The Effects of Using a Systematic Approach During Mathematical Instruction

Heather Arroyo
St. Catherine University

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The Effects of Using a Systematic Approach During Mathematical Instruction

An Action Research Report

By Heather Arroyo
The Effects of Using a Systematic Approach
During Mathematical Instruction

By Heather Arroyo

Submitted on May 15, 2014

in fulfillment of final requirements for the MAED degree

St. Catherine University
Saint Paul, Minnesota

Advisor _______________________________  Date ________________
Abstract

The intent of this study was to determine the effect of using a systematic concrete-representational-abstract approach during mathematical instruction on student outcomes. The research study took place in a first grade public school elementary classroom with 19 students. The sources of data collection were from a pretest and post-test, lesson exits, student journal entries, and teacher reflections. The data revealed an overall increase in student results from the pretest to the post-test. The lesson exits exhibited a steady increase in understanding. The teacher reflections also revealed information that monitored when the process should move on to the next stage. In conclusion, students were confident and excited to explain their thinking through the use of materials. Due to the systematic CRA structure, the charted data outcomes demonstrate place and coin value student growth and further support the use of CRA in instructional decisions.
Great is the brain of a young learner! Every day is a day of discovery as students explain how they come up with their conclusions. Our school brought in a new mathematics curriculum four years ago and I have observed a continual decline in student thinking during mathematics. Even though I purposefully model how to express student thinking, the structure of the lesson does not allow for students to demonstrate their full ability to express how they figure out the answers. It has been determined during one of our Professional Learning Collaboration group meetings that the instruction within the mathematic curriculum was traditional in format and promoted procedural processing of each math concept. I felt it was difficult to get significant information from my students.

Having a lack of documentation by students of pre or post assessments, I felt there was no way of knowing where students were missing foundational concepts or how to determine which gaps needed my explicit whole group instruction and which concepts needed small group interventions. I also felt insecure in implementing interventions, or, what solid evidence based interventions would give my students the best outcomes.

I decided to review literature on how to produce mathematical thinking students and review studies on the best research strategies for both whole and small group instruction. The findings of my research review helped me conduct an action research study to determine to what extent a first grade students’ thought process with a concept in mathematics will be impacted by using a systematic instructional structure. The review helped me make the best decisions in terms of what curriculum, instruction format, and researched practices will benefit my student thinking and outcome results.
Current research points to several “best practice” strategies for engaging students in mathematical thinking and verbalization. Baker, Gersten, and Lee (2002) along with Witzel, Ferguson, and Mink (2012) concur that the most powerful strategies teachers can implement are: using concrete experiences, teaching skills to proficiency, and promoting the use of mathematical vocabulary so that students have a solid number sense background.

Kostos and Shin (2010) add the use of journals as a foundational strategy to support student thinking because of its visual nature. When students were given a rubric and explicit instruction on how to demonstrate mathematical thinking, the overall achievement from pre to post assessment during a five week study increased from seven and a quarter out of twelve to ten out of twelve. Instructors also observed that this process allowed for them to have increased knowledge on student thinking and focus their instruction on what students need to revisit.

Steedly, Dragoo, Arafeh, & Luke (2012) also stress the importance of over 183 research studies in which systematic, explicit instruction and visual representation of math concepts demonstrates an impact on all learners. Each of these studies, along with Witzel, Riccomini, & Schneider (2008) supports using the systematic Concrete-Representational-Abstract (CRA) method for all learner types and recognizes the value of CRA for facilitating student success in reaching proficiency at all grade levels.

Studies by Eastburn (2011) further compared the concrete and representational stage as a foundation to mathematical achievement, equal to phonemic awareness being the foundation to reading achievement. Number sense and concrete-representational
stages act similar to phonemic awareness in that, it supports student success in all future math concepts. Jordan, Kaplan, Locuniak, & Ramineni (2007) also concurred that number sense, which uses concrete-representational as a foundation, was a predictor of student success in math. Both studies see number sense used heavily throughout concrete and representational stages in math.

Researchers have found many advantages of using the CRA systematic approach for instructing students in math. Garcia (2008), Hauser (2004), and Paulsen (2005) all noted that because of the way the structure of CRA is modeled, off-task behavior becomes minimal and math anxiety diminished -- leaving students confident and engaged, with a curious desire to make connections to math concepts. CRA also targets visual, tactile, kinesthetic, or logical learning styles by infusing them within the structure, as well as, benefiting all grade levels and student populations (Witzel, et al. 2012).

CRA facilitates teachers’ reflection and the analysis of student work to drive instruction. This structure allows teachers to observe the understanding of the class as they demonstrate their knowledge, and in turn, educators can make changes as students show their skills. According to one of the educators, “the research was a wake-up call as to what teachers and students should be doing”(Cooner, Knight, & Wiseman, 2000, p.26). Students at all levels of mathematical understanding demonstrated an increase in math concepts compared to students without this structure and in fact, CRA enhanced the mathematical performance of students, allowing students to retain math concepts more easily at a higher level (Cooner, et al. 2000; Kostos & Shin, 2010; Witzel, et al. 2008).
In addition to using CRA as an instructional model for the whole group, teachers also included it as an intervention for Learning Disabled, English Language Learners, and low performing or at risk for math failure students throughout the year (Flores, 2010; Witzel, et al. 2008). Through collaboration teachers arranged students into small groups for several weeks of intervention. They worked on the standard by starting from the conceptual stage and explicitly showing the relationship between all the stages. The students showed improvement of 77% to 90% mastery in the written portion of the test (Cooner, et al. 2000). Bryant and colleagues (2011) also discovered that a dedicated intervention time increased assessments in all these areas. Their research showed all intervention groups had positive results in data, and in fact, they saw that the benefit was worth the cost (time invested) and would like to continue with small group intervention time with the focus on student outcomes within the CRA model.

After spending time reviewing different researched practices, I decided to follow the CRA structure to implement my action research. The following demographics support the background of the students involved in the action research. The study took place in a rural Prek-12 public school setting. Currently, the school consists of approximately 500 students with 281 of those students being open enrolled into the school. There are 16% special education students, 4% multi-ethnicity, 96% Caucasian, and 58% students qualifying for free or reduced lunch. The classroom involved in the action research has: 19 students total (10 boys and 9 girls), 3 are special education students with an additional paraprofessional supporting them within the classroom, all 19 students are Caucasian, 74% qualifying for free or reduced lunch and all students range in age from 6-7 years.
The research in this review lays out the benefits of using a systematic research based model, Concrete-Representational-Abstract, both in whole and small group, and at any grade level in order to support the goal of developing mathematical thinking in students through all stages. Therefore, I decided to focus my action research on the CRA model within my mathematic instruction. What I would like to know is: to what extent can a first grade students’ thought process with a concept in mathematics, be impacted by using a systematic concrete-representational-abstract instructional structure? As I moved forward with the research of using CRA in my classroom, I laid out my plan as to how I followed the CRA structure to instruct my students in mathematics.

Description of Research Process

I chose to teach five weeks of mathematics using the gradual release of concrete materials to representational and abstract thinking in mathematics. The research began on January 6, 2014 and concluded on February 7, 2014. My data collection included: (1) pre and post-test (see Appendix A), (2) mathematic lesson exits, (3) student journal representations, and (4) teacher reflections and notes. Prior to the study, the students were given a pretest with 35 questions that revealed their knowledge on the mathematical concept of place value to the tens and one place, the value of coins, identifying coins by name, and adding coin amounts up to one dollar. These concepts on the pretest are all derived from the Minnesota standards in mathematics. I then reflectively took the results to craft my instruction for both whole and small group with the use of materials called base ten blocks, pennies, nickels, dimes, and quarters. The class also brought supplies from home, priced, and managed a class store. Students then received concrete instruction with each of these concepts throughout the study.
Student knowledge was monitored throughout the investigation with the use of daily lesson exits. Then additional support with concrete lessons during small group instruction was given to those students that struggled on the daily lesson concept. As students improved on exits with concrete materials, I started to include representational work so that students could display their understanding by drawing or writing out their mathematical thinking. The use of these lessons monitored which students needed additional small group support and gave way to gauging when student learning could be gradually released to abstract reasoning in each of the concepts being assessed.

Students also had the opportunity to represent their ideas each week in a student journal. The use of a rubric (see Appendix B) to monitor student outcomes in their mathematical journal helped support my decisions as to when I should move on to a new concept or stage in the concrete-representational-abstract instructional process. The journaling rubric consisted of a scale that started at one with the highest being a three. The rubric also included the same scale of one to three for students’ telling how they figured out their mathematical answers with the whole class during the closing of each math class.

In addition to the student data, I also included a teacher observation and reflection (see Appendix B) for each week that noted: student learning, assumptions, misconceptions, questions, ideas for next steps, student behaviors, and reactions to the instruction for both whole and small group. My reflective writing gave me the chance to differentiate my instruction with small groups and pause to decide what would be the most effective method to deliver the instruction to the class.
The students in the investigation started each lesson with connections to their previous day’s instruction by doing a few questions on the smartboard with their partner and talking about the answers as a whole group. The students were able to use the manipulative material to explain their knowledge to the class. I then modeled and built the next level of understanding with each concept by concretely illustrating for the students how good mathematicians answer questions. It was important to show how I came up with my answer by talking through the step by step process until I had an answer. Two concepts that were modeled during this action research included, (1) place value: the value of a digit, where the digit is placed changes the value of that digit, and understanding how to use the place value chart, and (2) coin value: identify the name of each coin, identify the value of each coin, make coin amounts, and add coin amounts up to one dollar to buy and sell.

Throughout the investigation, interactive materials on the smart board that looked just like their base ten blocks and coins were used, and students also had access to online apps and games to help with all concepts. YouTube videos and children’s literature also supported the modeling for all aspects of the investigation. I wanted to make sure several different modes were used to support my student learners. Students used the online materials just as effectively as the physical materials during the concrete stage of the action research.

During both whole group and small group, students were given charts to help organize and sort their thinking. For place value, we did base ten and ones with a T-chart (see Appendix C) that was labeled Tens and Ones. The students then moved the materials on the chart to represent and make those numbers. We then counted the
amounts together on our chart by tens and then ones to show if our understanding matched the numerical digits. For coin value, we used a coin sorting tray, which was a divided paper tray with permanent marker labeling in each section so students could identify the coin and place the materials in the right section. Each day they had a different amount on the tray to organize. After arranging and identifying coins, we used a 4 way T-chart (see Appendix C) to identify, sort, and add coin amounts. The headings on the chart gave the ten frame dots as a visual since these were taught earlier in the school year, along with the coin name and value.

The daily exits and reflections drove my instruction and my next steps, along with journals and student drawings (see Appendix D). The students showed evidence of their understanding when they could discuss what they had on paper and concretely on their chart. Gradually, this process gave way to abstract thinking by filling out receipts (Appendix D) for the class store. The students had to use the concrete materials with the receipts interchangeably to exhibit understanding of all the instruction for the concept of coins.

We ended the study with this receipt being the connection to value of a digit under the place value that started the whole research. Students then used the concrete materials together to show that the ten rod was equal to the dime or one block was equal to the penny. The study then concluded with inviting another class over to their art museum to purchase art that the students created. During this activity, I was observing students ability to buy and sell, use coins correctly, and add up amounts on a receipt. After the study was over, the students then took the post-test to validate their new knowledge about place and coin value.
Overall, the process of using a systematic concrete-representational-abstract instructional structure within my mathematic lessons flowed nicely. I was able to model and support students in both whole group and small group with these activities. This action research was to determine to what extent a first grade student’s thought process with a concept in mathematics can be impacted by using a systematic concrete-representational-abstract instructional structure? The following analysis lays out the results of following this CRA process.

Analysis of Data

When the research was finished I gathered all the data from the pretests before I began the systematic CRA approach to instruction and compared that pretest with the post-test. Both assessments were similar in layout and in the questions being asked so that the data would benefit our data analysis. I also analyzed the lesson exits that were collected, the teacher reflections, and journal rubrics written by the students.

The data analysis started on February 10th, 2014 with the comparison between the pretest and the post-test. Both assessments had all 19 students present, a classroom paraprofessional, and myself. The post-test also had a student teacher to support students with reading the test. I made it clear that a question could be read to the student if they raised their hand. For this research to be accurate, I wanted to know what students did not understand in mathematics. As shown in Figure 1, the pretest score for each student is represented in dark gray. After five weeks with the use of concrete-representational-abstract systematic instruction, with both whole group and small group, the post-test score for each student is represented in light gray.
There were 35 questions that students had to answer. They covered both the Place Value and Coin Value under the 1st grade Minnesota Standards for Mathematics. All 19 students made positive gains with the post-test. Student one and two did not make it to the 80% outcome and need further analysis as to why. The questions on the assessments were split into sections that I sub-strand for deeper analysis. Question number one through five had the students reading the number in word form and then writing the answer in numerical form. Then students had to circle the digit in either the ones or tens place. These questions were read to the students so that reading deficiencies would not hinder their responses. The outcomes for both the pretest and post-test for this sub-strand exhibit each students’ growth in this area of the research.
Figure 2. Sub-strand section with student ability to write the number and circle the proper digit to represent place value of tens and ones.

Analysis of this graph (see Figure 2) shows two things: (1) the pretest shows about half of the ten questions correct and I need to know where the split in concept lies, (2) there are still a few students that need further investigation as to why they are not able to understanding the value of a digit in the post-test. When I looked closely at where the breakdown was in the pretest, students answered ten questions with five of the questions asking students to circle the number in the either the ten’s or one’s place. Students demonstrated zero out of the five questions in ability to circle the number in either the tens or ones place. Furthermore, when students were able to get a four or five out of ten on the pretest, they were demonstrating their ability to write the number I read out loud to the whole class. I have done previous work with writing our numbers to 120 by starting from any number. I can see I clearly have to spend our time with CRA instruction and the value of a digit! I spent my whole group instruction modeling and supporting the later part of the pretest in reference to the value of a digit.

In addition, the post-test reflected two of the students, number 15 and 19, did not do as well as others on this sub-strand. When looking more closely at these students, it is apparent that they grasp concepts more readily when given the chance to practice what is being taught. I also know that I did this portion of research when number 15 was out of school for five days of vacation and number 19 missed two days with illness. This does not mean I should disregard further investigation to determine if either of these students lack this concept or vacation and illness become the excuse. I need to review with these students in a future small group.
The next portion of the tests consisted of 10 questions that demonstrated student ability to create a number up to 120 by using the base ten materials and then point to either the tens or the ones. The graph (see Figure 3) exhibits student pretest and post-test results of creating number amounts I said with materials and then pointing to either the base ten or ones when asked.

Figure 3. Pretest and post-test results for creating numbers with materials and being able to point to the correct place value.

The pretest (see Figure 3) demonstrates five students will need to be placed in an enrichment group during small group time. Three of the students were not able to create a number with materials or point to the proper material that represented the tens or ones place and will receive further support in a small group. I also noticed number nine did not make any gain and number thirteen went down to 9. When looking at the question missed by both students, the question involved a number above 100. The first grade standard only goes to 99 with place value.
Students also were asked to identify coins, add coin amounts, and represent an amount by drawing out the coins and labeling them with a P (Penny), N (Nickel), D (Dime), or Q (Quarter). I have divided this portion of the test into three sub-strands. The first is identifying coins and consisted of four questions. The students were asked to point to the appropriate coin. The graph (see Figure 4) is a sub-strand representation of identifying coins in a pretest and post-test results. I still have number 17 mixing the dime with the nickel. Many on the pretest mixed the dime with the nickel, which they corrected after we spent time sorting coins.

Figure 4. Pretest and post-test with identifying coins.

The next sub-strand was adding coin amounts. There were six questions with five questions having coin pictures for students to add up and one question with materials to add up an amount. A comparison (see Figure 5) of both the pretest and the post-test demonstrates an area of need for whole group instruction and practice with counting coin amounts.
On the pretest, nine of the students were not able to add coins together. On the post-test, only five students still need to work on adding coins while in a small group. When I look closely at who still needed intervention two special education students emerged. They always need additional time to grasp concepts being taught in class. I also saw number one and two with low post-test scores. We have been monitoring number one for behavior with a behavior plan, however, the plan did not work. We started a new intervention plan the last week of this study. This plan is working much better. Therefore, due to proximity, number two and number thirteen both are distracted at times. I may need to move those students to another space during learning time.

The last portion of the pretest and post-test consisted of five questions and students needed to draw out their thinking on paper. I stated a number amount and students then used the P, N, D, or Q to represent their answer. The graph (see Figure 6) shows the comparison of both the pretest and post-test in reference to visualizing their thinking through written representation.
Figure 6. Representing a coin amount by drawing out the answer.

When I analyze figure 6, I notice low scores on the pretest and need to determine exactly how to instruct written expression with coins. Only six students are able to demonstrate their work through written expression, yet even those were at a low level of understanding. A great deal of time needed to be spent on modeling how to write down my thinking on paper.

Not only did I break down the pretest and post-test by student, I also analyzed them by question. If certain questions were more challenging to the class, I wanted to see how this could determine what and how I instructed the CRA structure in both whole group and small group. The graph (see Figure 7) is a breakdown of all 35 questions from both the pretest and post-test.
These data show I needed to spend increased time on the value of a digit and the value of each coin. The first ten questions exhibited the students could write the number but did not understand they mean different amounts when placed in other positions. They could not tell the difference between groups of ten and individual ones. The next set of questions eleven to twenty demonstrated they could manipulate materials but could not tell the difference between groups of ten and individual ones. When looking at question twenty-one to twenty-six, students were challenged to add up various coin amounts. All questions across this section showed students needed to spend additional time within the research on this concept. Questions twenty-seven to thirty let me know that students did not need to spend time with identifying a penny. We spent most of our time identifying the difference between the dime and nickel. The last set of five questions had a continual decline. The questions did progress with difficulty and students only knew how to use pennies at the beginning.

I also plotted student understanding of various lessons by using exit questions throughout the study. These exits covered the sub-strands of the pretest and post-test. As I watched the plot of their exits, I could determine if we could go on to the next sub-strand, move to small groups, or consider the concept mastered. The graph (see Figure 8) shows a line graph on how the students did on average with each exit.

Figure 7. Analysis of each question used to determine instruction
Figure 8. Analysis of student exits given at the end of lessons.

The first place value exit was given after a couple days of instruction. I had four days instruction with a snow day interrupting our study and then I gave the second exit after the instruction for that day and students did well to understand the value of a digit. Identifying coin exits were given after the first day of instruction with sorting coins and then again at the end of four lessons. I joined the instruction on identifying coins with making coin amounts so that students started to grasp the idea that each coin has a different value. I gave an exit every couple of days to monitor if they were improving their ability to make amounts. I then added in the representation exits toward the end of the coin amounts. I noticed the students did not have enough time in the study to support these exits. I will continue to use representation of coin amounts in our review and small group instruction.

The students also did two math journal entries to demonstrate their ability to represent their thinking. I wanted the students to journal every day so that students would practice representing their work. I found it impossible to get that into my day. Instead, we had two math journal entries for place value and then again with coin amounts that
were examined with a rubric. The findings showed students were able to draw out the place value well, but the drawing out coin amounts needs more time to model how to make different coin values. The way we did the coding for the coins did not help students to be able successfully to represent their ideas. I should have used 1, 5, 10, and 25 with a circle around it. I had a hard time deciding if it was a D or a P inside their circle and, therefore, could not see if the students were correct or not. These results exhibited how the 19 students demonstrated their ability within the rubric given at the end of the study, yet not accurate due to determining if students wrote D or P. The findings show the same two students being challenged to write their thinking. One student struggles with behavior and writing, and the other is next to this student.

In place value the results include: (3 students) unable to demonstrate their thinking through pictures, (4 students) could draw their thinking, and (12 students) drew their thinking with details. Representing coin value amounts exhibit: (2 students) unable to demonstrate their thinking through pictures, (5 students) could draw their thinking, and (12 students) drew their thinking with details. This was an area I need to spend more time modeling how to draw out their thinking.

My conclusions are that using a systematic concrete-representational-abstract instruction structure benefits students at all levels. The use of materials and drawing their thinking on paper together supports students when in abstract mathematics. Students were engaged and enjoyed showing how they came to their conclusions. I was able to get better data and reflect on student learning because I actually watched them think as they moved materials to get the answers.
In this action research I was investigating to what extent a first grade students’ thought process with a concept in mathematics, be impacted by using a systematic concrete-representational-abstract instructional structure? After analyzing the results of all the data, my next steps are noted and will be brought into my daily mathematic instruction.

Action Plan

I feel energized to reform the way I teach! This research study has shown me the benefit of following a systematic concrete-representational-abstract structure (CRA). The pretest and post-test results have proven effective, and now I need to transform how I teach all concepts in mathematics. I am leaning toward questioning how this structure could overflow into all core content in first grade.

When I bring all this research to a summative state, I realize that my instruction needs to increase in the amount of time I use materials to help set a solid foundation within a young child’s ability to grasp information. Throughout the study, I would monitor and reflect when to move on to the next stage by using lesson exits or observations, and students always seemed to need an additional day to solidify the concepts. I noted in the research that before students move on to abstract learning, students need additional time building the bridge with materials and visualizing their understanding. I further concluded from the study that my modeling of the representational stage needs more time. During the study, I modeled for students and made the connection between concrete and representational, but I believe students needed more time to learn how to write down their own thinking. Students had limited exposure to practicing their own way of representing their thinking. Maybe representing our work
would have been better if I were to model this structure from the beginning of the school year.

A few other limitations that could have impacted the investigation include insufficient daily instruction time. Our school has 60 minutes for whole group, small group, and calendar math. At the present time, students need an additional 15 to 20 minutes to apply their new knowledge. My lessons felt rushed as I took note of student’s still needing support yet the time was up. Another limitation was transition time for small group and the timing of small group. Both classrooms share small group time and the time of day for small group seemed to interrupt my math lesson.

An area of the study that has changed my instructional practices includes the use of a pretest and then a post-test. I was able to utilize my time more effectively and concentrate on areas that students did poorly on and then use the materials to support those concepts. After seeing the encouraging change in the student results, I have the desire to continue with this practice of pre-assessing so that my instructional vision is clear and I am able to teach students with greater skill.

I have redesigned my lesson plan format to include the use of concrete thinking and ways to measure student learning and then progress with a gradual release of concrete materials to the representational and abstract instruction. I believe this format will increase the student engagement and achievement results and, therefore, support student critical thinking.

Student intervention in small group has also benefited student outcomes in that they received additional time to practice with materials and internalize the instruction
given to the whole group. Individuals that were not able to exhibit mastery in the whole group were then given the needed boost to excel and repeat that new knowledge in their own words. They were given the same concrete to abstract instruction.

A potential future research investigation that could build off of this current study would include students that still struggle with representing their thinking on paper. Maybe they needed more time, further modeling, or integration of materials with the representation of their thinking. I would like to dig deeper into how the representational stage can improve student learning.

To further use of a structured CRA method, and improve its outcome, I am curious as to how I can support this process across content areas throughout the day. This would include both whole group and small group instruction. As an educator, driven to provide what students need, I am able to understand a student’s thinking with more meaning as I watch how they process the content. If students were able to demonstrate their understanding with deeper engagement and critical thinking throughout the day, I would better strengthen their learning outcomes.

The last potential research investigation I would like to spend more time studying, involves use of hands on materials at the concrete stage and the use of technology to produce this hands-on exposure. I would like to see how any technological device could help improve student understanding, by way of, materials being on an electronic device instead of physical objects in front of the student. Would the use of technology engage students so that they better demonstrate their thinking and become more critical in their learning? Do younger students need the actual physical object to move as they learn or
could there be a combination of technology and materials to bridge their concrete to abstract thinking?

I do believe the structure of CRA is powerful across all subjects, grade levels, and intervention groupings. I have seen the progress that is an outcome of following this structure. Now, I want to continue to improve my ability to use this method of instruction to improve student outcomes. That being said, I would like to make sure assessments drive the instruction, follow CRA structure, draw out the representational stage to demonstrate deeper thinking, and enhance the CRA with the use of technology when needed. Many great things can come from incorporating CRA into my whole day.
References


Retrieved from:


http://165.139.150.129/intervention/ConcreteRepresentationalAbstractInstructionalApproach.pdf


Appendix A

Pre-Assessment

Name: __________________

Date: ______________

1. Write the number thirty-two and circle the number in the tens place.

2. Write the number forty-three and circle the number in the tens place.

3. Write the number seventy-four and circle the number in the ones place.

4. Write the number nineteen and circle the number in the ones place.

5. Write the number sixty-eight and circle the number in the tens place.

6. Show me 45 with blocks and point to the tens place.

7. Show me 13 with blocks and point to the tens place.

8. Show me 98 with blocks and point to the ones place.

9. Show me 36 with blocks and point to the ones place.

10. Show me 117 with blocks and point to the tens place.
Count the coins in each box.

Write the correct amount on the line.

1. ________
2. ________

3. ________
4. ________

5. ________

Draw the amounts using: P   D   letter symbols.

6. 15
7. 37

8. 55
9. 60

10. 84

Identifies (Circle if student can name the coin correctly): P   N   D   Q

Yes   No   Adds up coin amount (84)
Post-Assessment

1.1.1 Place Value

1. Write the number twenty-three and circle the number in the tens place.

2. Write the number fifty-one and circle the number in the tens place.

3. Write the number eighty-nine and circle the number in the ones place.

4. Write the number eighteen and circle the number in the ones place.

5. Write the number seventy-two and circle the number in the tens place.

6. Show me 48 with blocks and point to the tens place.

7. Show me 17 with blocks and point to the tens place.

8. Show me 92 with blocks and point to the ones place.

9. Show me 35 with blocks and point to the ones place.

10. Show me 114 with blocks and point to the tens place.
Count the coins in each box.

Write the correct amount on the line.

1. ______

2. ______

3. ______

4. ______

5. ______

Draw the amounts using:  P     D    letter symbols.

6. 18

7. 30

8. 45

9. 26

10. 72

Identifies (Circle if student can name the coin correctly):  P   N   D   Q

Yes  No  Adds up coin amount (69)
Appendix B

Student Name:

Journal Response Rubric

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<td>Uses vocabulary</td>
<td>Uses vocabulary with details explained</td>
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<td>Drawing</td>
<td>Unable to demonstrate thinking through picture</td>
<td>Draws thinking through picture</td>
<td>Draws thinking through pictures with details</td>
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<tr>
<td>Share thinking</td>
<td>Unable to explain how they got their answer</td>
<td>Explains how they got their answer</td>
<td>Explains thinking with details or multiple ways to get the answer</td>
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Notes: 

Next Steps:

1st week:

2nd week:

3rd week:

4th week:

5th week:
Teacher Observation Form

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Reflections

Rubric for observations

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Representational</th>
<th>Abstract</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>unable to use materials to explain understanding</td>
<td>Unable to represent thinking in a drawing or limited vocabulary</td>
<td>unable to use symbol to demonstrate understanding</td>
<td>Uses materials to explain thinking, yet unsuccessful</td>
<td>Uses abstract symbol process, yet incorrect in answer</td>
<td>Uses symbol successfully and explains how the correct answer was given</td>
</tr>
<tr>
<td>Uses materials to explain thinking, yet unsuccessful</td>
<td>Able to either represent thinking or vocabulary, yet unsuccessful</td>
<td>Uses symbol successfully and explains how the correct answer was given</td>
<td>Uses materials to explain thinking with details or multiple ways</td>
<td>Uses abstract symbol process, yet incorrect in answer</td>
<td>Uses symbol successfully and explains how the correct answer was given</td>
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</tbody>
</table>
Appendix C

These are the T-charts used to support student materials with place value and coin value.

<table>
<thead>
<tr>
<th>Tens</th>
<th>Ones</th>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Coin</td>
<td>Value</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>Penny</td>
<td>1¢</td>
</tr>
<tr>
<td>Nickel</td>
<td>5¢</td>
</tr>
<tr>
<td>Dime</td>
<td>10¢</td>
</tr>
<tr>
<td>Quarter</td>
<td>25¢</td>
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</table>
Appendix D

Representational data for coin amounts. Store receipt sample as well.

<table>
<thead>
<tr>
<th>ScOp and Total</th>
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<tbody>
<tr>
<td>1. 28¢</td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
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<tr>
<td>6.</td>
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<tr>
<td>7.</td>
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<tr>
<td>8.</td>
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<tr>
<td>9.</td>
</tr>
<tr>
<td>10.</td>
</tr>
<tr>
<td>11.</td>
</tr>
</tbody>
</table>

Smartie School Store

<table>
<thead>
<tr>
<th>Dimes</th>
<th>Pennies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1¢</td>
</tr>
<tr>
<td></td>
<td>2¢</td>
</tr>
</tbody>
</table>

Cashier Name ___________________________