Teaching Place Value in First Grade: A Resource Guide

Ivygail Abella
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Introduction:

Place value concepts are often difficult for primary students to grasp. During the beginning stages of place value instruction, the algorithmic process may confuse rather than enhance conceptualization. Students often memorize the steps and rules for getting the correct answers resulting in frustrations and misunderstanding. Since place value knowledge is pre-requisite to success in primary mathematics, students would benefit from an experiential approach, whereby they explore, construct and practice required skills with teacher directed guidance within varied instructional settings geared to individual students’ learning needs. This resource guide focused on utilizing the following researched based strategies in teaching place value into different math stations: (a) Scaffolding, teaching new skills and concepts by using previously taught skills, (b) Paired-Cooperative or Peer-Mediated Instructions, guiding students pairs in joint explorations, (c) Cognitive Strategy Instruction (CSI), instructing students in the development of thinking skills and processes as a means to enhance learning and (d) Concrete Representational Abstract Sequence (CRA), teaching math through the use of concrete manipulatives, representational pictures and abstract symbols.

The flow of the activity will start with the teacher directed instruction, followed by different math stations and ongoing assessment. The students have multiple opportunities to explore in learning stations which may require independent or paired learning tasks. The math station will focus on the application of concrete manipulatives, followed by paper-pencil assessments to measure students’ progress.
Rationale:

- According to National Council of Teachers of Mathematics (NCTM), “developing an understanding of place value and the base-ten number system was considered a fundamental goal of the early primary grades.”

- Many students in the U.S. have difficulty learning place value skills and concepts, and teaching of these fundamental competencies needs to improve.

- Students who are proficient with basic math skills will be more successful in understanding new math task.
Project Goals

Teachers Goal: The primary goal of this project is to create a resource guide for second grade teachers to teach place value concepts.

Students Goal: The secondary goal of this that second grade students will be able to use the math stations to learn place value.
Professional Questions:

What are the effective strategies for teaching place value in second grade?

How can second grade students learn place value concept from the teaching strategies presented?
Professional Standards

The following professional standards from the National Council of Teachers of Mathematics (NCTM) were addressed in this project:

1. Standard 4 - Knowing Mathematical Pedagogy
2. Standard 7 - Assessing the students’ understanding of mathematics

In addition to NCTM standards addressed in this project, the following Core Propositions from the National Board for Professional Teaching Standards were included:

1. Preposition 1: Teachers are Committed to Students and Their Learning
2. Preposition 2: Teachers Know the Subjects They Teach and How to Teach Those Subjects to Students.
Common Core Standards

The following Math Common Core Standards for First Grade were addressed in this project:

1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones.

   Understand the following as special cases:

   1. NBT.2. a Ten can be thought of as a bundle of ten ones - called a "ten."

   Counting and number patterns: Counting tens and ones - up to 20
   Counting and number patterns: Counting tens and ones - up to 99
   Counting and number patterns: Hundred chart

   1. NBT.2.b the numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

   Counting and number patterns: Counting review - up to 20
   Counting and number patterns: Counting tens and ones - up to 20

   1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).

   Counting and number patterns: Counting by tens - up to 100
Abstract


Many students have difficulty understanding place value because they lack concrete experiences, collaborative explorations, and insufficient instructions. The purpose of this professional project is to enhance second grade teachers’ place value instructional practices. Four recommended strategies presented in this handbook are: Scaffolding, Cognitive Strategy Instruction (CSI), Paired-Cooperative Strategy, and Concrete Representational Abstract Sequence (CRA). Included in the resource guide are (a) teacher directed instructions, (b) cooperative-d math stations, (c) independent math stations and (d) post-assessments.
Place Value Concept

According to Richardson, (1999) the following are several pre-requisite skills that the students must understand as they learn the concept of place value:

- **When counting large numbers it is essential to form groups based on tens.**
  
  The number system is based on forming groups of tens. When there are ten single units, group it into a group of ten. Once there are ten groups of ten, then group them into one group of one hundred.

- **Groups are counted as single objects.**
  
  Student’s first counting experiences involve an understanding of one-to-one correspondence. When dealing with numbers beyond ten, it will be efficient for students to count it by groups as though they were individual objects.
• **One large group may be made up of many small groups.**

  Students will need to understand that ten ones are the same as one group of ten and ten groups of tens is the same as 100.

• **A numeral (digit) can stand for different amounts depending on where it is written in the number.**

  A particular number can stand for many different amounts, depending on its “place” in the number system. For example, 77 the first number 7 represent seven ones and the other seven represents 7 tens or seven group of tens.
Math Stations

Differentiated instruction means tailoring instruction to meet individual needs.

Whether teachers differentiate content, process, products, or the learning environment, the use of ongoing assessment and flexible grouping makes this a successful approach to instruction (Tomlison, 2000). To teach differentiated instruction in place value, one best practice is to use math stations. Math stations are a great way to help the teachers meet the learning needs of all the students. The students are assigned to a particular learning station according to their instructional level. Each station has a specific activity to challenge the students’ skills by the tasks derived directly from teacher assessment and instructional discretion. Through frequent opportunities to practice place value concepts, students will advance to the next level of challenge.
**Whole Group Teacher Directed Instruction**

During whole group teacher directed instruction, the teacher will provide the essential skills needed to learn place value. The teacher models the desired learning strategy or task, then gradually shifts the responsibility of learning to the students. Scaffolding is important in this whole group because the teacher can assess student pre-requisite of basic math facts and numerical relationship through questioning and short performance tasks. The building upon what students know and bring to a learning setting, referred to as scaffolding, benefits every student. The goal is to use astute questions and observational skills of students to ascertain when they may embark on independent activities. Here is an example of an observational checklist during whole group teacher directed instruction:

<table>
<thead>
<tr>
<th>Place Value Observation Checklist</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistently add one cube to the ones side of the place value mat when the signal is given.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose cubes were at the one side of</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the place value mat. |   |   |
---|---|---
Snap ten cubes together and move it to the tens side of the place value mat. |   |   |
Understand the regrouping steps independently |   |   |

**Concrete Representational Abstract Sequence**

The next place value strategy is called Concrete Representational Abstract Sequence (CRA). Students will learn place value through the use of concrete manipulatives, representational pictures and abstract symbols. This particular strategy will allow the students to use concrete materials in learning place value such as beans, hundred chart, unifix cubes, dice, place value mat, and flip chart.
Cognitive Strategy Instruction (CSI)

The use of scaffolding and CRA strategy will be integrated with the model of Cognitive Strategy Instruction. CSI is important because it will allow teachers to systematically teach the concept of place value. The following steps are the stages of teaching CSI instruction: (1) develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment (Reid, 2006). After the completion of this segment of instruction, a post-assessment observation of the students will be given to determine their level of proficiency and the math stations where the students will be placed.

Paired-Cooperative or Peer-Mediated Stations

During paired-cooperative math stations the students will be paired and work cooperatively. The students will gain knowledge with their peers. The students will be
on task promoting higher level of thinking skills by viewing the lesson from their peers’ perspective. The students will also apply the same strategies presented in the teacher directed instruction such as scaffolding, CRA, sequence and CSI. Once the students become proficient in their place value skills, students will then be placed into independent stations.

**Independent Stations**

During the independent math stations the students who demonstrate proficiency in the skills taught will productively focus on applying the place value skills they learned from the teacher directed instruction. As the students become more proficient with their understanding of place value concept, a post-assessment will be administered each time their level of understanding progresses.

The students who are not meeting the standards will have an opportunity to work with the teacher to improve the students’ individual skill level to maximize and increase their understanding of the place value concept.

Here is an example of post-test after completion of Independent Stations:

Use your skills of place value to tens, to complete the place value charts for the following problems:
<table>
<thead>
<tr>
<th>Tens</th>
<th>Ones</th>
<th>Number in Words</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Skip counting and forming groups

Teacher Directed Instruction

- Activity: Process of skip counting and forming groups with teacher directed instruction
  
  It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, and CSI.

  In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm.

  In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.

  In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1) develop and active background knowledge, (2)
discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment.

- **Materials:**
  
  Dry lima beans, cupcakes papers, and containers

- **Who says it is important?**

  The following authors state the importance of this activity: Barrata-Lorton (1995), Cole and Washburn (2010), Reid, (2008) and Richardson, (1999). This activity is important to serve as a foundation and a skill builder to meet the following First Grade Math Common Core Standards:

  1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

     1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."
     1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
     1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

- **Procedure:**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Today we are going to play a game called grouping. We will be using dry beans to count. Let me illustrate to you using dry</td>
<td>Students will follow the teacher directed instruction individually.</td>
</tr>
</tbody>
</table>
| Students will follow the teacher directed instruction individually. | Say: Next, I will put two dry lima beans on each cupcake papers then watch me on how to count by twos.
Say: Which way do you think it is more efficient to count, by twos or ones?
Students: By twos |
|---|---|
| Then, the teacher will place all the dry beans back into the container to prepare for the next activity of skip counting by 5s.
Say: Next, I will put five dry lima beans on each cupcake papers then watch me on how to count by 5s. | Students will follow the teacher directed instruction individually |
Say: Which way do you think it is more efficient to count by twos or ones?

Students: By fives.

- Tips for teachers
  The students’ thinking of one-to-one correspondence will be shifted to skip counting. The skip counting will give the students the opportunity to count groups as though they are individual objects.

- Pre-Assessment Rubric:
  Record the observation from students’ work and pre-test. Use the rubric below to assess students’ knowledge. When the students scored three on the rubric, the students will directly go to independent math stations. When the students scored two, the students will go to paired-cooperative station. When the students scored one, the students will go to the teacher for a small group instruction. The small group instruction with teacher will implement the same activity presented from the teacher directed instruction with a smaller teacher to student ratio.
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Errors</td>
<td>Students made no errors</td>
<td>Students made 1-3 errors</td>
<td>Students made 4 or more errors</td>
</tr>
<tr>
<td>Organization</td>
<td>Answers show a complete understanding of grouping.</td>
<td>Answers show a little understanding of grouping.</td>
<td>Answers show no understanding of grouping.</td>
</tr>
<tr>
<td>Mathematical Concepts</td>
<td>Answers show a complete understanding of skip counting</td>
<td>Answers show a moderate understanding of skip counting</td>
<td>Answers show very little understanding of skip counting</td>
</tr>
</tbody>
</table>

- **Pre-Test Assessment**

1. The second graders gathered too much pebbles to count it all by ones! Help them count their fruits faster by circling groups of 2, 5 and 10.

<table>
<thead>
<tr>
<th>Circle the pebbles by 10’s</th>
<th>Circle the pebbles by 2’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>. . . . . . . . . . . . . . . . .</td>
<td>. . . . . . . . . . . . . . . . .</td>
</tr>
<tr>
<td>. . . . . . . . . . . . . . . . .</td>
<td>. . . . . . . . . . . . . . . . .</td>
</tr>
</tbody>
</table>
2. Complete the skip counting tables:

**Skip count by 2s**

- 16
- 18
- 20

**Skip count by 5s**

- 15
- 20
- 25

**Skip count by 10s**

- 20
- 30
- 40
**Paired-Cooperative Stations**

- **Activity: Process of skip counting and forming groups with paired-cooperative stations**

It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, Paired-Cooperative Strategy and CSI.

In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm.

In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.

In Paired-Cooperative strategy, it will students to work together to communicate about and explore with their own solutions to mathematical situations. This strategy will provide students with the opportunities to work in groups to formulate and pose questions; share ideas; clarify thoughts; and experiment, brainstorm, and present solutions with peers.

In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1) develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment.
• **Materials:**

Dry lima beans, Containers, Cupcake papers, 100 Charts and Markers

• **Who says it is important?**

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1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:
   1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."
   1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
   1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

• **Procedure:**

The teacher will put dry lima beans in each paired-cooperative station for the students to count. A 100 chart will be used to mark the pattern of counting. Start the activity by pairing each student who scored two from post-assessment rubric. Students will be working collaboratively in skip counting and grouping.
<table>
<thead>
<tr>
<th>Student 1</th>
<th>Student 2</th>
</tr>
</thead>
</table>
| 1. Student 1 will place 2 lima beans on each cupcake papers.  
2. Student will start to skip count by 2s with the lima beans. | 1. Student 2 will mark a pattern of skip counting by 2s using markers on his or her 100 chart while student 1 is skip counting by 2s. |

3. Once the students have completed their practice skills in skip counting by 2s and marking the pattern by 2s in their 100 chart, students will switch roles.

After skip counting by 2s the students will repeat the same process with skip counting by 5s and 10s.
Independent Stations

- **Activity: Process of skip counting and forming groups with independent stations**
  
  It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, and CSI.

  In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm.

  In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.

  In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1)develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment.

- **Materials:**
  
  Dry lima beans, Containers, Cupcake papers, 100 Charts and Markers

- **Who says it is important?**
  
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1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

- **Procedure:**

  The teacher will put dry lima beans in each independent station for the students to count. A 100 chart will be used to mark the pattern of counting. Students will practice the same activity presented at the paired-cooperative station independently. Students will take the post-assessment test after completion of the independent station activity in skip counting and grouping.

**Post-Assessment Test:**

The second graders gathered too much pebbles to count it all by ones! Help them count their fruits faster by circling groups of 2, 5 and 10.
3. Use this chart to help you count by 2's.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
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<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
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<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

Count up by 2's from 0. Circle the numbers you count in the chart. Look at the circles. Which columns have some of the numbers you counted?
4. Use this chart to help you count by 5’s.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
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<td>19</td>
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<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

Count up by 5’s from 0. X the numbers you count in the chart. Look at the X’s. Which columns have some of the numbers you counted?

A  C, E, G, I
B  A, E, I
C  B, D, F, H, J
D  A, G, J

5. When counting by 10’s which numeral does NOT belong in this series?
   30 40 45 50 60 70 80

A  40
B  45
C  50
D  80
• **Post-Assessment Rubric:**

Use the rubric below to assess students’ knowledge. The students who scored four are “exceeding” the standards. The students who scored three in the rubric are considered “meeting” the standards. The student who scored two, in the rubrics is considered “approaching” the standards. The students who scored one are considered “emerging” the standards.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematical Concepts</strong></td>
<td>Students made no errors in post-test and show consistent application of skip counting in math stations</td>
<td>Students made no errors in post-test</td>
<td>Students made 1-3 errors in post-test</td>
<td>Students made 4 or more errors in post-test</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Students made no errors and show consistent application of organization in math stations</td>
<td>Answers show a complete understanding of grouping.</td>
<td>Answers show a little understanding of grouping.</td>
<td>Answers show no understanding of grouping.</td>
</tr>
</tbody>
</table>
Grouping by Tens I

Teacher Directed Instruction

- Activity: Process of grouping by tens with teacher directed instruction

It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, and Cognitive Strategy Instruction CSI.

In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm.

In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.
In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1) develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment

- **Who says it is important?**

  The following authors state the importance of this activity: Barrata-Lorton (1995), Cole and Washburn (2010), Reid, (2008) and Richardson, (1999). This activity is important to serve as a foundation and a skill builder to meet the following First grade Math Common Core Standards:

  1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:
    
    1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."
    
    1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
    
    1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

- **Materials:** Unifix cubes, Place value mat and Containers
**Procedure:**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Today we will play the game called grouping. In your desk you have cubes and a paper colored white and blue. We will call this colored paper place value mat. The white side of your place value mat will be called as ones. Then the blue side of your mat is called tens.</td>
<td>Students will listen and be familiar on the procedures of the game.</td>
</tr>
<tr>
<td>This is the procedure of the game: Listen for the bell. Every time you hear the bell rings it’s time to add one cube to the ones side of your mat. We will add one cube at a time to the ones side of your mat. Once the ones side of your mat reach ten cubes, snap it together and move it to the tens side of your mat.</td>
<td>.</td>
</tr>
<tr>
<td>Ask the students about the procedure of the game. Say: Are the cubes snap together on the ones side?</td>
<td>Students: No</td>
</tr>
<tr>
<td>Say: Are the cubes snap together on the tens side?</td>
<td>Students: Yes</td>
</tr>
<tr>
<td>Say: Now let’s read our place value mat.</td>
<td>Students: Zero tens, zero ones</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Say: Look at your place value mat? Do you have any cubes yet?</td>
<td>No</td>
</tr>
<tr>
<td>Say: We will read our place value from tens’ side to ones’ side. Slide your hand from tens side to ones side.</td>
<td>Students slide their hand from tens side to ones side of the place value mat.</td>
</tr>
<tr>
<td>Teacher will ring the bell. Ding! Say: This is the signal to add one cube to the ones side of the place value mat.</td>
<td>Students will add one cube to the ones side of the place value mat.</td>
</tr>
<tr>
<td>Say: Read your place value mat.</td>
<td>Students: Zero tens, one ones</td>
</tr>
<tr>
<td>Ring the bell again. Ding? Say: This is the signal to add one more cube to the ones side of the place value mat.</td>
<td>Students will add one more cube to the ones side of the place value mat.</td>
</tr>
</tbody>
</table>
Read your place value mat. | Students: Zero tens, two ones
---|---
Ding! This is the signal to add one cube to the ones side of the place value mat. | Students will add one more cube to the ones side of the place value mat.

| Read your place value mat. | Students: Zero tens, three ones
---|---
Repeat the same activity until you reach ten cubes. | Students will add one more cube to the ones side of the place value mat.

- The activity below will target adding cubes on the tens side of the place value mat

| Teacher | Student
---|---
Ding! Say: Add one | Students will add one more cube to the ones side of the place value mat.
Say: You now have ten cubes, it is time to snap ten cubes and move it to the tens side of the place value mat. | Students snap the cubes together and move it to the tens side of the mat.
<table>
<thead>
<tr>
<th>Say: Read</th>
<th>Students: One ten, zero ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Ding! Add one</td>
<td>Students will add one more cube to the ones side of the place value mat.</td>
</tr>
<tr>
<td>Say: Read</td>
<td>Students: One ten, one ones</td>
</tr>
<tr>
<td>Say: Ding! Add one</td>
<td>Students will add one more cube to the ones side of the place value mat.</td>
</tr>
<tr>
<td>Read</td>
<td>One ten, two ones</td>
</tr>
</tbody>
</table>

**Tips for Teachers:**

The activity above demonstrates the concept of forming groups of tens. Once the students reach ten cubes, the goal is to snap the ten cubes together and move it to the tens side of the place value mat.

The students need to understand that ten individual units of cubes are the same as one group of tens.
• **Pre-Assessment Observation Checklist:**

<table>
<thead>
<tr>
<th>Place Value Observation Checklist</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistently add one cube to the ones side of the place value mat when the signal is given.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose cubes were at the one side of the place value mat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snap ten cubes together and move it to the tens side of the place value mat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand the regrouping steps independently</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• **Pre-Assessment Rubric:**

Record the observation from students’ work. Use the rubric below to assess students’ knowledge. The students who scored three on the rubric will directly go to independent stations. The student, who scored two, will go to group paired station. The students who scored one, will have a small group
instruction with the teacher. The small group instruction with teacher will implement the same activity presented from the teacher directed instruction with a smaller teacher to student ratio.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Errors</td>
<td>Students made no errors</td>
<td>Students made 1-3 errors</td>
<td>Students made 4 or more errors</td>
</tr>
</tbody>
</table>
| Organization                    | Answers show a complete understanding of grouping. | Answers show a little understanding of grouping. | Answers show no understanding of grouping. |.
| Mathematical Concepts of ones and tens | Answers show a complete understanding of adding cubes from ones and tens correctly | Answers show a moderate understanding of adding cubes from ones and tens | Answers show very little understanding of adding cubes from ones and tens |

**Paired-Cooperative Stations**

- **Activity: Process of grouping tens with paired-cooperative stations**

It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, Paired-Cooperative strategy and CSI.

In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm.
In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.

In Paired-Cooperative strategy, it will students to work together to communicate about and explore with their own solutions to mathematical situations. This strategy will provide students with the opportunities to work in groups to formulate and pose questions; share ideas; clarify thoughts; and experiment, brainstorm, and present solutions with peers.

In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1) develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment.

- **Who says it is important?**
  
The following authors state the importance of this activity: Barrata-Lorton (1995), Cole and Washburn (2010), Reid, (2008) and Richardson, (1999). This activity is important to serve as a foundation and a skill builder to meet the following First Grade Math Common Core Standards:

1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

   1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."
1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

1.NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

- **Materials:**

  Unifix cubes, Place value mat, Containers and Dice

- **Procedure:**

  Start the activity by pairing each student who scored two from previous activity. Explain to the students the procedures on paired stations.

<table>
<thead>
<tr>
<th>Student 1</th>
<th>Students 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student 1 will roll and count the dots from the dice. Then student 1 will tell the number of dots to student 2. For example, Student 1 will tell student 2 that the result of the rolled dice is three.</td>
<td>Student 2 will count the dice again to verify that result of the rolled dice is correct. Then student 2 will remove three unifix cubes from the container and place the cubes on the ones side of the place value mat..</td>
</tr>
</tbody>
</table>
Students 1 and student 2 will do the above activity to practice the addition concept of place value. Students 1 and student 2 will change roles to be more proficient on the practice skills. Once the students become proficient in adding cubes in the ones place value, then the student will enhance their skills by adding cubes to the tens place value. The students need to understand that the tens place value is composed of ten connected cubes as a group.

**Independent Stations**

- **Activity: Process of grouping tens with independent station**

It is important to include all the students in this activity to later assess which math stations the students will be placed. In this activity the following research based strategies are important because it will help the students to investigate and conceptualize the concept of place value: Scaffolding, CRA sequence, and CSI.

In scaffolding strategy, the teacher will model the desired learning strategy or task, and then gradually shifts the responsibility of learning to the students. The students will practice the strategy in learning rather than memorizing math facts and following the process of algorithm. In CRA sequence strategy, the materials in this activity will served as the manipulatives. Students will use the manipulatives to visualize the concept of place value. Manipulatives should be gradually removed, in order for the students to eventually demonstrate comprehension independently.

In CSI the teacher will have a systemize structure in teaching place value. The following stages should be followed to gain success: (1) develop and active background knowledge, (2) discuss the strategy, (3) model the strategy, (4) memorize the strategy, (5) support the strategy, (6) independent performance, and (7) post-assessment.
• **Who says it is important?**

  The following authors state the importance of this activity: Barrata-Lorton (1995), Cole and Washburn (2010), Reid, (2008) and Richardson, (1999). This activity is important to serve as a foundation and a skill builder to meet the following First Grade Math Common Core Standards:

  1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

    1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."

    1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

    1. NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100

• **Materials:** Unifix cubes, Containers, Dice and Place value mat

• **Procedure:**

  Individual student will practice the same concept presented on the paired-cooperative stations independently.
Grouping by Tens Using A Flip Charts

- **Materials:** Unifix cubes, Containers, Flip Chart, and Place Value Mat

- **Who says it is important?**

  The following authors state the importance of this activity: Barrata-Lorton (1995), Cole and Washburn (2010), Reid, (2008) and Richardson, (1999). This activity is important to serve as a foundation and a skill builder to meet the following First Grade Math Common Core Standards:

  1. NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:
     1. NBT.2.a 10 can be thought of as a bundle of ten ones - called a "ten."
     1. NBT.2.b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
     1.NBT.2.c The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). Counting and number patterns: Counting by tens - up to 100
• **Procedure:**

In this activity the students are ready to the second part of CRA sequence strategy, which is the transition of concrete manipulative to mathematical symbol. The second part of CRA sequence involves connecting the mathematical symbol to the number of objects being added or subtracted. The cubes represent the concrete manipulatives while the flipcharts represent the mathematical symbol. The bell will continue to indicate when the students should add or subtract one cube. As soon as each student is ready, say “flip”. Each student should flip to the number that shows the total number of loose objects and groups of objects on his or her place value mat. Then the students read their board as before. The students know how to play the basic game, adding or subtracting when they hear the bell; they know how to borrow a group from the tens side when they have to, how to regroup when they get enough cubes on the ones side, and how to read their board. The new step merely connects a math symbol by flipping the chart to a process the students already know from previous activity.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Today we will play the game called grouping but with the addition of a flip chart. You will use the same rules from the previous grouping game. The only difference is that you should flip a number chart to illustrate the total number of cubes on your mat.</td>
<td>Students will listen to the rules and procedures of the game.</td>
</tr>
<tr>
<td>Say: How many cubes do you have on your place</td>
<td>Students: Zero</td>
</tr>
</tbody>
</table>

![Image of cubes and flipchart]
<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value mat?</td>
<td>Students: Zero</td>
</tr>
<tr>
<td>Say: What number is showing in your flip chart now?</td>
<td></td>
</tr>
<tr>
<td>Say: Now let’s read our place value mat.</td>
<td>Students: Zero tens, zero ones</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring the bell. Ding!</td>
<td>Students will add one cube to the ones side of the place value mat.</td>
</tr>
<tr>
<td>Say: Add one</td>
<td></td>
</tr>
<tr>
<td>Say: Flip</td>
<td>Students will flip the chart to number one to match the number of cube in the ones side of the mat.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Read your place value mat.</td>
<td>Students: Zero tens, one ones</td>
</tr>
<tr>
<td>Ring the bell. Ding!</td>
<td>Students will add one more cube to the ones side of the place value mat.</td>
</tr>
<tr>
<td>Say: Add one</td>
<td></td>
</tr>
<tr>
<td>Say: Flip</td>
<td>Students will flip the chart to number two.</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Say: Read your place value mat.</td>
<td>Students: zero tens, two ones</td>
</tr>
<tr>
<td>Ring the bell. Ding!</td>
<td>Students will flip the chart to number one.</td>
</tr>
<tr>
<td>Say: Add one</td>
<td></td>
</tr>
</tbody>
</table>

---

**Notes:**
- When flipping the chart, ensure students are paying attention to the correct number.
- Encourage active participation by asking students to describe the numbers they see.
- Use the bell to signal when it's time to flip the chart.

---

**Images:**
- Chart with numbers 0 and 2.
- Chart with numbers 0 and 3.
<table>
<thead>
<tr>
<th>Say: Flip</th>
<th><img src="image1.jpg" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Read your place value mat</td>
<td>Students: Zero tens, three ones</td>
</tr>
<tr>
<td>Once the students reach ten cubes, reinforce the rules of base ten system. The students need to snap the cubes together and put it to the tens side of the place value mat.</td>
<td></td>
</tr>
<tr>
<td>On this illustration the students reach ten cubes. Say: You now have ten cubes, it is time to snap ten cubes and move it to the tens side of the place value mat.</td>
<td>Students snap the cubes together and move it to the tens side of the mat.</td>
</tr>
<tr>
<td>Say: Read</td>
<td>Students: One ten, zero ones</td>
</tr>
<tr>
<td>Say: Now look at your place value mat. How many cubes are there in the ones side?</td>
<td>Students: Zero</td>
</tr>
<tr>
<td>Say: Since there are zero cubes on the ones side, let’s turn the flip chart on the ones side of the place value mat back to zero.</td>
<td>Students change their flip chart to zero.</td>
</tr>
<tr>
<td>Now look at your place value mat. How many</td>
<td>Students: One</td>
</tr>
</tbody>
</table>
group of cubes are there in the ones side?

<table>
<thead>
<tr>
<th>Say: Since there are zero cubes on the ones side, let’s turn the flip chart on the ones side of the place value mat to one.</th>
<th>Students change their flip chart to one.</th>
</tr>
</thead>
</table>

Read

One ten, one ones

After the completion of the grouping by tens using a flip chart, the students will take the post-assessment test to determine their progress.

**Post-Assessment Test:**

1. The students will take the assessment test without the help of the place value mat.

Instruction: Group the following dots.

I. If you have these cubes, how many group of tens will there be in the tens side of your place value mat?

II. How many cubes will there be in the ones side of your place value mat?

● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●
I. If you have these cubes, how many group of tens will there be in the tens side of your place value mat?

II. How many cubes will there be in the ones side of your place value mat?
### Part II of the Post-Assessment Test:

Use your skills of place value to tens, to complete the place value charts for the following problems:
<table>
<thead>
<tr>
<th>Tens</th>
<th>Ones</th>
<th>Number in Words</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tens</th>
<th>Ones</th>
<th>Number in Words</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Post-Assessment Rubric:

Use the rubric below to assess students’ knowledge. The students who scored four are “exceeding” the standards. The students who scored three in the rubric are considered “meeting” the standards. The student who scored two, in the rubrics is considered “approaching” the standards. The students who scored one are considered “emerging” the standards.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematical Errors</strong></td>
<td>Students made no errors and show consistent application of skills in math stations</td>
<td>Students made no errors</td>
<td>Students made 1-3 errors</td>
<td>Students made 4 or more errors</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>Students made no errors and show consistent application of organization in math stations</td>
<td>Answers show a complete understanding of grouping.</td>
<td>Answers show a little understanding of grouping.</td>
<td>Answers show no understanding of grouping.</td>
</tr>
<tr>
<td><strong>Mathematical Concepts of ones and tens</strong></td>
<td>Answers show a complete understanding of adding cubes from ones and tens correctly in post-test and show consistent application of concepts in math stations</td>
<td>Answers show a complete understanding of adding cubes from ones and tens correctly in post-test</td>
<td>Answers show a moderate understanding of adding cubes from ones and tens in post-test</td>
<td>Answers show very little understanding of adding cubes from ones and tens in post-test</td>
</tr>
</tbody>
</table>
Lesson Extension

- **Grouping beyond Tens**

For the place value beyond tens such as hundreds and thousands, the teacher will review the previous activity used to teach tens place value. The teacher will continue on using the same format and materials into the larger place value of hundreds and thousands.
**Subtraction by Tens:**

![Diagram of tens and ones place value]

The teacher can extend the lesson using the concept of subtraction in place value. The teacher will follow the same activity presented from the addition concept but will demonstrate the concept of subtraction. Subtractions concept will be demonstrated by taking away cubes from their place value mat instead of adding cubes.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Now I am going to change the rules of the game. From now on when you hear the bell, I want you to take away or minus one cube from the ones side.</td>
<td>Students will listen for the instruction.</td>
</tr>
<tr>
<td>Ring the bell. Ding! Say: This the time to take away one or minus one from the ones side of your mat.</td>
<td>Students will take away one cube from the ones side.</td>
</tr>
<tr>
<td>Read</td>
<td>Students: Two tens, nine ones</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ring the bell. Ding!</td>
<td>Students will take away one cube from the ones side.</td>
</tr>
<tr>
<td>Say: Take away one or Minus one</td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Read</td>
<td>Students: Two tens, eight ones</td>
</tr>
<tr>
<td>Ring the bell. Ding!</td>
<td>Students will take away one cube from the ones side.</td>
</tr>
<tr>
<td>Say: Minus one</td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Read</td>
<td>Students: Two tens, seven ones</td>
</tr>
<tr>
<td>Continue the activity until only one cube was left on the ones side of the place value mat.</td>
<td></td>
</tr>
<tr>
<td>Say: Now that all the cubes from the ones side of</td>
<td>Students will answer the teacher’s question.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the mat were gone. Who has an idea of what to do next? Wait from the student’s response before giving the answer.

After all the cubes from ones were removed, the teacher will explain that ten ones are the same as one group of ten. The quantity of ten can be both one ten and ten ones at the same time. The students need to understand that they can only move the cubes from tens side to ones side after unsnapping the cubes, which means taking the group of tens into individual unit of ones. This concept was also a good introduction on the algorithm process of borrowing in addition and regrouping in subtraction. The focus is not only on how to carry out the algorithm, but also on why the algorithm works. Check the activity below on how this process should be instructed.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say: Okay let’s try to take out one cube from the group of tens.</td>
<td>Take one cube from the tens sides</td>
</tr>
<tr>
<td>Say: Now is this still together as a group of tens?</td>
<td>No</td>
</tr>
<tr>
<td>Say: Then, can it go to the blue side or tens side?</td>
<td>No</td>
</tr>
<tr>
<td>Say: Because it is not a group of tens, we need to move our cubes to the ones side.</td>
<td>Students will move the snapped cubes to the ones side.</td>
</tr>
<tr>
<td>Say: Is it okay now?</td>
<td>No, because snapped cubes are not allowed in the white sides</td>
</tr>
<tr>
<td>Say: What can you do about that?</td>
<td>Unsnap the cubes</td>
</tr>
<tr>
<td>Read your place value mat now?</td>
<td>One tens, nine ones</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Students can now do the same procedure for the rest of the cubes.</td>
<td></td>
</tr>
</tbody>
</table>
• **Connecting Place Value to Real World**

The students will practice the place value skills by connecting with real world situations. In this activity the students will be able to identify values, equivalencies of coins and bill, count money and make change. The students will create a store that will illustrate how to apply place value concept using money.

**Materials:**

Play money, items labeled with price

**Activity:**

For example a student will purchase an item within the store and use their paper money to pay for it. In this example the student have $1.00 to spend for an item that cost $.50. The student will determining how much change he or she will receive back. The student will illustrate the application of the place value concept by subtracting his or her $1.00 to the cost of the item which is $.50. To show correct application of place value skill, the student should determine the correct change of his or her money. In conclusion, the repetition of the process in the class store will allow the students to integrate the concept of place value to real world application.
Glossary of Terms

Algorithm- set of steps used to solve math problems.

Approaching standard- the student occasionally requires assistance with and or inconsistently demonstrates understanding of place value standards.

Cognitive Strategy Instruction (CSI)- instructional approach which emphasizes the development of thinking skills and processes as a means to enhance learning. The objective of CSI is to enable all students to become more strategic, self-reliant, flexible, and productive in their learning endeavors.

Concrete Material- also known as manipulative, is any concrete objects that allow students to explore an idea in an active, hands-on approach.

Concrete Representational Abstract Sequence (CRA)- an intervention for mathematics instruction that research suggests can enhance the mathematics performance of students. The CRA instructional sequence consists of three stages: concrete, representation, and abstract:

- Concrete. In the concrete stage, the teacher begins instruction by modeling each mathematical concept with concrete materials (e.g., red and yellow chips, cubes, base-ten blocks, pattern blocks, fraction bars, and geometric figures).

- Representational. In this stage, the teacher transforms the concrete model into a representational (semi concrete) level, which may involve drawing pictures; using circles, dots, and tallies; or using stamps to imprint pictures for counting.
- Abstract. At this stage, the teacher models the mathematics concept at a symbolic level, using only numbers, notation, and mathematical symbols to represent the number of circles or groups of circles. The teacher uses operation symbols (+, −, ) to indicate addition, multiplication, or division.

**Paired-Cooperative Station**- math station where the students will work in pairs.

**Differentiated instruction and assessment** - is a framework or philosophy for effective teaching that involves providing students with different avenues to know the content; to process, construct, or make sense of the lesson; and to develop materials and assessment measures to effectively meet the students’ learning needs.

**Emergent**- the student frequently requires assistance and demonstrates limited understanding of place value standard.

**Exceeding standards**- the students consistently and independently demonstrate understanding of place value standard and can extend the concept to new situations.

**Hundreds**- one hundred is ten sets of tens. Numbers, such as 546, have three digits. Each digit is a different place value. The first digit is called the hundreds' place. It tells you how many sets of one hundred are in the number. The number 546 had five hundreds. The middle digit is the tens' place. It tells you that there are 4 tens in addition to the seven hundreds. The last or right digit is the ones' place which is 6 in this example. Therefore, there are 5 sets of 100, plus 4 sets of 10, plus 6 ones in the number 546.
546
||__ones' place
||________tens' place
|_______________hundreds' place

**Independent Station**- it is math station where the students will work independently.

**Manipulative**- any concrete objects that allow students to explore an idea in an active, hands-on approach.

**Meeting Standard**- the students consistently and independently demonstrate understanding of place value standards.

**Paired-Cooperative Stations**- math stations where the students will be working in pairs collaboratively.

**Pedagogy**- refers to art and science of teaching. More specifically, it refers to styles and methods of instruction used in the teaching profession.

**Place Value**- The numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 are called digits. It is by using these ten digits that numbers are formed. The value of ten digit in a number is determined by its place in the number and is known as the place value. Place value is the value of a digit as determined by its position in a number.
**Teacher Directed Instruction**- Teaching direct instruction in math means providing instruction in a step-by-step manner. Teachers follow a sequence of events, generally stating the objective, reviewing skills necessary for new information, presenting new information, questioning students, providing group instruction and independent practice, assessing performance, and giving more practice.

**Tens**- one ten is a set of ten units. For example number 75 tells you that the left digit is the tens' place. It tells you that there are 7 tens. The last or right digit is the ones' place which is 5 in this example. Therefore, there are 7 sets of 10, plus 5 ones in the number 75.

7 5

| |__ones' place
|_________tens' place.

**Scaffolding**- instructional technique whereby the teacher models the desired learning strategy or task, then gradually shifts responsibility to the students. Scaffolding has been defined by Wood, Bruner, and Ross (1976) as “an adult controlling those elements of the task that are essentially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence.
References


Annotated Bibliography


This was a guide book on mathematics. The author’s purpose was to create activities in understanding mathematics by the use of concrete materials.

The guide book was designed to broaden the students’ understanding of mathematical concepts. The activities did not include the use of written numerals. Each chapter was developed in connection with the succeeding chapters. The opening page of the chapter listed the following: (a) mathematical skills and concepts, (b) self-concept, (c) social interaction skills, and (d) future application of the chapter. The main activities in the chapter were divided into three sections: (a) the introduction of the concept, (b) the application, and (c) the extension of the concept. One part of the guide explained how to use: (a) worksheets, (b) observational sheets, and (c) assessments of skills.


This guide book will be beneficial for primary math teachers. It enumerates different strategies in teaching math concepts using manipulatives and hands-on materials.

This was a theoretical article. The purpose of the article was to advance Fuson’s (1986) theory on learning place-value.

Fuson’s theory concluded that there was a need for an improvement in textbook based instruction regarding teaching place-value; however, he did not clearly state how place-value instruction should be changed and when it should be added to the curriculum. In this article, the
author proposed that multi-digit addition and subtraction lessons should be connected to a multiunit concept. The instruction on multi-digit addition and subtraction generated the aspect of a multiunit concept. Multiunit concept was the use of meaningful models and linking these models into written symbols. The author also proposed to replace the practice of introducing two-digit addition without trading before introducing single digit combinations. In conclusion, the introduction of multiunit as soon as the students begun using two-digit numbers benefited in developing a more secure basis of understanding multiunit concept. This article will be useful for math teachers who teach place value. It illustrates differentiated instruction in teaching place-value concepts.


This was a guide book in mathematics. The purpose of the author was to educate teachers in a learner-centered approach instruction of mathematics.

The guide book was designed to engage students in constructivist teaching process; it involved, hands-on learning, problem solving, and communicating mathematical reasoning. Each chapter was developed to explain the appropriate teaching process in math. The topics covered in the chapters were as follows: (a) number and operation, (b) algebra, (c) geometry, (d) measurement, (e) data analysis, and (f) probability. The ideas presented were integrated to meet the National Council of Teachers of Mathematics (NCTM) standards. It featured *Connecting with Standards* that links mathematical methods, classroom practice and the NCTM principles and standards. Another helpful feature of the guide book involved: (a) practical tools for teaching, (b) personal tools for developing teachers’ experience, and (c) supplemental resources.
This guide book will be beneficial for math teachers. It will help teachers understand how a learner-centered classroom works.


This was a theoretical article. The purpose of this article was to report how to integrate an assessment in mathematics with instruction during classroom activities that involve performance of hands-on problem solving.

The research emphasized the importance of major methods in assessing young children’s development in mathematics. Assessment was obtained through observation, informal intervention, conversation, interviews, and problems evaluated with performance rubrics. Individual interviews gave the teacher an opportunity to look at specific skills and ideas. It was critical to observe children’s problem solving processes and to question them regarding their thinking in order to understand how they arrived at their solutions. In conclusion, observation provided connections for scaffolding. Problem solving skill is important for young children in applying math processes: (a) reasoning, (b) communication, (c) connections, and (d) representations.

This article will be beneficial for teachers conducting assessments on young children’s mathematics knowledge on problem solving.


This was a teachers’ guide in mathematics. The purpose of the author was to help teachers understand the importance of inquiry-based instruction.
The article was designed to help teachers teach math in a complementary way instead of conflicting. The emphasis was on the conceptual understanding of math rather than the ability to memorize facts and apply algorithm (pg. 15). The author evaluated different style of teaching mathematics: (a) schema based instruction, solving mathematical word problems by helping students understand the structure of the problems given, (b) cognitive strategies, allowing students to follow the correct steps in solving word problem, (c) scaffolding, teaching new approaches by using previously taught skills, (d) peer-mediated instruction, students in pairs and (e) concrete representational abstract sequence, learning mathematics through the use of concrete manipulatives, representational pictures, and abstract symbols (pg.18).

This guide book will be beneficial for primary math teachers. It enumerates different strategies for teaching math concepts.


This was an empirical article. The purpose of the article was to support the understanding of place value through using Egyptian and Mayan number systems.

The hypothesis was to create connections between Egyptian and Mayan number system to our own in teaching place value. The participants were three students who just finished second grade and third grade students. The following alternative activities were used in this research

- Mystery-number activity using the Egyptian number, students converted Egyptian numbers to Hindu-Arabic numbers
- Writing numbers, students picked Egyptian numbers to write
- Place-value positions, students used Mayan numbers system in learning place
In conclusion, the students became more engaged in learning place value. The students were able to make connections between the ancient system and current number system. Students realized that both numeral and its position in the place value affect the value of the number. Students were able to connect the base twenty Mayan numbers system with our base ten number system. Mayan twenties position helped the students to recognize that our tens place value represents one ten and not just one, which strengthened their understanding of place value.

Second grade and third grade teachers will find this article beneficial; it illustrates alternative lessons in teaching the concept of place value. This article will also help math teachers in developing effective strategies in teaching place value concepts.


This was an empirical journal. The purpose was to test the effectiveness of using based ten blocks in learning place value and multi-digit addition and subtraction.

The first study was composed of 169 first and second grade graders who demonstrated multi-digit addition and place value concepts up to at least four-digit numbers. The second study was composed of 783 second graders who learned four-digit addition and four-digit subtraction. Based ten blocks were used to make different three and four-digit numbers. Steps in addition and subtraction of four-digit numbers were utilized by using the different sizes of the blocks; each step was immediately recorded with base ten numerals. The result of the post-assessment showed students in the experimental group had significant growth from their pre-test results, compared to
insignificant growth for the control group.

Primary math teachers would find this article beneficial, as it relates to place value, multi-digit addition and subtraction that are important to learn for primary grades students.


This was a theoretical article. The purpose of the study was to apply known math facts of the students into deriving unknown math facts from number combinations.

The author explained how different strategies must be emphasized to be fluent with basic addition facts. The activities used in this study were: (a) quick images with dot patterns, students were shown counters in a grid to retain mental pictures of the images (b) ten-frames, students used a ten-frame to compute subtraction problems (c) tens go fish, students used a deck of cards to look for pairs of numbers that add to ten and (d) turn over ten, students practiced making combination of numbers to make ten. The author also condemned memorization of isolated facts to develop proficiency with basic facts. In conclusion, the strategies helped the students to be engaged in mathematical activity. It promoted learning of key facts, doubles and combination of ten. Students began to recognize sums and differences of single-digit numbers and use known number patterns and combinations to help determine unknown math facts.

This article will be beneficial to elementary math teachers. Elementary teachers can use the strategies presented in the article to increase math fluency of students with basic addition.


This was a theoretical article. The purpose of the article was to create an effective way of understanding place value by using grouping strategies that the students can relate in learning.
The author conveyed the importance of allowing enough time for the students to work with concrete materials in learning place value. The author developed a guided lesson on place value system. The activities on the lesson presented are as follows: (a) *flip-books*, (b) *tic-tac-tens*, (c) *zero wins*, and (d) *adding up*. The activities aimed to allow students to work with concrete materials; and help the students learn how to connect the gap between manipulatives and paper-and-pencil tasks (pg. 10). The students passed through three stages to bridge the gap from manipulative to paper and pencil. The stages were as follows: (a) *concrete*, involving activities like blocks, block with flip-books, (b) *semi-concrete*, involving blocks, block with flip-books, teacher’s recording, student’s volunteer recordings, and (c) *abstract*, involving students working in pairs. All activities required a place-value board. Block activities involved place-value models for ones, ten, and hundreds (pg.10) that were used to separate each column in the place-value board. Flip-books were set of ten cards, with numbers one to ten that were put together in the place-value board. Each student took turns in rolling a dice, and then the other students changed the place-value board based on the outcome of the dice. In conclusion, students need to work with both concrete and symbolic forms to understand place value.

This article will be useful for math teachers who teach place value. It illustrates strategies in teaching place value that can be utilized as differentiated instruction.


This was an empirical article based on quantitative research. The purpose of the study was to investigate issues of conceptual understanding in teaching and learning place value.
The hypothesis was to build connections between external representations in teaching place value with the internal development of learning place value. The participants were 153 first grade students who attended suburban or rural schools. Four classrooms implemented alternative conceptual based instruction on place value, and two classrooms followed a textbook-based approach. The alternative based instruction used external representations to solve place value problems. In conclusion, the data suggested that understanding place value was influenced by the instructional environment. One viable form of instructional environment was an instruction that supports students’ efforts to connect different forms of representation.

First grade math teachers would find this article beneficial, as it relates specifically in teaching place value with first grade. This article will also be beneficial in developing effective strategies in teaching place value.


This was a theoretical article. The purpose was to examine the playfulness of educational games in students’ learning.

The author organized a game-based learning from Andresen and Ahdell’s six element theories and Price’s five conditional theories on designing games. The study composed of six key categories: (a) degree of uncertainty, (b) equal conditions for fair play, (c) opportunities for competition and cooperation (d) level of challenge (e) flexibility in decision making, and (f) level of interactivity. The author examined which factors from the six key categories had the
most and least impact on playfulness. The author concluded that out of the six categories reviewed; the degree of uncertainty and flexibility in decision had the most impact in the playfulness of games, and the level of interacting showed the least impact. He also concluded that the principles of design in creating playfulness on games were based on the players’ interaction, competition and collaboration.

Teachers creating games as part of their lesson plan would find this study beneficial, as it enumerates important key factors in creating playful games. Teachers will be able to use playful games in motivating their students in learning.


This was an empirical article. The purpose was to test the effectiveness of teaching primary math without the use of algorithms.

The authors refrained from teaching algorithms, instead had the students invent their own procedures for solving mathematical operations. The participants were students from lower grades: (a) first grade, four out of four teachers, (b) second grade, two out of three teachers, (c) third grade, one out of three teachers, and (d) fourth grade, none of four teachers. Students’ understanding of place value was examined to test the effectiveness of teaching non-algorithm method. In conclusion, the second graders who did their own thinking scored better on the test compared to fourth graders who were taught algorithms. It was clear that algorithms slowed students from learning number sense and place value. The author stated that it was better for students to invent their own procedures in learning place value rather than following algorithms for three reasons: (a) it was not necessary for students to give up their own thinking, (b) students
understanding of place value was not strengthened by algorithm, and (c) students developed number sense by thinking on their own (pg204).

This article will be useful for teachers who teach primary math. It will help primary math teachers understand the importance of students developing number sense by inventing their own procedures.


This was an empirical article based on quantitative research. The purpose of the article was to test the hypothesis if physical-knowledge activities are good for slow-to-develop first graders in building cognitive foundation of numbers.

The study was composed of two teachers who divided the class of twenty six first graders into thirteen students each. These groups of students were called the constructivist group. The constructivist group was given physical-knowledge activities every day during math time. Physical activities on this research were: (a) bowling game, (b) pick-up sticks, (c) the balance game, and (d) jenga. While the second group of students composed of 20 first graders was called the comparison group. The comparison group was given worksheets throughout the school year. Pretest was administered at the beginning of the school year. The pretest was an orally presented multi-choice group test published by Houghton Mifflin (2002). The results of the pretest scores were similar for both groups averaging 78.6% and 79.38%. At the end of the school year, post-tests were given to students. It was composed of mental arithmetic and four word problem. The post-test showed that the constructivist group did better than the comparison group. In conclusion, students with good cognitive foundation learned faster compared to
students who only did worksheets. The physical-knowledge activities helped the students to think logico-mathematically.

First grade math teachers would find this article beneficial, as it relates to first grade students. The strategies used in the article can be used as part of differentiated instruction in teaching math.


This was a theoretical study. The purpose of the study was to advance Piaget’s theory between intuitive (pre-operational) time and operational (logico-mathematical) time.

Piaget’s theory concluded that students start to develop sense of operational time around seven to eight years of age; however, he did not give specific age norms of when the students will be proficient in learning the concept of operational time. The study focused on finding out the specific age of the students which was not presented in Piaget’s theory. The participants were 184 students in grades K-5. Individual interviews were done to test the students’ concept of operational time. Piaget’s theory concerning the development of operational time from intuitive time that deals with the age differences between an apple tree and a pear tree was used in supervising the interviews. In conclusion, the study showed that operational time was demonstrated by 79% in grade three, when children were eight to nine years old.

This study will be beneficial for primary elementary math teachers. It will help teachers to identify the nature of students’ maturity in relation to operational time.

This was an empirical article. The purpose of this study was to collect materials with bearing on matches and mismatches between pedagogical principles and practice when students play math games.

The participants were forty, eight to ten years old students who regularly played a math game during math lessons on 9 weeks. The general question addressed in the study was: Is student understanding of the targeted mathematical principles supported by features of the game as intended? The research method was an application in the context of base-10. The educational game was based on a metaphor for arithmetic, where numbers are graphical objects, and arithmetic operations were animated actions on these objects. The result showed the difficulty of predicting areas in which possible mismatches appear between the intentions of the pedagogues and designers of educational technology and the actual use of the technology by the students.

This research will benefit teachers who use technological games in teaching base-10. It will help teachers to find pertinent questions when using certain technological software in the classroom.


This theoretical article described a *Personal Learning Plan* method used in early childhood education courses as learner-centered, inquiry based instruction.
The author described *Personal Learning Plan* method as a template for early childhood education and specific project based instruction. The author explained how learner-centered, inquiry based instruction promoted skills that were critical to the success of the teacher in the classroom. In conclusion, *Personal Learning Plan* method was viewed positively by the students and appeared to be a powerful tool for teaching and learning. The researchers also found that *Personal Learning Plan* was not a cost effective method of teaching.

This article will be useful to teachers who will include inquiry based instruction as a teaching tool. It demonstrates sample preliminary *Personal Learning Plans* that can be used in inquiry based instruction.


This was an empirical article. It was a qualitative study. The purpose was to examine the associations between cognitive abilities and three domains of math skills: (a) knowing, (b) applying, and (c) problem solving.

The participants were 723 third-grade students from 28 elementary schools. The researchers wanted to test the analyses of a four-factor model of math skills: (a) knowing-recalling, (b) knowing computing, (c) applying and problem solving and (d) nine-factor model of cognitive abilities. The nine-factor model of cognitive abilities involved: (a) non-verbal and verbal reasoning, (b) verbal concepts, (c) planning, (d) visuo-spatial working memory, (e) phonological awareness working memory and (f) phonological verbal working memory. The test results showed that verbal reasoning and verbal concepts were most consistently associated with knowing math and problem solving domains. Verbal concepts also contributed to applying math
domains. Simultaneous processing of verbal working memory also predicted problem-solving skills in math.

    This research will be beneficial to elementary teachers in supporting the learning process of students with difficulties in math.


    This theoretical article discussed teacher’s processes of learning in the classroom from observing and interacting with students’ work.

    The researchers tested the effectiveness of teachers reflecting on students’ interaction with them. The research was done in two parts. The first part of the article explained the importance of “observational didactic knowledge,” which grows from the teacher’s observation and reflection upon students’ mathematical activity in the classroom. The second part was applied in two case studies by four mathematics teachers who conducted ordinary lessons. The teachers decided to prepare all the lessons for their classes collaboratively. In conclusion, the authors discussed what teachers observed in students’ activity, and how teachers’ training plays a role in modifying their knowledge about students’ ways of dealing with mathematical problems.

    This article is useful for math teachers who will reflect on students’ interaction with math activity. It will also benefit math teachers by improving teachers’ knowledge of the usefulness of reflecting upon students’ interactions.

This is an empirical article based on qualitative research. It clarified students’ understanding of the factors that influence their perception of school tasks.

The research had been done in four kindergarten classes and one combined kindergarten or first grade class. The researchers wanted to test how students perceived their assigned tasks in the classroom. Students were interviewed informally as they completed their tasks. Observational records were made of lesson introductions, activities available, and teachers’ comments to students before, between, and after interviews. In conclusion, the research indicated that in classrooms where teachers emphasize work completion by worksheets as instructional core, students were likely to perceive that what they were doing was work. While the students who were playing perceived it as something they can easily do and were less likely to perceive it as work.

This research will be useful for kindergarten and first grade teachers. It will help the teachers to generate activities that will motivate students to their tasks.


This was an empirical study. It aimed to evaluate the relationship of basic numerical competencies with building blocks for more complex math skills in a longitudinal approach.

The participants were 94 first grade students. In first grade, students were administered transcoding task and magnitude comparison task lasting 10 to 15 minutes each. Two years later, students’ calculation ability was assessed by a computerized addition task. The author
investigated the influence of basic numerical competencies on later math performance in a longitudinal approach. The author analyzed whether first graders performance in basic numerical tasks and place-value understanding reliably predicted performance in an addition task in third grade. The results showed that early place-value understanding was a reliable predictor for specific aspects of math performance in the future.

This study will be beneficial for primary elementary math teachers. It suggests many strategies that math teachers can use in teaching place value and addition problems.


This empirical article compared the effectiveness of two theoretically distinct interventions, *Cover, Copy, and Compare* and *Facts That Last* in improving the subtraction-fact fluency of second grade students.

The participants were 19 second grade students from a rural elementary school in the Midwestern United States. *Cover, Copy and Compare*, and *Facts That Last* interventions were implemented daily across ten consecutive school days, and maintenance data were collected two months after the intervention were concluded. The researchers wanted to test the effectiveness of *Cover, Copy, and Compare*, and *Facts That Last* approach in subtraction-fact fluency. Results showed that *Cover, Copy and Compare* led to increases in subtraction-fact fluency, whereas *Facts That Last* did not.

Second grade math teachers will find this article beneficial, as it relates specifically to improve subtraction-fact fluency. Second Grade teachers can use the *Cover, Copy and Compare*
strategies as part of math interventions in subtraction-fact lessons.


This was a web based guide. The purpose of the author was to coordinate the key feature of scaffolding instruction.

The author identified the meaning of scaffolding. The author pointed several key elements of scaffold instruction. It covered the following scaffolding elements: (a) *common goal*, sharing understanding between the teachers and students, (b) *ongoing diagnosis and adaptive support*, evaluating students’ progress and providing support, (c) *dialogues and interactions*, students taking turns in group interactions, and (d) *fading and transfer of responsibility*, decreasing the support to students. The author also tackled the following key terms in scaffolding: (a) examples of scaffolding, (b) scaffolding in classroom situations, (c) software tools in the classroom, (d) peer interaction, and (e) distributed scaffolding.

This article will be beneficial for teachers who will use scaffolding on their math lessons. It evaluates the importance of scaffolding in teaching math.


This was an empirical article based on quantitative research. The purpose was to investigate the relationship between level of cognitive development and math fluency abilities in first and second grade students.

The author tested the relationship of the cognitive abilities of the students with math
fluency using *Woodcock Johnson Test of Achievement*. There were 39 first and second grade students who took the test. To test the students’ mathematical fluency abilities, students were required to complete as many simple one digit addition, subtraction and multiplication problems within three minutes. The cognitive level of students were determined by their performance on *Conservation of Number*, and *Conservation of Substance*. In conclusion, the author suggested that there was a direct relationship between fluency and cognitive ability of the students. The test results demonstrated that concrete operational students were able to complete more problems within the specified time frame compared to pre-operational students who did not possess math fluency.

First and second grade teachers would find this study beneficial, as it enumerates math fluency that is important with first and second grade students.


This was an empirical article. The purpose of the research was to compare the instructional effectiveness of games to conventional classroom instruction in: (a) social studies, (b) math, and (c) language arts.

The author tested the benefits of games in classroom instructions. The *Educational Products Information Exchange*, was used to review the use and effectiveness of gaming techniques in 170 commercially available educational computer software programs. Teachers were trained to use an evaluation instrument to rate each program on several variables. The research was considered over a period of 28 years from 1963-1991. There were 68 studies that
reflected a trend to use descriptive reports rather than empirical studies. The authors concluded the use of games to be more beneficial in math compared to social studies and language arts.

This article will be beneficial for teachers who use games as part of educational instruction. It will help teachers to identify different games that are more effective in teaching math.


This was an empirical article based on quantitative research. The purpose of the research was to understand the mathematical knowledge of students in Montessori school and non-Montessori school involving place value concepts.

The participants were 93 students in grades 1-3 in a Montessori school and in traditional school: 14 first graders, 17 second graders, and 16 third graders from Montessori school; and 16 first graders, 16 second graders, and 14 third graders from non-Montessori school. The author investigated the understanding of place value concept of Montessori students compared to traditional students. Students were interviewed individually for 30 minutes. The interview tasks were as follows: (a) flower task, (b) bean task, (c) horizontal addition task, and (d) vertical addition task. The individual tasks showed that Montessori students consistently surpassed the traditional students on tasks of a more conceptual nature, while both groups performed the same in symbolic tasks. In conclusion, the strategies used by Montessori students indicated that they have a better understanding of place value, while traditional students who were tied to the use of standard algorithms showed lower performance on place value concepts.

This article will be useful for math teachers who teach place value. It illustrates the
importance of different strategies in teaching place value.


This was a teachers’ guide in mathematics. The purpose of the author was to help teachers understand the step by step process of cognitive strategy instruction.

The article was presented to help teachers model cognitive strategy instruction based on Harris and Graham’s (1996) self-regulated strategy development model. The author defined the meaning of cognitive strategy instruction and the effectiveness of the strategy. The author systematized the stages in using cognitive strategies, it was the following: (a) develop and activate background knowledge, (b) discuss the strategy, (c) model the strategy, (d) memorize the strategy, (e) support the strategy, and (f) independent performance. The author also identified ways of evaluating the students’ performance; students as co-evaluators and utilizing portfolio assessment procedures (pg. 5).

This guide book will be beneficial for math teachers. It enumerates the effectiveness of cognitive strategies and organized the model of implementation.


This was a teacher’s guidebook. The author’s purpose was to create a multi-unit approach in teaching math concepts.

The author presented different ideas in teaching place value-concepts. The guide book involved primary grade activities in building foundation of the students in making sense of place value. The approach in the guidebook showed certain principles of how students learn
mathematic concepts. The lessons were instructed through teacher-directed whole class activities followed by a form of independent practice. Two chapters of the guidebook addressed the understanding of place value concepts including: (a) forming and counting group, (b) recognizing patterns in the number system, (c) organizing groups into tens and one, and (d) adding and subtracting two digit numbers.

This guidebook will be beneficial for primary math teachers. It showed a series of strategies that can be used in teaching place value concept.


This was a teacher’s guide book. The purpose of the author was to create a single guide book that will help teachers plan in teaching math.

The author prepared a year-long plan for teaching kindergarten through third grade and multi-age classes. The initial part of the guide book composed of how the instructional setting of the classroom would be organized. It was composed of three basic parts: (a) whole class setting, (b) independent station, and (c) small group setting. The guide book involved grade level planning for teaching math. The components of the plan were as follows: (a) concept development, it sets the timeline of teaching different math concepts, (b) planning chart, it was composed of whole-class work, ongoing independent-station work, and teacher-directed focus work or shared experiences, and (c) planning notes, it was composed of whole-class work, shorter mini-lesson, longer mini-lesson and ongoing independent station-work.

This guide book will be beneficial for primary math teachers. It summarizes the appropriate pacing of math concept.

This was an empirical article based on qualitative research. The purpose was to discuss the mathematical and epistemological issues regarding two models of subtraction: (a) taking away (ta), (b) determining the difference (dd) and its inverse relation to addition.

The author analyzed the use of the subtraction model by second grade students. The students were given a subtraction problem to solve, 83-79. The task suggested using the (dd) model and its reverse addition strategy because the subtrahend is close to the minuend. However, the students described their solutions differently; the students chose the taking away strategy. The research found that students hardly made use of the (dd) model, and their choice of the strategy rarely depended on the task of a given problem. In conclusion, using the (dd) model and its inverse relation between addition and subtraction was more efficient compared to the (ta) strategy; however it was rarely use. The author suggested the (dd) model should be taught from first grade. It was derived from longitudinal perspective that constantly built on existing knowledge, taking into account how the previous learning environment must be oriented towards the future learning environment.

Primary elementary math teachers would find this study beneficial. The strategy presented can be used in teaching subtraction.

This was an empirical article based on quantitative research. The purpose of the article was to find out the relationship between a particular mathematical skill and working memory components.

The participants were 90 students in primary grades. A detailed math test was administered to measure number writing, symbolic magnitude judgment and single-digit arithmetic. The assessment was composed of: (a) working memory, it relates to the capacity to simultaneously store and manipulate information; (b) visual-spatial sketchpad, the students were shown a route through a maze; (c) central executive, the students were assessed by four complex working memory tasks; and (d) phonological loop, the students listened to series of real worlds and were asked to recall the words. In conclusion, the test resulted:

- visual-spatial sketchpad played a significant role in the development of number writing and magnitude judgments but a lesser role in early arithmetic;
- central executive functioning played a role in the development of early addition abilities;
- phonological loop functioning showed a variance in multiplication; and
- working memory showed a significant variance in number writing, magnitude judgment, and single digit arithmetic.

This article will be beneficial for teachers who teach early arithmetic. This article will help teachers to uncover different factors influencing the early mathematical skills of their students.