all of the index cards are placed on the graph, give the children the graphing grid, color tiles, and crayons. Instruct the children to make the bar graph using their color tiles and tell them to choose the color they would like to use for each pet. (i.e green for frogs..etc). Be sure to tell them to use one color for each pet. At this point walk around and observe the students creating the graph. After the students have created the bar graph with color tiles, ask them to remove the tiles and color one box on the grid for each animal. (i.e five turtles=5 boxes)

Next, tell the children that they are now going to interpret their graph. Here are some questions to ask the students?

- Which bar is the longest?
- Which bar is the shortest?
- Which pet is liked the most?
- Which pet is the least favorite?
- How can you tell?
- Is there another way we can take this same information and create a different type of graph?
- Why is it important to make graphs?

c. Misconceptions/Common Errors

- The children might color too many boxes for pets. Help children to understand that bar graphs can be done horizontally and vertically.
- Students may have difficulty with counting different objects (or pictures) for each set of information. Instead of just counting one column or one row in a graph, they may count all of the columns or rows together.

d. Additional Instructional Strategies/Differentiation

- Teacher questioning can guide students to make connections between number, quantity and measure (i.e., when interpreting data from a graph, the teacher may pose questions like, "Which is taller/ shorter)?" "Which has more than the others / less than/ the same as?" "What does that tell you?").

- Give each child about 20-25 different patterns blocks and ask them to create a bar graph representing each pattern piece. This would be an independent activity, so all the graphs would have different data. Take that information and compile it and make one large bar graph.(variation: work in groups)

- Give a group of 4-5 students a pack of m & m's and instruct them to organize the candy and create a graphic display. The students will transfer their information to a grid sheet (similar to the one attached.) Instruct groups to create questions about their graphs. Collect the graphs and distribute to other groups for them to answer.

- **Enrichment:** *For students who understand how to sort and classify objects based on attributes, provide activities that will allow them to create graphic displays to represent the way they sorted a group of objects. Have students explore different graphic displays: object graphs, bar graphs, tally charts, picture graphs. Students should write statements that describe their data.*

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."

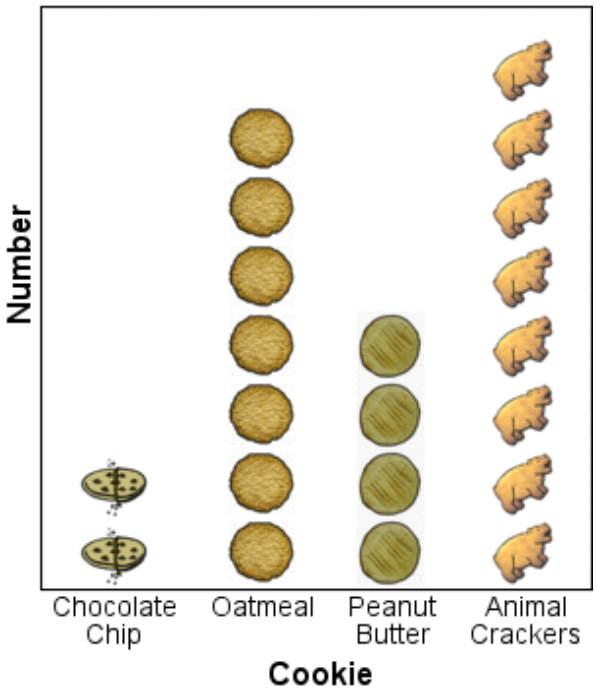
http://www.harcourtschool.com/activity/olivia_octagon/activity6/a6Shell_6.html
Students explore graphing and comparing sets

f. Assessing the Lesson

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

Use the graph below or a similar graph to assess students' ability to interpret data in a graphic display. Observe and listen to the student to assess the following:

- know which column to count
- able to count the objects without any miscounts
- understands what the graph is about



1. How many people chose oatmeal as their favorite cookie?
2. Which cookies is the most popular?
3. Which cookie is the least favorite?

Name_____ Date_____

FROG ***FISH*** ***TURTLE*** ***HAMSTER***

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.

Assessment Guidelines

K-6.1 Organize data in graphic displays in the form of drawings and pictures.

The objective of this indicator is organize which is in the "analyze conceptual" knowledge cell of the Revised Taxonomy table. To organize means to determine how elements fit or function within a structure. The learning progression to **organize** requires students to analyze patterns from information (K-1.4). . Students generalize connections (K-1.7) among the data and use multiple informal representations (drawing and pictures) to convey their mathematical ideas (K-1.8) Mastery of this skill is determined through a student's consistent demonstration of grouping data by attributes

K-6.2 Interpret data from a graph.

The objective of this indicator is interpret, which is in the "understand conceptual" knowledge cell of the Revised Taxonomy table. To interpret requires students to construct meaning from instructional messages and graphic communication. Conceptual knowledge is having the knowledge of principles and generalizations. The learning progression to **interpret** requires students to recall basic counting numbers, organize data, and recognize the differences in the data collected as they clarify its meaning through teacher's questioning. Students should apply substantive mathematical problem-solving strategies (K-1.1) as they explain and justify answers to the problems (K-1.3) using a variety of forms of mathematical communication (K-1.6). Students should interpret data in graphic displays in the form of drawings and pictures

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

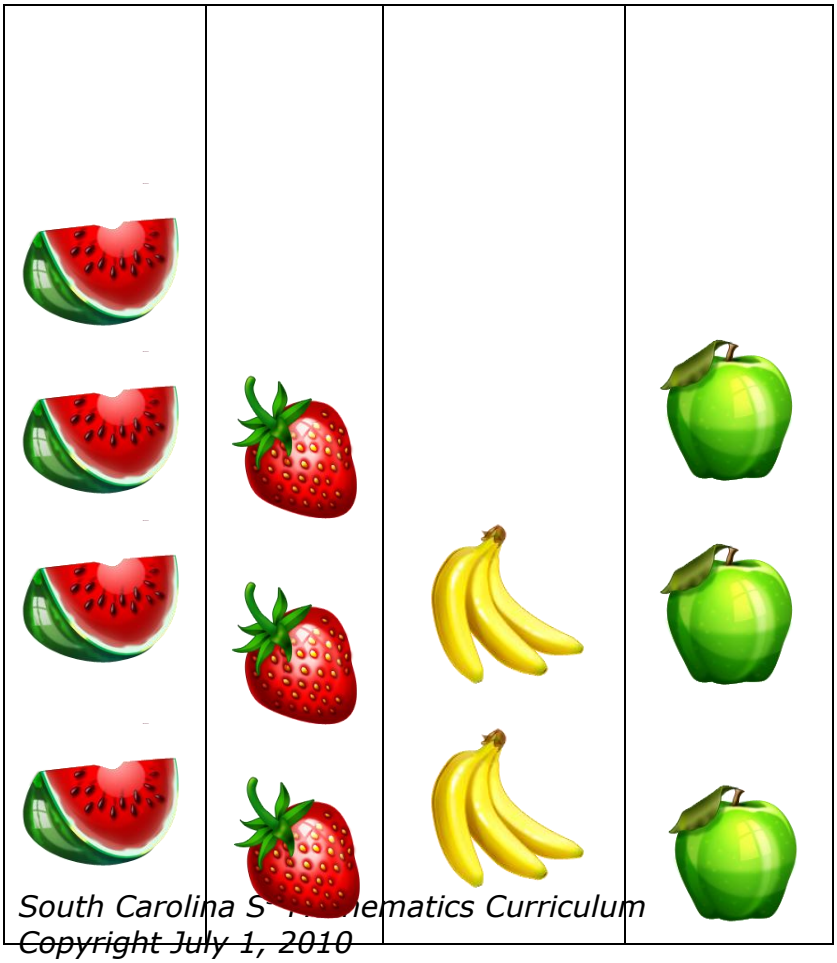
Assessment for K-6.1- This module would be best assessed through a one on one performance assessment interviews. Record notes of students progress. The following checklist is one suggestion of recording data from the interviews.

Task: Give students a bag of unifix cubes with at least five colors. Ask the students to think about a way they could sort the cubes. Ask the student to create a graphic display using the cubes.	Notes:
Task: Give the student a piece of paper and ask them to record their graphic display in the form of drawings or pictures	Notes:

Assessment for K-6.2-Interpret data from graph Interview each student using the following graph. Read the questions to the students and ask them to tell or write their responses.

FAVORITE FRUIT
What is the favorite fruit?
What is the least favorite fruit?
How can you tell?
Which two fruits had the same number?

FAVORITE FRUIT



MODULE

3-3

Measurement Concepts: Length, Weight, Time, and Temperature

This module addresses the following indicators:

K-5.2 Compare the lengths of two objects, both directly and indirectly, to order objects according to length. (B2)

K-5.3 Use nonstandard units to explore the measurement concepts of length and weight. (B3)

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

K-5.5 Understand which measurement-length, weight, time, or temperature- is appropriate for a given situation. (B2)

This module contains 4 lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S^3 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 student's prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

Continuum of Knowledge

K-5.2 Compare the lengths of two objects, both directly and indirectly, to order objects according to length. (B2)

- Pre-Kindergarten students develop an understanding of attributes by looking, touching, or directly comparing objects. They line up blocks and cars during play time in a linear form.

- In First grade, students use whole-inch units to measure the length of an object (I-5.4) and use common referents to make estimates in whole inches (1-5.6). Students generate common referents for whole inches. (1-5.5)

K-5.3 Use nonstandard units to explore the measurement concepts of length and weight. (B3)

- Pre-Kindergarten students determine who has more by looking at the size of piles of objects or identify which of the two objects is heavier by picking them up. They begin their exploration of measurable attributes by looking at, touching, and comparing physical things directly.

- In First grade, students use whole-inch units to measure the length of an object (I-5.4) and use nonstandard units to measure the weight of objects. (1-5.7)

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

- Pre-Kindergarten students have had some exposure to measurement instruments in real life situations. Most students have begun to connect some measurement instruments with their uses, such as weighing when going to the doctor.

- In First grade, students use common referents to make estimates in whole inches(1-5.6) and use nonstandard units to measure weight of objects. (1-5.7) They use analog and digital clocks for time (1-5.8) and illustrate past and future dates on a calendar. (1-5.9)

K-5.5 Understand which measurement-length, weight, time, or temperature- is appropriate for a given situation. (B2)

- Pre-Kindergarten students explore measurement tools through the use of sandboxes, connecting cubes, and stepping on scales, etc. as an introduction to it.

- In First grade, students use whole –inch units to measure the length of objects (1-5.4) and nonstandard units to measure weight of objects. (1-5.7). They use analog and digital clocks to tell and record time to the half hour. (1-5.8)

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.*

Length*	Weight*	Time*	Temperature*
compare longer* shorter* taller* ruler* yardstick* measuring tape	Heavier* Lighter* Balances* Scale*	Calendar* Clock* Day* Week* Month* analog digital	degrees thermometer*

II. Teaching the Lesson(s)

1. Teaching Lesson A-Length

Teacher Notes (Length)

Any learning encounters related to length should begin with students exploring the concepts of length through hands on experiences. Students should be given opportunities to build a conceptual understanding of linear measurement, realizing that length tells something about the size of an object- how tall, short, or long it is. Some research states that early measurement concepts are built by comparing height and length of objects, first directly, then indirectly. Objects being compared should be situated both horizontally and vertically to promote flexibility of thinking. When making the visual comparison, the length of the objects being compared should be distinctly different. The goal is for students to begin to make comparisons with regard to length, not distinguish between minute differences in length.

Experiences with comparisons for length should include situations where an object is perhaps longer this time and shorter when compared to something

else. Experiences such as these will prevent students from thinking an object will always be identified as "longer" or "shorter". The emphasis will be on the comparative length relationship between the two objects. Once students are able to make a determination of one object being bigger, smaller, shorter, or longer than another object when objects are placed side by side, they should move to indirect comparisons where they mentally compare two objects that are not placed next to each other. Once they grasp the concept of comparing objects, they can move on to proving their comparisons by measuring objects using nonstandard units. In regard to use of nonstandard units, it is important to note that whatever unit is used must be uniform. In other words, a student may use his own hands repeatedly to measure the length of a table, but it would be incorrect to use a combination of hands of different sizes for a single measurement. The point here is the units must be uniform – which leads in first grade to the concept of using measuring devices. While kindergarten experiences are limited to measuring with nonstandard units, it is important that they be introduced to the tools used for measuring and have an understanding of which measure and which tool is appropriate for a given situation. For example, students should understand that a ruler is used to measure length and that length is the measure if one wants to know how long something is.

a. Indicators with Taxonomy

K-5.2 Compare the lengths of two objects, both directly and indirectly, to order objects according to length. (B2)

Cognitive Process Dimension: Understand.
Knowledge Dimension: Conceptual Knowledge

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

- Place two objects next to each other (vertically and horizontally) and make a determination as to which one is longer/shorter, taller/shorter (direct comparison).
- Mentally compare two objects that are not placed next to each other and determine which one is longer/shorter or taller/shorter.

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

- Measure objects to the nearest unit using a measuring tool.
- Use standard units to measure objects.

K-5.3 Use nonstandard units to explore the measurement concepts of length and weight. (B3)

Cognitive Process Dimension: Apply
Knowledge Dimension: Conceptual Knowledge

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

- Align objects used to measure correctly with object being measured. (Students measure the length of a toy train by using small cubes placed side by side in a straight row with no gaps, and that one end of the object that they want to measure must be aligned with one end of the train.)
- Know the vocabulary associated with the concept of length and weight(i.e. the box is heavier refers to the weight of the box and not the length).
- Identify a measureable attribute of an object. Use a balance scale to measure the weight of the cup by using cubes, or use cubes to measure the length of an object. Cubes can be used in both weight and length, so do not have students focus on the cubes, but the attribute it is measuring, such as, the height or weight of the cup not its color.

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

- Measure objects to the nearest unit using a measuring tool.
- Use standard units to measure objects.

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

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

- Know the vocabulary associated with the concepts.
- Determine that both length and weight tell something about the size of objects – length tells how long, short, or tall something is and weight tells how heavy or light an object is.
- Familiarize themselves with the different measuring tools and their uses.
- Understand what tool is appropriate to use given a situation (i.e., thermometer measures temperature, ruler measures length, and digital clock gives the time, etc.)

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

- Measure objects to the nearest unit using a measuring tool.
- Estimate measures of objects.

b. Introductory Lesson(s)

Materials Needed:

- bags of Unifix cubes or other building blocks
  (each bag should contain one single color, and each pair should receive two bags. One bag per group should have considerably fewer blocks than the other.)

Suggested Literature Connection

Super Sand Castle Saturday by Stuart J. Murphy is a book about kids building a sand castle, but when they compare to see who has the longest, tallest etc., they use different nonstandard units and trouble begins.

Length (Math Counts) introduces children to the concept of length with real- life examples.

Introductory Lesson A: Length Part 1

In pairs, give students two bags of Unifix cubes, each bag holding a different color. One bag should have noticeable fewer cubes than another bag. Ask the pairs to construct two towers, one from each bag of blocks. After the towers have been constructed, ask students what they notice about each of the towers. Ask them to tell the class which of their towers is taller and which one is shorter. Depending on the level of understanding, you may ask students to compare their towers with towers from groups across the room. (ex. My blue tower is shorter than Amy's green tower.) Also, you could ask students to identify one tower that is taller than one of theirs and one that is shorter.

Introductory Lesson A: Length Part 2

Materials Needed:

- Towers built in part 1 of the lesson
- Various examples of Nonstandard measurement tools (paper clips, colored squares, links, etc.)
- Math journals or paper and pencil/crayons
- Ruler
- Tape measure
- Yardstick

Using the towers from part 1, provide students with various nonstandard measuring tools. Have students measure the height of their towers using any of the tools. (Note: You may need to assist students in laying their towers flat to use some measurement tools.) Bu sure to note that only one measuring tool can be used in a measurement. You may ask them to measure the tower more than once using a different tool each time. As students measure, ask questions such as, "How many paperclips did it take to measure your

taller tower? Do you think it will take more or fewer to measure your shorter tower?" After students have finished measuring, have them record their observations on paper by drawing their towers and the measurement tools they used lined up next to them.

To conclude the lesson, tell students that all of the measuring tools they used to measure the length of their towers helped to tell how long their towers were. Introduce the ruler and tape measure as tools that could also be used to measure length. Also, show the yardstick as a tool that is used to measure the length of longer objects.

At the completion of this series of lessons, place the measuring tools in a center along with objects for students to measure.

c. Misconceptions/Common Errors

- Some students might think that because one object is taller or longer than another, that object is the tallest of all. To correct this misconception, students need experiences with comparisons for length that include situations where an object is perhaps longer this time and shorter when compare to something else.
- Students think the length of the object changes if it is turned in a different direction (vertical to diagonal or horizontal). Given a variety of experiences, they will learn that the length of an object remains constant when the object is moved.

d. Additional Instructional Strategies/Differentiation

Measure the Teacher- Have a letter delivered to the class from the principal asking students to figure out a way to find out how tall the teacher is. Have students develop a plan to measure the teacher using nonstandard units.

Yarn Comparisons- Cut varying lengths of yarn, one for each student. Have students come up one at a time and order themselves in the front of the room according to the length of their yarn.

Read Emperor's Egg. Use yardsticks and measuring tape to show height of an emperor penguin. Measure yarn to 4 inches. The students use the length of yarn to compare the height of a penguin to other items in room. *[Anderson 5]*

Remediation: Give students a strip of tagboard, length of rope, or some object with an obvious length dimension. The task one day might be to find 5 things that are shorter than the object. On another day, students search for 5 things that are longer than their tagboard, rope, etc, and on another

day find 5 objects that are about the same length. Have them draw pictures or write the names of the objects they find. (*Activity from Teaching Student Centered Mathematics Grades K-3, John A Van de Walle, page 229)*

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 manupulatives. Concrete manupulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

http://illuminations.nctm.org/LessonDetail.aspx?id=L187
lluminations lesson on using different sized length of step (big steps, little steps, normal steps) to measure the same distance.

f. Assessing the Lesson

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

As students compare their unifix towers in Part 1 of the lesson, teacher observations should focus on whether students are lining the towers up at one end in order to compare. In part 2, questions that will provide information on student's understanding of measurement with nonstandard units include:
"How many paper clips did it take to measure the taller tower?"
"Will it take more or fewer to measure the shorter tower?"
Observe whether students are leaving gaps between the nonstandard units or randomly placing the units next to the tower without beginning at one end to start.

2. Teaching Lesson B- Exploring Weight

Teacher Notes – Weight

In kindergarten, exploration experiences dealing with weight should lead students to the understanding that weight tells how heavy or light an object is. Since some research shows that students develop understandings of measurement concepts by first comparing, students should begin weight explorations by lifting two objects in their hands and comparing the two using vocabulary such as "heavier than" or "lighter than". After the concept of weight has been grasped, they should move to using a pan balance and nonstandard units to measure weight. As with length, when using nonstandard units, it is important to note that whatever unit is used must be

uniform. For example, using coins of the same kind to weigh objects would be appropriate, but using a mixed collection of coins would be incorrect

a. Indicators with Taxonomy

K-5.3 Use nonstandard units to explore the measurement concepts of length and weight. (B3)

Cognitive Process Dimension: Apply
Knowledge Dimension: Conceptual Knowledge

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

- Know the vocabulary associated with the concept of length and weight(i.e. the box is heavier refers to the weight of the box and not the length).
- Identify a measureable attribute of an object. Use a balance scale to measure the weight of the cup by using cubes, or use cubes to measure the length of an object. Cubes can be used in both weight and length, so do not have students focus on the cubes, but the attribute it is measuring, such as, the height or weight of the cup not its color.

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

- Measure objects to the nearest unit using a measuring tool.
- Use standard units to measure objects.

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

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

- Know the vocabulary associated with the concepts.
- Determine that both length and weight tell something about the size of objects – length tells how long, short, or tall something is and weight tells how heavy or light an object is.
- Familiarize themselves with the different measuring tools and their uses.
- Understand what tool is appropriate to use given a situation (i.e., thermometer measures temperature, ruler measures length, and digital clock gives the time, etc.)

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

- Measure objects to the nearest unit using a measuring tool.
- Estimate measures of objects.

b. Introductory Lesson

Materials Needed:

- a lighter object for each student (feather, cotton ball, penny, etc.)
- a heavier object for each student (small apple, wooden block, etc.
- a variety of nonstandard units to measure weight (unifix cubes, bear counters, etc.)
- balance scales, one for each student or small group of students
- everyday objects that fit into the balance buckets

Suggested Literature Connection

The Dragon's Scales: a Math Reader by Sarah Albee can be used to introduce the concept of weight. When a dragon threatens to disrupt a town, a little girl challenges the scaly creature to a math contest involving knowledge of weight.

Mighty Maddie by Stuart Murphy can be used to discuss weight. As Maddie cleans up her room, she learns how to compare the weights of various objects.

Introductory Lesson B: Exploring Weight

Begin by giving placing a lighter object (feather, cotton ball, penny etc.) and a heavier object (small apple, wooden block, etc.) in front of each student. Ask the students to stand. Have them pick up each of the items. Ask, "What do you notice about these objects?" Target the responses having to do with weight. Tell students that they are going to turn themselves into measuring devices. First, have them hold their arms out balanced. Talk about how since they have nothing in either hand, their scale is "balanced". Direct them to pick up one of the objects in each hand. Ask them which of the objects feels like it is weighing them down the most. Model how they should tilt one arm down and the other up. Then, ask, "What might happen to our scale if we traded our neighbor so that everyone will have two of the same object in their hands?" Make the point that no matter which object they have, since the objects are about the same weight, they balance the scale. Next, call on students to go around the room selecting objects and comparing them using their "human scale".

Then, introduce the balance scale as a tool that measures weight. Also place the various types nonstandard units you plan to use next to

the scale. Have students place their heavier object in one of the balance buckets. Ask why they think the bucket sank. What might they do to balance the scale?

Continue weighing objects using the balance scale. You may also ask them to predict how many of the nonstandard unit it might take to balance the scale.

Place these materials in a center for further exploration.

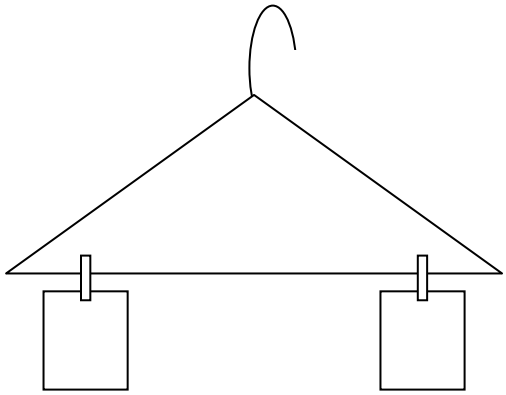
c. Misconceptions/Common Errors

Students at this level might think that objects that take up more space are heavier than objects that take up less space.

d. Additional Instructional Strategies/Differentiation

- **Remediation:** Vocabulary is very important in developing measurement sense. Look for opportunities throughout the day to have students use the terms *heavier* and *lighter* to compare the weights of objects. Also have students predict if an object is heavier or lighter than another, then use the balance scale to check. Before placing the objects on the scale, have the students predict again what they think will happen – which side will go down.
- **Enrichment:** Have pairs of students weigh small classroom objects on the balance scale using connecting cubes as the nonstandard unit. Create a graphic display of the results using the cubes. Compare their graphic display to another group. Place the objects weighed by both groups in order from lightest to heaviest.

- Have students create their own balance scales using a clothes hanger, two clothes pins, and two sandwich bags. (See the diagram below.) Students place objects in the bag and balance the hanger on their finger.



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 manupulatives. Concrete manupulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

http://www.crickweb.co.uk/assets/resources/flash.php?&file=fruitbalance3
Students compare the weight of different fruits using the balance scale. Teachers can manage the mass of the fruits and reset their weights to adjust the difficulty of the activity.

f. Assessing the Lesson

Create a performance assessment where students are presented with situations where an object is placed in one side of a balance scale. Ask what they might do to balance the scale. Also, show the student a scale where one side is heavier than the other. Ask the student which is heavier and/or which is lighter. Students can also be presented with a scale that is balanced and asked what the scale is showing. The depth of student understanding will be evident based on the discussion held during these activities.

3. Teaching Lesson C-Temperature

Teacher Notes - Temperature
In kindergarten, the thermometer should be introduced as a device that measures temperature. Students need to develop an understanding of the meaning of temperature, therefore, students should be given opportunities to make the connection between the rise and fall of the red liquid in a thermometer. They must also be able to identify when the attribute of temperature is appropriate to measure in given situations.

a. Indicators with Taxonomy

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

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

- Know the vocabulary associated with the concepts.
- Familiarize themselves with the different measuring tools and their uses.
- Understand what tool is appropriate to use given a situation (i.e., thermometer measures temperature, ruler measures length, and digital clock gives the time, etc.)

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

- Measure objects to the nearest unit using a measuring tool.
- Estimate measures of objects.

b. Introductory Lesson

Materials Needed:

- Freezer bag of ice
- Heating pad
- Thermometer
- Poster sized diagram of a thermometer
- Clip art of clothing for different temperatures (swimsuit, short sleeve shirt, sweater, winter coat, etc.)

Suggested Literature Connection

Temperature by Melissa Gish presents an introduction to temperature, in simple text with illustrations, including information on what it is, how it is measured, and how it affects the environment

Introductory Lesson C: Temperature

Have students to feel the freezer bag of ice. Ask how it feels. Then have them feel the heating pad and describe how it feels. Introduce a thermometer as a device that measures hot or cold. Point out the red liquid. Ask students to predict what they think might happen if you were to place the thermometer in the bag of ice. Then, place the thermometer in the bag of ice. Show students what happens to the red liquid. Repeat using the heating pad. Call students' attention to the poster sized thermometer diagram and the pictures of clothing. Color the bottom portion of the thermometer blue. Ask students to think back to the thermometer's red liquid when they placed it in ice. Then ask them to choose which clothing might be most suitable for days that cold. Adhere the winter related clothing next to the blue area. Then, ask students to think about the red liquid when they measured the temperature of the heating pad. Color the top of the diagram red. Ask students what clothing might be appropriate for really warm days. Fill in the rest of the diagram using green, yellow, then orange. Have students arrange the other clothing pictures according to the temperatures.

c. Misconceptions/Common Errors

Students may be able to name the tools, but have little idea what they are used for if they lack experience in using them.

d. Additional Instructional Strategies/Differentiation

Some materials from this lesson might be placed in a supervised center for further exploration

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 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.

Questions to ask during the lesson to assess student's understanding of temperature and the use of a thermometer:
What does it mean when the red liquid goes down in a thermometer?
What does it mean when the red liquid goes up in a thermometer?
How does a thermometer help us?
Show students a picture of a child wearing a heavy coat. What would the thermometer look like if you were dressed like this?

4. Teaching Lesson D- Attributes of Measurement

a. Indicators with Taxonomy

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight, calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

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

- Know the vocabulary associated with the concepts.
- Determine that both length and weight tell something about the size of objects – length tells how long, short, or tall something is and weight tells how heavy or light an object is.
- Familiarize themselves with the different measuring tools and their uses.
- Understand what tool is appropriate to use given a situation (i.e., thermometer measures temperature, ruler measures length, and digital clock gives the time, etc.)

For this indicator, it is **not essential** for students to:
- Measure objects to the nearest unit using a measuring tool.
- Estimate measures of objects.

K-5.5 Understand which measurement-length, weight, time, or temperature- is appropriate for a given situation. (B2)

Cognitive Process Dimension: Apply
Knowledge Dimension: Conceptual Knowledge

For this indicator, it is **essential** for students to:
- Develop an understanding of attributes to determine which measure is appropriate for each measurement concept. For example, an hour is used to measure time not length or weight.

For this indicator, it is **not essential** for students to:
- Generate common referents for smaller units of measurement (i.e., the thumb is about an inch in width).
- Use standard units to measure objects.
- Recognize the different tools used as measuring devices.
- Evaluate units of measure based upon real-world situations.

b. Introductory Lesson- Attributes of Measurement

Materials Needed:
- Picture cards showing various situations where specific attributes of measurement are required
- Mystery Bag with different measurement tools (ruler, thermometer, scale, measuring tape, clock) The Mystery Bag will be used to assess the lesson

After each attribute of measurement (length, weight, time, or temperature) has been taught, hold up situation cards and ask students to tell which measure and/or tool would be required to measure in the given situation. Be sure to ask students how they know they are correct.

c. Misconceptions/Common Errors

If students have not built a strong conceptual understanding for each unit of measurement, they may confuse the tools used to measure each attribute.

d. Additional Instructional Strategies/Differentiation

- Design instruction in such a way that measurement (as well as conversations about measurement) is taught and practiced in real situations.
- While kindergarten experiences are limited to measuring with nonstandard units, it is important that they be introduced to the tools used for measuring and have an understanding of which measure and which tool is appropriate for a given situation. For example, students should understand that a ruler is used to measure length and that length is the measure if one wants to know how long something is.

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 manupulatives. Concrete manupulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

http://illuminations.nctm.org/LessonsList.aspx?grade=1&standard=4
This site has several measurement ideas for the classroom.

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

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

Show students a mystery bag. Tell students that the bag has some tools that are helpful for measuring. Let students take turns pulling a tool from the bag.
Ask students the following questions about the tool:
What is the name of the tool?
What would you measure with the tool?
(*This activity is from Anderson 5.)*

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.

Assessment Guidelines

K-5.2 Compare the lengths of two objects, both directly and indirectly, to order objects according to length.

The objective of this indicator is compare, which is in the "understand conceptual" knowledge cell of the Revised Taxonomy table. To understand requires students to build connections between the new knowledge to be gained and their prior knowledge. Conceptual knowledge is having the knowledge of classifications and categories. Students should compare the lengths of two objects, both directly and indirectly, to order objects according to length. The learning progression to **compare** requires students to recognize the differences in lengths of the objects. Students should use (K-1.8) multiple informal representations and apply (K-1.1) substantive mathematical problem solving strategies that will enable them to generalize connections (K-1.7) among the environment. Students should compare the lengths of two objects, both directly and indirectly, to order objects according to length.

K-5.3 Use nonstandard units to explore the measurement concepts of length and weight.

The objective of this indicator is use, which is in the "apply conceptual" knowledge cell of the Revised Taxonomy table. To apply requires students to carry out or use a procedure in a given situation. Conceptual knowledge is having the knowledge of classifications and categories. Students should use nonstandard units to explore the measurement concepts of length and weight. The learning progression to **use** requires students to recall the procedures for measuring lengths and weight of objects. Students explore length and weight using multiple informal representations (K-1.8). They apply substantive mathematical problem solving strategies (K-1.1) as they determine the length and weight of object using non standard units. As students measure, they explain and justify their answers to their classmates and their teacher.

K-5.4 Identify rulers, yardsticks, and tape measures as devices used to measure length; scales and balances as devices used to measure weight; calendars and analog and digital clocks as devices used to measure time; and digital and standard thermometers as devices used to measure temperature.

The objective of this indicator is identify, which is in the "remember factual" knowledge cell of the Revised Taxonomy table. Remember requires students to

retrieve relevant knowledge from long-term memory. Factual knowledge is having the basic elements to be acquainted with a discipline or solve problems in it.. The learning progression to **identify** requires students to recall the measuring tools and recognize their purposes. To support retention of these facts, students explore length, weight, time and temperature in context as oppose to rote memorization of relationships. Students should use a variety of mathematical communication (K-1.6) as they exchange (K-1.2) mathematical ideas to justify (K-1.3) answers to these simple problems

K-5.5 Understand which measure—length, weight, time, or temperature—is appropriate for a given situation.

The objective of this indicator is understand, which is in the "understand conceptual" knowledge cell of the Revised Taxonomy table. To understand requires students to find a specific example or illustration of a concept or principle. Conceptual knowledge is having the knowledge of classifications and categories. Students should understand which measure – length, weight, time, or temperature – is appropriate for a given situation. The learning progression to **understand** requires students to remember the different types of measuring tool and their purpose. When given a problem, students analyze patterns (K-1.4) and apply mathematical problem solving strategies (K-1.1) to determine types of measurements being made. They explain and justify their answers (K-1.3) to their classmates and their teacher using a variety of forms of mathematical communication (K-1.6).

Since the lessons are driven by observation and discussion more than pencil and paper, the summative assessment should also be administered through student observation and discussion. One suggested method might be to conduct one on one interviews on the measurement concepts and use a checklist to keep track of data. The measurement summative assessment might be administered over a period of days.

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.

Measurement Checklist

Task	Student Response	Observations
Compare 2 unifix trains of different lengths. Which train is the longest?	Compared indirectly _____ Compared directly_____ Attempted to compare directly but error(s) made _____	
Measure the length of classroom object (book, table, paper, etc) with nonstandard units (paper clips or blocks)	Measured correctly and gave the correct number of units _____ Errors made in measuring _____ Errors made in counting units _____	
Name the measurement tool and explain its use (show a ruler, thermometer, balance)	Names tool: Ruler _____ Thermometer _____ Balance _____ Explains tool's use: Ruler _____ Thermometer _____ Balance _____	
Uses balance scale to identify which object is heaviest. (Place an object in each bucket. Which is heaviest?)	Correctly identifies heaviest object _____	