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Exploring mathematics Assessments

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Abstract
Students will take more than one type of assessment throughout their educational career. It is the teacher’s job to determine which type of assessment will help their students achieve success. The researcher believes that the state of Virginia has a limited amount of alternative assessments for students with special needs. She decided to investigate which types of assessments would be effective for her students. The children who participated in this study are students who receive special education and English as a Second or Other Language (ESOL) services. The researcher created several alternative mathematics assessments and administered them to four students during a three month period. The researcher found that students with special needs and ESOL services performed better on alternative assessments. These types of assessments allowed them to demonstrate their understanding of the topic being studied.

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Table of Contents

Introduction 3

Literature Review 4
  Types of Assessment 4
  Creating Effective Assessments 11
  What Teachers Say About Alternative Assessments? 12
  Testing/Accommodations 14
  Effective Test-Taking Strategies 15
  No Child Left Behind/Test Anxiety 19
  Summary 20

Methodology 21
  Participants 21
  Materials 21
  Procedure 22

Results 25

Discussion 28

Conclusion 31

References 32

Appendixes 36
Exploring Mathematics Assessments

Assessment drives instruction. Teachers develop curriculum and instruction based on students' understanding of content studied. In 2001, the No Child Left Behind Act was created. This act requires school districts to assess their students at various grade levels using one standardized type of assessment. If teachers are expected to modify and shape instruction to meet the individual needs of each student, how can one formulated assessment serve as the only reference of progress? This research project examines mathematics assessments and their effectiveness for all students. The researcher believes that there is a need for alternative assessments both at the state level and in the classroom. With little power to change state assessments, the researcher's goal is to examine how educators can create differentiated math assessments at the classroom level to meet the needs of all students. The research was conducted in a second grade inclusion classroom. The students that participated in this research project are students who receive special education and English as a Second or Other Language (ESOL) services. To conduct this research project, the researcher created several types of alternative assessments. She believes that alternative assessments will better assess the students' understanding of topics studied. She will also be able to adapt instruction based on how well the student does on the assessments. Some possible implications with this research project include: evidence of what the students understand will not be shown, the alternative assessments will not be effective, and even after conducting this research there is no one particular form of assessment that will work for all students. In order to be best informed, the researcher needs to collect and analyze a variety of sources.
Literature Review

Richard J. Stiggins (2005) defined assessment as the process of gathering evidence of student learning to inform instructional decisions. Assessment is an integral part of education. It allows teachers to develop curriculum that is appropriate based on students’ ability levels. The National Council of Teachers of Mathematics believed that assessment also helps educators identify ways to improve mathematics instruction, curriculum and children’s mathematics learning (National Council of Teachers of Mathematics, 1998). The goal of assessment is to create instruction that will benefit our students. Teachers should not use assessment as a means of grading students, but rather as a way to enhance both their desire to learn and their achievement (Stiggins, 2005). Assessment is an ongoing process that determines what the student understands. This literature review will explore the different aspects of assessment. It will look at the different types of assessments, how teachers can create effective assessments, test-taking strategies for students, and the benefits to using alternative assessments.

Types of assessment

It takes more than one form of assessment, or more than one tool, to gauge individual learning (Chapman & King, 2005). That it is why it is important to offer a variety of assessments. According to Chapman and King (2005), traditional assessments include those that involve paper and pencil, short answers, multiple choice questions, have specific time limits, reflects recall ability, and can be administered and graded quickly. These types of tests do not reflect the students’ ability to perform tasks. Rather they test isolated facts, definitions, and procedures (Woodward, Monroe, & Baxter, 2001). “Tests are important qualitative assessment tools, but in and of themselves do not constitute the
assessment techniques make it difficult to develop inferences about children’s learning,
and consequently new ideas about how to improve children’s learning are less likely.
Walker and Schmidt (2004) agreed since they claimed that paper and pencil tests focus
on recall and rote memorization instead of promoting thinking skills. Walker and
Schmidt (2004) admit that paper and pencil tests created by teachers are the most
common forms of assessment and the easiest to manage and generate data. But it is
important to remember that assessment should inform instruction as well as support
students in becoming successful learners.

Chapman and King (2005) defined authentic assessment as activities that give
learners opportunities to use information or skills in realistic situations. An authentic
assessment helps students to stimulate life experiences and allows them to apply what
they learned. Authentic assessments are hands-on activities. They apply knowledge to
real-life situations. Authentic assessments involve multiple skills in a single task. They
can be ongoing and last throughout a unit of study. Authentic assessments are important
because they reflect growth in a skill or ability over time (Chapman & King, 2005).

Alternative assessment is a type of authentic assessment. Adams (1998) stated that
alternative assessment techniques provide a more comprehensive picture of the learner,
and provide more authentic information about the learner, than do traditional assessment
techniques, which provide little information about children’s understanding and learning.
Kulm (1990), Resnick & Resnick (1992), and Romberg (1995) agreed with Adams and
believed that alternative assessments offer a variety of avenues for documenting
substantive mathematical understanding, while at the same time support and reinforce
changes in classroom instruction. The National Council of Teachers of Mathematics
described how teachers can focus on getting students to make connections between
mathematics and the real world, reason and communicate mathematically, and value
to happen. Cooney, Bell, Fisher-Cauble, and Sanchez (1996) believed the intent of
alternative assessment is to encourage students to think more deeply about the
mathematics they are learning and teachers should use it as a valuable tool for revising
and redirecting their teaching when necessary.

Alternative assessments include portfolios, performance tasks, observations, journals,
interviews/conversations, self-assessments, and surveys. These types of assessments
allow students to demonstrate their knowledge of content being presented. Stiggins
(2005) stated that the great strength of alternative assessments lies in its ability to provide
a dependable means of evaluating skills as students are doing the things that reflect forms
of achievement. Observing students in action can be a rich and useful source of
information about their attainment of very important forms of skill achievement. Adams
(1998) took this one step further in saying that teachers can use the authentic assessment
information we collect to provide authentic curriculum and instruction.

Portfolios allow the student to display a collection of work. They can showcase both
exceptional and non-exceptional work. This helps to illustrate the students’ growth over
221). Believe it or not portfolios can be used in mathematics. For example during a
geometry unit a student can create a collection of geometric shapes and go on to explain
what he or she has learned during the unit. According to Stiggins (2005) portfolios
contain details in the form of examples of student work with student reflections on the quality of that work. He believed that portfolios allow teachers to develop a clear view of the student’s growth and current needs. Portfolios allow teachers to get to know the students as individuals rather than part of a group. Stiggins found that the benefits of portfolios include:

- Track student achievement over time to reveal improvement or the lack thereof.
- Afford students an excellent context within which to take responsibility for maintaining and tracking their own files and records of achievement.
- Helps students to learn to reflect on and see their own improvement as achievers.
- Document student attainment of required district or state standards in an assessment of learning context (p. 322).

There are many benefits to using portfolios but there can also be some drawbacks. Teachers assessing the portfolios may be biased so rubrics must be developed to avoid this situation. It is also difficult to manage student portfolios if you do not have an organized system. Overall, portfolios benefit both the student and teacher because it allows everyone to see how the student has grown.

Performance assessments include timelines, brochures, skits, songs, poems, and displays (Chapman & King, 2005). Performance assessment tasks generally require students to solve complex problem(s) and communicate how they derived their answer(s) or justify why their answer(s) is correct (Woodward et al., 2001). They can provide a means of assessing student reasoning and problem-solving proficiency (Stiggins, 2005). Performance assessments allow students to develop products that can demonstrate their understanding of content. Performance assessments are scored based on rubrics created
by the teacher. Woodward et al. (2001) believed that performance assessments can be effective in helping students with learning disabilities by improving their strategic knowledge, allowing student interactions, and creating teacher directed discussions in the classroom.

An observation is another alternative assessment. Teachers can observe students in action and record anecdotal notes about what they see the students doing. Adams (1998) suggested that teachers observe with a specific goal in mind. Remember that students do not need to be observed every day. It is important to focus on one child at a time. Through observations, teachers can assess children’s abilities to communicate mathematically, apply mathematics concepts and skills, solve problems and work with others (Adams, 1998).

Journals, interviews, and conversations are alternative assessments that involve communication between the student and teacher. Journals provide students an opportunity to reflect on their own capabilities, attitudes and dispositions, and for evaluating their ability to communicate mathematically through writing (Adams, 1998). It is important for teachers to develop a purpose for journal writing or it will not be an authentic experience for students. Journals give teachers an opportunity to communicate with students through a series of letters back and forth. Teachers can also allow their students to share their journals.

Teachers can assess children’s cognitive and affective development through interviews (Adams, 1998). Teachers create open-ended questions, which allow students to demonstrate mathematical concepts and skills by discussing what they learned. Communication is an effective form of assessment because it gives the students an
opportunity to explain their understanding of mathematics. In mathematics, students have to explain how they solved a problem. It is particularly important for students with limited English proficiency to describe how they solved a problem to increase their mathematics vocabulary. Communicating about mathematics is a daily task. We talk about the weather, sports scores, and the stock market in the real world all the time. When students realize the importance of communicating mathematically it becomes a more authentic experience for them.

The use of self-assessment has increased in the classroom. Doud (1998) stated that it is now well-accepted that the ability to assess one’s own work is an important element in most forms of learning and that it is an ability which must be cultivated if learners are to engage effectively in lifelong learning. Goh (2004) agreed saying that self-assessment helps students play an active role in determining what will be assessed and evaluate their own work. Using self-assessment in the classroom can be very effective. It takes time and practice for students to understand what to look for when assessing their work. The teacher should provide a rubric or a list of criteria the students should be looking for. Adams (1998) suggested that self-assessment works better in a classroom where students are not afraid to take risks and expose their errors. Self-assessment helps to foster a community of learners where taking risks is a good thing.

Surveys allow teachers and students to collect information. Teachers can collect information about student’s mathematical dispositions, attitudes, efficacy, and anxieties (Adams, 1998). The survey can help determine the misconceptions students might have about mathematic concepts.
It is important to remember the goal of alternative assessment is to provide a more direct and authentic measure of student learning and progress than do standardized tests (Goh, 2004). Worthern (1993) agreed with Goh and stated that teachers want their students to demonstrate what they know and what they can do with their knowledge.

**Creating Effective Assessments**

Any technique that is used to assess children’s mathematics learning should reflect the goals and objectives of curriculum and instruction (Adams, 1998). In order to create an effective assessment, teachers need to make sure that tests are valid and reliable. For an assessment to be valid, its results must serve a purpose. Reliability means that an assessment can be given over and over again and the results will stay the same (Stiggins, 2005). Wilson (2004) stated that assessment must give us valid information for decision making. Paying attention to the wording, format, or presentation of a test question may make a major difference for students. That is why when teachers create an assessment, they must keep the students in mind. Teachers should administer assessments that are at the students’ ability level. According to Chapman and King (2005), effective teacher tests show the following:

- The students’ strengths and needs
- The skills or concepts the learner needs to learn next
- Misconceptions that require reteaching or more background
- How the student is processing information
- The learner’s interpretations (p. 126)

When teachers are creating assessments they need to think about what is being asked. Teachers need to think about what they want the students to understand at the end of the
unit. Wilson (2004) encouraged teachers to make small alterations to the wording or the testing conditions in order to increase the accuracy of what we learn about student understanding. This gives teachers a more accurate picture of what the students know. When developing assessments, Walker and Schmidt (2004) suggested asking the following questions: what do students need to know, what do students need to be able to think about, and what do students need to demonstrate? By beginning with the end in mind, teachers can identify essential skills and goals for what they want the students to understand at the end of a unit of study (Walker & Schmidt, 2004).

According to Walker and Schmidt (2004), teachers should match assessment tasks to the purpose and context of instruction. Tasks should relate directly to the goals of instruction and incorporate content and activities that have been part of the classroom instruction. Walker and Schmidt agreed with Chapman and King that assessments should allow students to clearly demonstrate their knowledge, skills, and attitudes (Walker & Schmidt, 2004).

What Teachers Say About Alternative Assessments?

There are many justifications for the use of alternative assessments. They allow students to discuss mathematics and apply their knowledge. Teachers develop a better understanding of what their students know mathematically. Even with the positive outcomes, there are still some teachers who are hesitant to use alternative assessments. Cooney et al. (1996) discusses how alternative assessments place additional burdens on teachers in terms of planning for instruction and assessing students' performances. Teachers have the following issues with alternative assessments: A loss of predictability
in the classroom, content coverage, familiarizing students with teacher’s expectations, and dealing with increased demands of time (Cooney et al., 1996).

Teachers who are set in an organized routine do not like the unpredictability of alternative assessment. The climate of the classroom does not change drastically with the use of alternative assessment. In fact, one teacher commented that becoming involved in alternative assessment has allowed her to let go of always requiring a particular answer and of making the students “practice a million problems” because she knows that as students work with a particular topic, they will get practice “where it is needed” (Cooney et al., 1996, p. 484). Some teachers fear that the elimination of drill and practice will limit the amount of mathematics content taught. There is no evidence to support this misconception. A major concern for students and teachers is the grading policy. If teachers describe their expectations ahead of time, students will be able to focus on what is being assessed. Walker and Schmidt (2004) believed teachers should make time to discuss with students both the purpose of specific assessment tasks and how the information these tasks generate can be used.

It is important for teachers to begin small when creating alternative assessments. Try not to take on too much at one time. If you start off developing one type of alternative assessment the demands of time will not seem so overwhelming (Cooney et al., 1996). Another suggestion from Cooney et al. (1996) is to discuss with colleagues what is working and what is not. Teachers will benefit from hearing what others are trying. Despite all the reservations and the demands placed on their time, teachers see a value in alternative assessment that goes beyond the benefit to their students (Cooney et al., 1996).
Testing Accommodations

Many students with disabilities may struggle to access test content unless accommodations are provided (Bolt & Thurlow, 2006). An accommodation is any change in standard test administration procedures that are intended to remove the associated construct-irrelevant variance (i.e., variance with extraneous features of test administration) for students with disabilities (Fuchs, Fuchs, Eaton, Hamlett, & Kams, 2000). According to Hollenback (2002), accommodations are those that (a) involve a change to standard procedures that promote access for students to demonstrate knowledge, (b) do not change the assessment construct, and (c) provide differentiated access. Calhoon, Fuchs, and Hamlett (2000) stated that the goal of assessments should reflect students' achievement rather than their disability; therefore, test accommodations should be made if a student's disability will impact performance in ways that invalidate the score.

The law states that students who have an Individualized Education Program (IEP) are required to receive accommodations on state level and classroom level assessments. In the end, the IEP should be the source of information on the accommodations or modifications necessary for the student to succeed (Ketterlin-Geller, Alonzo, Braun-Monegan, & Tindal, 2007). According to NCLB, students with disabilities are required to participate in tests to the fullest extent possible (Fuchs, Fuchs, & Capizzi, 2005). Students who receive special education services can have a variety of accommodations for mathematics assessments. These include: extended time, group size, environmental modifications, large print test, assistance with directions, reading in English of test items, use of Braille, interpreting (e.g., cued speech, signing) test items, math aids (e.g.,
manipulatives), opportunity to respond orally, and use of a calculator. Providing extra
time has increased students' scores on standardized tests (Fuchs et al., 2005). Not only
has it benefited students with learning disabilities, it has also benefited students without
disabilities. Some studies have shown an improvement in standardized mathematics test
scores in students who received extra time. The read aloud accommodation is one of the
most commonly allowed accommodations on statewide math assessments (Clapper,
Morse, Lazarus, Thompson, & Thurlow, 2005). The effects of the read aloud
accommodation has yet to be determined. There has been an increase in student success
when the test is present orally to students with and without disabilities (Fuchs et al.,
2005). Many believe that it depends on the student and their specific needs. It is
important to remember that test accommodations play a critical role in enabling students
with disabilities to meaningfully participate and demonstrate their skills and knowledge
on tests (Ketterlin-Geller et al., 2007).

**Effective Test-Taking Strategies**

Students are unique individuals. Some students are able to process important
information and put it into their working memories, while others cannot. Teachers want
their students to transfer new knowledge and apply it both at school and in real-world
situations. To do this, teachers need to make learning meaningful and hold students
accountable for what they have learned (Chapman & King, 2005). Wilson (2004) would
agree with Chapman and King. She stated that many children lack the language skills
that are necessary to make sense of standardized test questions. She believed that
language is an issue for many students and for others the issue is that the format of the
test question limits the way they can respond and therefore interferes with their ability to access the mathematics.

In order for students with disabilities and English as a Second or Other Language (ESOL) to be successful when taking mathematics assessments, they need to be taught effective problem-solving strategies. In 1989, the National Council of Mathematics identified five mathematics goals for all students, including (a) learning to value mathematics, (b) developing confidence in one's mathematical ability, (c) becoming mathematical problem solvers, (d) learning to communicate mathematically, and (e) learning to reason mathematically. Mastropieri, Scruggs, and Shiah (1991) stated that research indicates that students with mild disabilities often fail to demonstrate mastery of basic mathematical skills. Instruction for students with mild disabilities has focused on mastery of basic math facts and computation skills rather than teaching problem solving and math processing skills (Miller & Mercer, 1993). Research has suggested teaching students how to solve mathematical problems can help them develop their computational and mathematics reasoning skills (deBettencourt, Putnam, & Leinhart, 1993; NCTM, 1989). Teachers want their students to make sense of the problem using a variety of strategies (Behrend, 2003).

NCTM suggested several strategies to help students become effective problem solvers. Connecting mathematics to real-world situations gives the student a purpose for solving problems. Associating mathematical concepts and skills to everyday situations can help motivate students to learn concepts while encouraging active, purposeful learning (Salend & Hofstetter, 1996). Lovin, Kyger, & Allsopp (2004) suggested helping students connect the old with the new can be accomplished through structured
discussions in which both the teacher and the students engage in reasoning and communication. Using visuals allows students to visualize mathematics ideas, concepts, and solutions (Salend & Hofstetter, 1996). This is especially important for ESOL students who may not have the vocabulary necessary to understand the problem. Teachers need to encourage students to draw pictures to help solve a math problem in class, on homework, and on assessments. Another effective strategy is the use of manipulatives. Manipulatives can assist students in learning math concepts of varying degrees of difficulty by introducing these concepts in a nontaxing problem-solving approach that makes the connection between mathematics and their everyday lives (Salend and Hofstetter, 1996). Manipulatives allow students to have something concrete in their hands that they can manipulate to help with problem solving. Students who receive special education and ESOL services also benefit from peer-tutoring. Grouping students in a heterogeneous group provides students the opportunity to learn from their peers rather than just an adult. Students often have a better understanding of how to explain a mathematics problem to a peer. Peer-tutoring allows students to understand multiple perspectives and solutions to mathematical problems and encourage students to appreciate that mathematical problems can be solved and approached in different ways (Salend and Hofstetter, 1996).

Language is an important aspect of mathematical literacy and provides students with a framework for solving problems (Salend and Hofstetter, 1996). Bray (2005) stated that “we want students to feel confident about mathematics as a language, as a way of communicating to other people about ideas and problems and their own thinking” (p. 324). Students who can communicate using mathematical language are better able to
construct and share their understanding of mathematics (Salend & Hofstetter, 1996). Moore (1995) believed that communication of math knowledge is vital. She said "that today's forms of alternative assessments call for the communication of math knowledge" (p. 50). Not only do students have to be able to solve the problem, they must be able to explain how they arrived at the answer and why the answer is correct. Moore has begun to use oral and written communication in her math instruction. She feels it helps students feel more comfortable with math language. Some ideas she uses includes reading literature about mathematics, playing games, writing math stories, oral explanations and using math journals (Moore, 1995).

Another group of teachers has taken teaching the language of mathematics one step further. DiGisi and Fleming are literacy specialists who work in a school with a high population of ESOL students. They decided to collaborate with the mathematics teachers to develop a way to teach mathematics language. During their research DiGisi and Fleming (2005) determined that students need to read and understand three types of vocabulary: math vocabulary (e.g., square yard, circumference, symmetry, integers), procedural vocabulary that tells students what to do (e.g., sketch a graph, explain, calculate, show your work), and descriptive vocabulary that test writers use to provide the context for math problems (e.g., installation, granola bars, cinnamon, amusement park). DiGisi and Fleming recognized the importance of teaching the mathematics vocabulary prior to using it in instruction. They also provided students with strategies for reading the questions and identifying what they need to do. DiGisi and Fleming (2005) taught the students to read the questions at least twice so they understood what was being asked.
They found that by teaching students the mathematics language the students' confidence and motivation increased.

**No Child Left Behind and Test Anxiety**

Recently there has been a lot more pressure placed on students and teachers to meet the requirements of the No Child Left Behind Act. States are now requiring that all students meet higher standards of success and achievement. This new act has played a vital role in determining whether students are learning (Ryan, Ryan, Arbuthnot, & Samuels, 2007). With this added pressure teachers are now investigating what kind of anxiety it places on the students. School districts use the standardized high-stakes testing to determine if a student will move on to the next grade or graduate. Students in grades 3-8 are experiencing state tests on a yearly basis. Subsequently, No Child Left Behind (NCLB) has become the focus of teaching and learning in public schools throughout the United States (Toch, 2006). Unfortunately many schools feel the pressure to make Adequate Yearly Progress (AYP). If a school does not meet the requirements of AYP they face a loss of students and funding. For example, schools in the Title I program that do not meet the federal accountability standard for two consecutive years must allow parents a choice of sending their child to a school that made AYP (Mellott, 2006).

It was released early in the fall of 2006 that the United States Department of Education would not allow schools to use the Stanford English Language Proficiency test for students with limited English skills (Mellott, 2006). The state of Virginia had to make a big decision on the best way to assess their students with limited English proficiency according to state standards. The state decided to use the Virginia Grade Level Assessment. The teachers create a portfolio of students’ work based on the
Virginia Standards of Learning (SOL’s). In the beginning, many teachers felt it was time consuming. "It is a tremendous amount of work and it's a tremendous cost to the division (p. 1)," said special education teacher, Cindy Pletke, as cited in McCallum (2007). Pletke's school created sixty-three binders during a six-month assessment period. Despite how time consuming the portfolios may have been, they helped the school make AYP. McCallum (2007) stated "for learning-disabled students, the alternatives can be tremendously important" (p. 2). A principal at Rustburg Middle School agreed. Richard Burge commented that "placing a student in front of a computer and asking him or her to remember everything they have learned since the beginning of the school year is difficult" (McCallum, 2007, p. 2). "Teachers stay committed because the work is in the best interest of their students", according to Burge (McCallum, 2007, p. 2). This is just proof of how effective alternative assessments can be for students with disabilities.

Summary

Today's standards are more demanding of teachers and students. In any given classroom teachers are educating students who receive a variety of services which include special education, gifted and talented, speech and language, and students who require ESOL (English as a Second or Other Language). Research has shown that it is more important now than ever for teachers to differentiate instruction and assessments based on the students' needs and abilities in the classroom. Teachers need to remember when creating assessments variety is essential. By creating individualized assessments, teachers can engage and motivate students to become more successful learners and thinkers (Walker & Schmidt, 2004).
Methodology

Differentiating curriculum to meet the needs of all students is an essential part of a teacher’s job. One area that has put more pressure on teachers in recent years is assessment. States are now requiring that all students meet higher standards of success and achievement. The No Child Left Behind Act has undoubtedly contributed to these pressures.

If teachers are expected to modify and shape instruction to meet the individual needs of each student, how can one formulated assessment serve as the only reference of progress? This question has plagued the researcher as a teacher of students with special needs. The researcher seen growth in her students during the school year; however, this growth is not evident in the scores they receive on state assessments.

There is a need for alternative assessments both at the state level and in the classroom. With little power to change state assessments, the researcher’s goal is to determine how educators can create differentiated math assessments at the classroom level to meet the needs of all students. This study is an attempt to address these issues in the classroom.

Participants

To understand what assessments are effective for all students, the researcher will assess twenty students from a second grade classroom. The researcher is a special education teacher who co-teaches in this inclusion classroom on a daily basis. The classroom is located at a Title I elementary school in Annandale, Virginia. The students in this class are seven and eight years old. There are eight boys and twelve girls. The population of this class includes Caucasians, Hispanics, Vietnamese, and Somalia
students. There are two students receiving special education services under the
categories of Autism and Other Health Impairment. There are also eighteen students
receiving English as a Second or Other Language services.

The students in this class are eager learners. Despite any difficulties they may face,
they are determined to succeed. They all have a positive attitude towards mathematics.
The students are respectful of their teachers and their classmates. They embrace their
diversity and each other’s cultures.

Materials

The materials needed to conduct the research included math manipulatives (base 10
blocks, coins, hundreds chart, number line, rulers, etc.), assessments created by the
researcher (such as performance assessments, reflections, written assessment, and
observations), and the Everyday Math curriculum created by McGraw-Hill.

The researcher created various types of mathematics assessments. The assessments
were created based on the students’ ability levels, Virginia Standards of Learning for
second grade and the curriculum taught using the Everyday Counts mathematics
program. As an informal assessment, the researcher used observations. Each day, during
mathematics instruction which lasted approximately one hour, the researcher took
anecdotal notes in a notebook to monitor student progress and focus instruction. Based
on the anecdotal notes taken, the researcher knew if the topic had to be revisited or if the
students were ready to move on to the next topic. The researcher also created
paper/pencil assessments that included pictures and graphics (see Appendix A and
Appendix B). Performance assessments and rubrics were created to assess students
understanding of coins and place value (see Appendix C and Appendix D).
Procedure

The students were assessed in their regular classroom in a small group. These particular students were selected because they are currently having the most difficulty with the second grade mathematics curriculum. The students sat at their seats and had dividers up in order to ensure they were completing their own work. During the paper/pencil assessments, the researcher read the test out loud to the students. She monitored the students’ progress and wrote anecdotal notes about what she observed. For the performance assessment, the student was tested individually with the researcher. They sat in a quiet area of the room. The researcher asked the following questions:

- Using the number 246, what number is in the hundreds place, tens place, and ones place?
- Please use the flats, longs, and cubes (100’s, 10’s and 1’s) to demonstrate the following numbers: 350, 476, and 124.
- Using the flats, longs, and cubes (100’s, 10’s and 1’s) to create a number and read it out loud to me.
- What is the value of a penny, nickel, dime, and quarter?
- Using the money manipulatives, please make 22 cents, 43 cents, and 36 cents.

The students used the manipulatives to answer the questions. During the performance assessment, the students were able to talk out loud about their problem solving strategies. The researcher wrote anecdotal notes about what the students were doing to solve the problems and demonstrate their understanding of place value and counting coins. The students participated in all assessments with appropriate testing accommodations. These
accommodations included the use of manipulatives (i.e. 100's chart, coins, clocks, and counting cubes), extended time, small group administration, and tests read aloud.

The assessments created by the researcher helped to determine what type of assessments have the most positive impact on her students. To determine positive impact, the researcher analyzed the assessments given. If the students did well on the assessments i.e. by passing the assessment and demonstrated their understanding of topics taught, then the researcher knew the assessments were effective. If the students did poorly, it was an indication to make changes. The researcher also met with the students on a daily basis during math instruction and made observations to improve classroom learning.

In this inclusion classroom, the classroom teacher normally develops the assessments, but they are not differentiated to meet the needs of the students. In the past every student received the same test. The researcher is going to help in the development of math assessments as well as differentiate the assessments based on the needs in the classroom. This does not change what regularly occurs in the classroom because the students will still be assessed using classroom accommodations.
Results

The researcher collected data during a three-month period in a second grade inclusion classroom. This classroom has a diverse group of learners, including four students who receive special education and ESOL services with whom the researcher worked primarily. The assessments that were created were differentiated based on the students’ abilities levels. This particular group of students was all performing below grade level. When the students receiving special education services were given a paper and pencil test that was modified based on their ability levels, they passed satisfactorily. These students received classroom testing accommodations (i.e., the test read aloud to them) and used manipulatives. The researcher created paper and pencil assessments that included pictures and graphics similar to the ones used in the students’ math workbooks. When the students were completing the test, the researcher also took anecdotal notes. Based on her observations, she saw the students using their math strategies and manipulatives correctly. The students were using the 100’s chart to skip count by fives and tens. They were also using the hundreds chart to help them add two-digit numbers. The students successfully completed the paper and pencil test using the strategies they were taught.

Unfortunately, the student receiving ESOL services did not pass the paper and pencil tests satisfactorily. This student does not understand the difference between the two operations. Even after many individual work sessions with this student, she can not verbally state which operation to use to solve problems. One possible reason for this is the vocabulary used on the paper and pencil assessment might have been too difficult for the student to understand. This student is currently being evaluated for special education services.
When the students were given a paper and pencil test that was not differentiated based on their ability levels, they did not pass satisfactorily. During the researcher’s observations, she saw the students struggling to problem solve. One student was even quoted saying, “This is too hard.” He did not want to put forth any effort to complete the assessment. In fact, he stopped taking the test when he reached his frustration level. The students were having difficulty taking the test, which shows how effective differentiated assessments can be for students who receive special education and ESOL services.

Another type of assessment the researcher created was a performance assessment. This assessment tested the students’ knowledge about place value and coin value. A rubric was created to assess the students’ understanding. For the first part of the assessment, the students had to identify the one’s, ten’s, and hundred’s place. They then had to use manipulatives to create a three-digit number using the correct place value for the numbers given. Three out of the four students were able to do this successfully without any adult support. The fourth student needed minimal support in order to pass this assessment. For the second part of the assessment, the researcher asked the students to identify a penny, nickel, dime and quarter and their values. Then using play money the students had to create change based on a number given to them by the researcher. Only two out of four students were able to correctly identify the coins and their values. When asked to create change, only one of the students was successful. Based on this performance assessment, the researcher knew what still needed to be taught in order for the students to fully understand coins and their values. The researcher also found it beneficial to conduct this performance assessment because it allowed her to assess each student individually. The students were able to think out loud and explain their problem
solving steps. One student asked, “Can I think for a minute?” She then proceeded to count out loud on her fingers to figure out the problem. The researcher was able to determine what strategies were effective for her students to use when making change. The informal observations conducted throughout the three month period helped to drive instruction. Based on the test scores, the students did better when they received testing accommodations, a differentiated assessment and used manipulatives.
Discussion

Educators today face many challenges in the classroom. They have to develop a community of learners that include a wide range of needs. After researching what types of math assessments benefit all students, the researcher has concluded that students perform better on assessments that are differentiated based on their ability levels. The students she worked with showed an improvement in their understanding when assessments were differentiated. These differentiated assessments allowed the students to demonstrate what they understand about the math topics being studied. Worthen (2003) would agree with this and believed that teachers want their students to demonstrate what they know and what they can do with their knowledge. That is the ultimate goal of assessment.

There are benefits to using differentiated alternative assessments. These types of assessments give the teacher a more accurate picture of what the student can and cannot do. This allows teachers to modify instruction based on how the students perform on the assessments given. The researcher would agree that she saw how alternative assessments benefit her students. They seemed more motivated and did not look at assessment as something that is scary and difficult. Her students were more confident about their performance and willing to share the strategies they used to solve problems.

There are also some disadvantages to using alternative assessments. When the researcher was creating the assessments and giving them to the students, she realized how much time was involved in the whole process. It was difficult for her to test each student individually. To test a class of twenty students could take days and she did not know what to do with the other students during the assessment time. The researcher...
determined that assessing students using performance assessments all the time would not be a good idea. Having a mixture of assessments is a better approach. Cooney et al. (1996) discussed how alternative assessments place additional burdens on teachers in terms of planning for instruction and assessing students’ performances. Some teachers had difficulty dealing with increased demands of time and content coverage. Walker and Schmidt (2004) disagreed with this statement. They believed that teachers should make time to discuss with students both the purpose of specific assessment tasks and how the information these tasks generate can be used (Walker & Schmidt, 2004). The research conducted supports this statement. If teachers set clear expectations the students will do what is expected of them while the teacher is assessing other students. If the classroom is running smoothly, it allows for the teacher and a student to have individual work time. This will give the teacher more flexibility when creating assessments.

The researcher also saw an opportunity to have richer group discussions with the class when using alternative assessments. The students were not afraid to take risks and discussed different problem solving strategies. It was exciting to see students teaching their peers different ways they can solve math problems. Alternative assessments allow students to solve problems in different ways that are successful for them.

When creating alternative assessments Cooney et al. (1996) suggested starting off small. The research conducted supports this approach and recommends that teachers pick one subject area at a time. Research suggests that teachers become familiar with a variety of assessments that are effective for each student: there is no “one size fits all.” After mastering one subject area, students can take what they have learned and use it in other subject areas. Assessment is an ongoing process for both teachers and students.
Conclusion

This research project provided information about why differentiating math assessments is so beneficial for students and teachers. It is beneficial for students because they get to complete assessments that are designed for them to show what they understand. For teachers, using differentiated math assessments give a more accurate picture about their students. Using differentiated assessments also help teachers to create instruction based on various ability levels. The researcher found that teachers need to differentiate math assessments in order for students who receive special education and ESOL services to be successful in school.

The researcher would like to research different ways school districts and states could create effective standardized assessments. She believes if enough teachers voice their opinions about the need for differentiated assessments at the state level, then something will be changed to benefit all students. Educators need to remember to keep the child’s best interest in mind. Are students really getting any value out of taking these standardized assessments? Are educators getting an accurate picture of the students’ abilities when everyone receives the same state test?
References


Math Test Unit 2

1. Write the fact family:

```
    +   +   +   -
```

2. Write 5 ways to make the number 6

```
6
```

3. Use the rule to complete the frames

```
+ 5
```

```
10 25
```
4. Find the rule and finish the table

<table>
<thead>
<tr>
<th>In</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

5. Use the rule to complete the table.

Rule: +10

<table>
<thead>
<tr>
<th>In</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>55</td>
</tr>
</tbody>
</table>

Add and Subtract
(Remember to use your strategies!)

6. $3 + 1 = \underline{\phantom{0}}$

7. $0 + 9 = \underline{\phantom{0}}$

8. $4 + 5$

9. $3 + 5$
Add and Subtract
(Remember to use your strategies!)

10. $7 + 7 = \underline{\hspace{2cm}}$

11. $7 - 0 = \underline{\hspace{2cm}}$

12. $9 + 4 = \underline{\hspace{2cm}}$

13. $\underline{\hspace{2cm}} = 11 + 1$

$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

14. $6 + 7 = \underline{\hspace{2cm}}$

15. $7 - 4 = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

16. $5 + 4 = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

Write the fact family for the numbers:

8, 14, 6

$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$
Unit 3 Math Test

1. Make 27¢ 3 different ways. Use P N D and Q

   A. 
   B. 
   C. 

2. How much is 3 Q (quarters) worth?
   a. 25¢  
   b. 35¢  
   c. 75¢  
   d. 80¢  

3. Match the coins with their value
   Nickel 25 cents
   Dime 1 cent
   Penny 5 cents
   Quarter 10 cents

4. Add the coins
   D N N P P
   _______¢

5. Add the coins
   Q D N P P
   _______¢
6. Write the time

- 10:00
- 11:15
- 12:30

7. Draw the hands to show the time

- 10:30
- 11:45
- 12:00

8. Write the number

- 795

9. There are ______ hundreds.
There are ______ tens.
There are ______ ones.
10. Fill in the frames

**Rule**
Subtract 10

<table>
<thead>
<tr>
<th>55</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

**Rule**
Add 4

<table>
<thead>
<tr>
<th>43</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

11. Fill in the frames

**Rule**
Add 10¢

<table>
<thead>
<tr>
<th>25¢</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>65¢</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

13. Write the fact family using these numbers: 2, 9, 11

______ + ______ = ______

______ - ______ = ______

______ + ______ = ______

______ - ______ = ______
## Ones, Tens, Hundreds Place Value

**Student Name:**

**Date:**

<table>
<thead>
<tr>
<th>Category</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying Place Value</td>
<td>The student can correctly identify the ones, tens, and hundreds place in a 3-digit number.</td>
<td>The student can correctly identify 2 out of 3 (ones, tens, hundreds) place values in a 3-digit number.</td>
<td>The student can correctly identify 1 out of 3 (ones, tens, hundreds) place values in a 3-digit number.</td>
<td>The student cannot correctly identify the place values of a 3-digit number.</td>
</tr>
<tr>
<td>Drawing cubes, longs, and flats</td>
<td>Given a number, the student can draw the correct amount of cubes (ones), longs (tens), and flats (hundreds).</td>
<td>Given a number, the student can draw the correct amount of cubes (ones), longs (tens), OR flats (hundreds).</td>
<td>Given a number, the student can draw the correct amount of cubes, longs, and flats with teacher support.</td>
<td>Given a number, the student cannot draw the correct amount of cubes, longs, and flats.</td>
</tr>
<tr>
<td>Using a picture (cubes, longs, and flats) to create a 3-digit number</td>
<td>The student can correctly use a picture to put the numbers in the ones, tens, or hundreds place.</td>
<td>The student needed minimal help to correctly put the numbers in the ones, tens, or hundreds place.</td>
<td>The student needed support to correctly put the numbers in the ones, tens, or hundreds place.</td>
<td>The student cannot correctly use a picture to put the numbers in the ones, tens, or hundreds place.</td>
</tr>
</tbody>
</table>

**Student Observations:**
### Calculating Coin Value Up to $1.00

**Student Name:**

**Date:**

<table>
<thead>
<tr>
<th>Category</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying coins and their values</td>
<td>The student can correctly identify all coins and their values, penny-1 cent nickel-5 cents dime-10 cents quarter-25.</td>
<td>The student can correctly identify 3 out of 4 coins and their values, penny-1 cent nickel-5 cents dime-10 cents quarter-25.</td>
<td>The student can correctly identify 2 out of 4 coins and their values, penny-1 cent nickel-5 cents dime-10 cents quarter-25.</td>
<td>The student can correctly identify 1 out of 4 coins and their values, penny-1 cent nickel-5 cents dime-10 cents.</td>
</tr>
<tr>
<td>Can use coins to create change</td>
<td>The student can correctly use coins to create amounts of money under $1.00.</td>
<td>The student can correctly use coins to create amounts of money under $1.00 with minimal teacher support.</td>
<td>The student can correctly use coins to create amounts of money under $1.00 with teacher support.</td>
<td>The student cannot correctly use coins to create amounts of money under $1.00.</td>
</tr>
</tbody>
</table>

**Student Observations:**

---

---

---
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number 1</td>
<td>The student can identify the place value of 2-digit numbers in the context of a problem.</td>
</tr>
<tr>
<td>Number 2</td>
<td>The student can identify the place value of 3-digit numbers in the context of a problem.</td>
</tr>
<tr>
<td>Number 3</td>
<td>The student can use the Hundreds, Tens, and Ones Place Value Table to solve problems.</td>
</tr>
</tbody>
</table>

**Date:** 10/2/07

**Teacher Name:** Ms. Braze
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Solving: Ones, Tens, Hundreds Place Value</strong></td>
<td></td>
</tr>
</tbody>
</table>

- The student needs to correctly use a picture to solve the problem.
- The student needs to correctly draw the exercises (hundreds)
- The student needs to correctly draw the exercises (tens)
- The student needs to correctly draw the exercises (ones)
- The student can draw the exercises (hundreds)
- The student can draw the exercises (tens)
- The student can draw the exercises (ones)

Teacher Name: [Name]
Date: [Date]
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The student can count a group of objects.</td>
</tr>
</tbody>
</table>

**Teacher Name:** Janie...

**Date:** 1/2/07

---

**Math - Problem Solving:** Ones, Tens, Hundreds Place Value
<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Problem Solving: Ones, Tens, Hundreds Place Value</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>The student can match the model with accurate support.</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>The student can draw a circle in the hundreds place.</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>The student can complete and solve the number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The student can draw a circle in the tens place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The student can draw a circle in the ones place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The student can complete and solve the number.</td>
</tr>
</tbody>
</table>

Date: 3/4/2017
Teacher Name: Mr. Barr
Appendix E

Anecdotal Notes from Performance Assessment
10/2/2007

Student-J.D.
- Use manipulatives to model numbers
- Correctly identified coins and their values
- Can use the coins to create exact change-48 cents and 24 cents

Student-C.R.
- When asked to explain, CR had difficulty with his words
- Counting money (coins) out loud as he is creating 24 cents
- Used dimes as nickels
- Continued to call nickels dimes
- Trouble skip counting using 5’s
  - For example 25 5 5 5 ...
  - Q N N N

Student-D.C.
- Talking out loud when modeling 3-digit numbers
  - “Three ones, four tens, two hundreds.”
- Talking out loud when identifying coins
  - “This one might be a...” “What do you call 5 cents?”
- Picks smallest coin amount first-pennies
- Counting coins out loud
- Skip counting 10-20-30-40-41-42-43...
- Made 25 cents instead of 24 cents even though she was counting out loud
- Using pennies instead of nickels
- Cannot identify nickels and their value
- Trouble skip counting in the end

Student-A.L.
- Using manipulatives
- Stacking manipulatives
- Counting out loud
- Checking the number written down with the manipulatives she has used
- Guessing the coins she needs to use
  - “Can I think for a minute?”
  - Proceeded to count out loud on her fingers
- Skip counting out loud 10-11-12-13
Appendix F

Anecdotal Notes-Chapter 3 Math Test
11/7/2007

- Students cannot correctly count coins up to 50 cents
- Students still struggling with frames and arrows
- J.D. could not tell me the difference between addition and subtraction
  - She thinks for addition you need to count backwards on the 100’s chart
- Even with accommodations, the students struggled with paper/pencil test
- C. R. “This is too hard.”
  - He didn’t even attempt to finish the test