IMPROVING LEARNING OUTCOMES IN A MATH CLASS OF FIFTH GRADE STUDENTS: VOICES FROM THE CLASSROOM

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ABSTRACT

Maximizing student achievement is an educator’s ultimate goal. A critical link to improving student achievement is effective instruction for all students. Today’s students come from a wide range of background knowledge, experiences, and learning differences. Effective instruction requires an educator to create a teaching environment that provides all students the opportunity to succeed.

This action research combined theory with practice through an “insider’s” perspective from the classroom. Using the theory of Universal Design for Learning, differentiated instruction and assessments for learning, as it relates to effective teaching and instruction, the teacher implemented research-based strategies within her teaching instruction to find out how effective teaching practices and research-based teaching strategies affect students’ assessment scores and meet the fifth grade math benchmark.

Based upon the results of this study, reflection, teacher inquiry and planning for instruction served as the foundation to allow for meaningful and insightful experiences to emerge from within the classroom. Teacher inquiry provided the teacher the opportunity to modify learning activities and tailor the instruction to meet the specific needs of the students. In addition, research-based strategies and a variety of learning activities played a role in increasing student achievement and engagement in math learning. Achievement gains can be made when teachers engage in a continual “learning” process of their students and when students engage in a continual “learning” process of themselves.
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CHAPTER 1. INTRODUCTION

America is a country built on the pillars of equality, opportunity and success. Today’s educational classrooms “are culturally diverse with students of varying abilities” (Cox, 2008, p. 52). Diversity can take many forms: social, economic, cultural and linguistic. Each student represents unique qualities that are one of a kind. By integrating effective teaching instruction and the use of researched-based strategies student achievement can be maximized in today’s classrooms.

“With the growing complexity of the world, and the increasing demands of the 21st century workforce, there is little question that all students should graduate from high school fully prepared for college and success” (Achieve, 2013). According to the United States Department of Education (United States Department of Education (USDOE), 2013), “educational outcomes should foster all students, close achievement gaps (Appendix A), increase equity, and improve the quality of instruction.” Therefore, to reach all learners, it is essential for today’s teachers to understand and implement effective researched-based instructional strategies that have a high probability of enhancing student achievement (Marzano & Brown, 2009).

Problem Statement

Valley Elementary School (Valley School), where I have been a teacher for the last 7 years, has consistently exceeded proficiency levels for the State’s benchmarks on the Hawaii State Assessment, an annual exam given to Hawaii students in grades 3, 4, 5, 6, 8, and 10 in reading and math. For school year 2012-2013, 94% of our students met the reading proficiency objectives and 85% met the math proficiency objectives. However,
with the growing student population and resultant diversity of the student body, Valley School has identified challenges that we feel our school is facing in the 21st century. As we continue to strive for academic excellence, students and teachers are encouraged to collectively work together to understand the rationale behind “what” are best practices and “why” these practices should be implemented.

One of our challenges is that our fifth grade Hawaii State Assessment (HSA) math scores show an achievement gap between students meeting grade level benchmarks and students not meeting grade level benchmarks. Although a majority of the students are meeting benchmarks, there are a consistent number of students who do not meet them on a yearly basis. It is our responsibility as educators to develop academically responsive classrooms that are built on values of equity and excellence (Tomlinson, 1999). Recognizing the requirement to meet the needs of every child, I became interested in exploring approaches to teaching math that can best increase student assessment scores.

**Purpose of the Study and Research Questions**

On an individual level, the purpose of this qualitative action research was to adjust my teaching of mathematics through the use of research-based strategies to increase learning outcomes for fifth grade students in one class at Valley School. As a secondary purpose, this study can possibly identify an approach to achieve the state’s learning goals.

This study is in direct response to a strategic plan set out by the State of Hawaii, DOE along with the implementation of the Common Core State Standards. This strategic plan states, in relevant part, as follows:
In 2012, the Department and the Board of Education released a joint Strategic Plan that established a clear vision and roadmap for students, staff and system success, grounded in college- and career-readiness. That vision includes:

1. All students demonstrate they are on a path toward success in college, career and citizenship;

2. A commitment to using data and research to inform our efforts and replicate emerging best practices and successes;

3. Customized support to students, staff and schools that rewards success and ensures continuous improvement.

Hawaii Common Core Standards are a call to take another leap forward in our efforts toward ensuring that all of our students graduate from high school college- and career-ready. They align with college and workforce expectations, are clear and consistent, include rigorous content and application of knowledge through higher-order skills, are evidence-based, and are informed by standards in top-performing countries.

Transforming Hawaii’s public education system to meet this vision of success requires having the right systems and tools to measure performance and act on improvement strategies. (Hawaii Department of Education (HIDOE), 2013)

However, there appears to be a missing piece to this student achievement puzzle. Valley School is one of 283 public and charter schools in the Hawaii Department of Education (Hawaii DOE). While the Hawaii DOE has set out the global vision to have every Hawaii DOE graduate be college and career ready and able to compete in a global society, it has not yet developed or set forth clear instructional strategies to achieve that long-range goal. Therefore, this study is both necessary and relevant not only to my own teaching development, but to other teachers as well in addressing the significant gap between reform requirements and teacher practice.
The research questions to be explored in this study are:

1) How does effective teaching practices and research-based teaching strategies affect students’ assessment scores and meeting the fifth grade math benchmark?

2) What effective teaching practices impact the implementation of research-based teaching strategies?

3) What results from a teacher self-study are valuable for professional development and teacher growth?

**Conceptual Framework**

Maximizing student achievement is the ultimate goal for a successful educator. A critical link to improving student achievement is effective instruction for all students. However, in any classroom the teacher and the student are the variables. I believe that to achieve the most learning gains, teachers have to approach the learning process with flexibility in mind. Therefore, achievement gains can only be made if teachers themselves engage in a continual “learning” process about their students.

Today’s students come with a wide range of background knowledge, experiences, and learning differences. Effective teaching requires one to create a teaching environment that provides all students the opportunity to succeed. The theoretical approach of Universal Design for Learning (UDL) is based on research from the neurosciences and effective teaching. Combining UDL with differentiated instruction and assessment for learning lays the foundation to inform effective teaching instruction.
According to Meo (2008), the hallmark of UDL is accommodation of learner differences through increasing flexibility and accessibility. This ultimately benefits everyone, including those not explicitly intended to help.

In addition, Differentiated Instruction is a type of classroom instruction that supports UDL theory. Effective teaching includes the use of differentiated instruction in the classroom by presenting students multiple ways to “acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively” (Tomlinson, 2001, p. 1).

Effective teaching and instruction also comes from the research on assessment for learning. Chappuis & Stiggins (2002) state that assessment for learning occurs during the teaching and learning process and supports continuous improvement in the learning of all students. UDL, differentiated instruction and assessment for learning are used as building blocks to inform effective teaching instruction in my curriculum planning.

Similarly, research-based strategies are instructional strategies that have a high probability of enhancing student achievement (Marzano, Pickering, & Pollock, 2001). Application of research-based strategies reinforces and often overlaps with effective teaching and instruction and assessment for learning in the classroom. Utilizing researched-based strategies support effective teaching and instruction by providing the means for a teacher to deliver explicit instruction to a diverse classroom of learners who have varied ways of learning.

Common theory of both effective teaching and instruction and use of research-based strategies is having the flexibility to modify teaching to best reach each student. Not trial and error, but trial and elevate, in both teaching and learning.
This action research combines theory with practice. Using the theory of UDL and the research on differentiated instruction and assessment for learning as it relates to effective teaching and instruction, I was tasked with implementing research-based strategies within my teaching instruction to find out how does effective teaching practices and research-based teaching strategies affect students’ assessment scores and meeting the fifth grade math benchmark. In particular, reflection (Dewey, 2010; Schön, 1987, 1983), teacher inquiry (Dana & Yendol-Hoppey, 2009) and planning for instruction became the foundation to allow for meaningful and insightful experiences to emerge from within the classroom.

These theories allowed me to share what is happening from an insider’s perspective in the classroom. As a mid-career teacher who has been teaching for the past 11 years, there is a need for me to gain a better understanding of my approach to teaching math in a fifth-grade classroom in an effort to provide learning opportunities that are effective for all students. Using the theory of teacher inquiry to inform, plan, and reflect on my teaching instruction became a cycle that gave me the opportunity to modify learning activities and tailor the instruction to the specific needs of my students, as necessary throughout my lessons.

Although real world classrooms contain limitations in terms of time constraints, student diversity and economics, this study explored how the application from theories of reflection, learning, and assessment can yield measureable student achievement gains through reduced achievement score gaps.
Significance of the Study

This action research project has value to educators on three different levels: personal, classroom, and global. McCullough (2011) states that “when educators deliver effective instruction to accommodate students’ individual differences, it prepares students and teachers for a society that continuously desires higher standards of teaching and learning” (p. 20). That is, there is a continued “need for educators to make it their committed responsibility to effectively plan and deliver instruction that will have significant impact on the learning needs” of all students, with the goal of molding students into productive, life-long learners in a global society (p. 21).

On a personal level, this action research project is significant to teachers who are interested in improving their own teaching by examining their current practice through the use of reflection and teacher inquiry. According to Mackay & Tymon (2013), “teaching practice always deserves consideration of new and critical thinking approaches” (p. 643). Reflection and teacher inquiry allows educators to potentially connect theory with practice, which is a highly effective learning method (Mackay & Tymon, 2013; Holden & Griggs, 2011).

At the classroom level, this action research project has significance to other educators who are interested in raising student achievement in their math classes through the use of research-based strategies. One of the challenges at Valley Elementary School is that our fifth-grade Hawaii State Assessment (HSA) math scores show an achievement gap on student grade level benchmarks. This action research project seeks to contribute to research in the field by providing “insider” knowledge of teaching and learning in a real world fifth grade math classroom.
On a global level, educators face culturally diverse classrooms. That is, students come to the classroom with varying backgrounds, abilities and learning styles (Cox, 2008). Students also bring their own unique profiles, which influences his or her academic growth and success. Nowhere does this diversity more exist than in the State of Hawaii with our unique blend of cultures and ethnicities. Within the state, Valley School represents a good example of Hawaii’s varied demographic population within a multi-ethnic community. Therefore, the framework of this action research project investigated effective teaching and instructional practice of a math curriculum in a diverse classroom. In turn, teaching students the necessary skills to build self-efficacy and increase academic achievement helps meet the mission and vision of having every Hawaii DOE graduate be college and career ready in a global society.

**Limitations and Threats to Validity**

The outcome of this study is not generalizable to other schools, math programs, locations or populations due to the following limitations: data collection was limited to one fifth grade class at Valley Elementary School and the data collection period occurred during one quarter of the 2013-2014 school year. Additionally, the threats to the validity of this study include possible researcher bias as I created assessments, collected and also analyzed the data. In addition, findings were self-reported by the students and therefore, relies upon the assumption that the participants gave honest reflective responses regarding preferences about the effectiveness of research-based strategies in teaching. However, findings of the study still contribute to the growing understanding about math research-based strategies and inform other schools with similar philosophies and
curricula. Findings of this study also contribute to the literature on the strengths of being a teacher researcher and the role that educators play in generating a knowledge base for teacher professional development in pedagogy (Cochran-Smith & Lytle, 1993).

**Summary**

This action research project set out to find a way to close the math achievement gap in my students’ benchmark scores by refining my instructional approach to teaching math to fifth grade students though the integration of effective teaching instruction and the use of research-based strategies.

Chapter two will review the literature that supports maximizing student achievement for all learners based on theories and research regarding reflection and teacher inquiry, self-reflection through the use of journal writing, Universal Design for Learning (UDL), differentiated instruction and effective teaching and instruction.
CHAPTER 2. CURRICULUM DESIGN THEORY AND TEACHER INQUIRY

This action research study endeavors to explain the significance of adjusting my teaching practice to reach all students. My goal as a teacher was to try to narrow my class achievement gap in student math scores. My adjustments were based on a recursive reflective practice during the use of research-based strategies in teaching instruction and student self-assessment.

This literature review provides a framework of the related research that supports three key components that are the basis of my action research: teacher-reflection; implementation of research-based strategies; and student self-assessment.

In particular, this section will focus on the literature that discusses these three key components in terms of the following specific teacher/student tasks: 1) Reflection and teacher inquiry; 2) Self-reflection through the use of journal writing; 3) Universal design for learning and differentiated instruction; and 4) Effective teaching and instruction through the use of setting the objective/learning goals, note-taking and summarizing, feedback and student self-assessment. A strong teaching foundation and good instruction ultimately applies to all subject areas.

Reflection and Teacher Inquiry

Personal self-reflection can be discussed in terms of reflection and teacher inquiry. As an educator, “when you think of teaching, learning to teach, and continuing one’s growth as a teacher, you cannot help but be struck by the enormous complexities, paradoxes, and tensions that exists in the simple act of teaching” (Dana & Yendol-Hoppey, 2009, p. 1). In addition to my classroom teaching responsibilities, I am required
to comply with numerous Hawaii DOE requirements. In particular, in compliance with the Hawaii DOE requirements for effectiveness, I am subject to yearly observations and evaluations. In 2013, the Hawaii Department of Education implemented the Educator Effectiveness System (EES). The EES “is designed to measure an educators' professional practice and their impact, and provide feedback and support to teachers to improve their effectiveness with students. Highly effective teachers can be identified for recognition and to serve as leaders to their colleagues” (Hawaii Department of Education (HIDOE), 2014). However, spot inspections on a yearly basis do not adequately measure the effectiveness of a teacher. Rather, becoming a highly effective teacher requires a continuing process of reflection and growth on one's teaching practice.

Within the literature regarding research into teacher education, “reflection” as a part of teacher development is a recognizable topic. According to Jaworski (2006), the ability to reflect critically plays an essential part in a teacher’s professional growth. Similarly, the standards set forth by various professional commissions and boards express the value of teacher reflection. For instance, the National Board for Professional Teaching Standards, Proposition 4: Teachers Think Systematically about Their Practice and Learn from Experience, states that teachers must “critically examine their practice on a regular basis to deepen knowledge, expand their repertoire of skills, and incorporate new findings into their practice” (National Board of Professional Teaching Standards, 2014).

Theorist such as Dewey, Lewin, and Piaget (as cited in Osterman, 1990, p. 135) assert that, “experience is the basis for learning and that learning cannot take place without reflection.” According to Dewey (2010, p.10), there are two components in
reflective thinking: (1) a state of confusedness, anxiety, and hesitation, in the origin of one's thinking; and (2) an act of sorting through, inquiring, and investigating, in order to bring forward information that will lead to a conclusion either favorably or unfavorably to the suggested belief. Dewey concludes that the uneasiness of reflective thinking is based on its involvement of overcoming idleness in order for one to accept suggestions up front and involves one to open-mindedly accept a condition of psychological uneasiness and confusion (p. 13). Reflection is complex, rigorous and involves a lot of time to do well. Along those lines, Osterman (1990, p. 135) claims that, “[r]eflection is the essential part of the process that makes it possible to learn from experience. Without reflection, theories of action are not revised and, until new concepts, ideas, or theories of action begin to influence behavior, learning will not occur.”

Donald Schön (1983) (as cited in Cavanagh & Prescott, 2010) “views the reflective practicum as a place where the theoretical curriculum and practical experience are integrated” (p. 149). Schön dismisses the view of technical rationality – i.e. professional activity and knowledge seen “in terms of facts, rules, and procedures applied nonproblematically” (p. 39). Instead, he focuses on the reflective practitioner as one who “makes new sense of uncertain, unique or conflicted situations of practice” (p. 39). Thus, Schön’s work (as cited in Stevens & Cooper, 2009, p. 27) “describes two processes that contribute to the development of expertise: reflection-in-action and reflection-on-action. Professionals reflect while they are engaged in an experience and after an experience.”

Similarly, Larrivee (2000, p. 294) claims that “when teachers become reflective practitioners, they move beyond a knowledge base of discrete skills to a stage where they integrate and modify skills to fit a specific context, eventually, to a point where the skills
are internalized enabling them to invent new strategies.” McHatton, Parker, and Vallice (2013) reinforce Larrivee’s work in critical reflection by saying teachers experience continuous learning and discovery through the process of engaging in critical reflection. According to Larrivee (2000) then, there are “three essential practices for becoming a reflective practitioner: making time for solitary reflection, becoming a perpetual problem-solver and questioning the status quo” (p. 296). The first practice allows the practitioner the opportunity to reflect while the others “allow for a way of developing teaching practice that accepts uncertainty, recognizes contextual bounds and considers multiple plausible causal explanations for events and circumstances” (p. 296). Thus, Larrivee (2000) concludes:

The path to developing as a critically reflective teacher cannot be prescribed with an intervention formula. The route cannot be preplanned – it must be lived. Teaching in today’s classroom is a challenge of great magnitude. Meeting the challenge calls for a teacher to face the turmoil, the conflict, the uncertainty, and the chaos to allow for personal discovery to merge and become a reflective practitioner, continuously engaging in critical reflection, consequently remaining fluid in the dynamic environment of the classroom (p. 306).

Another evolving topic in education is teacher inquiry. Dana and Yendol-Hoppey (2009) define teacher inquiry as “teachers’ systematic study of their own practice” (p. 4). There are three competing paradigms of educational research: process-product research; qualitative or interpretive research; and teacher inquiry (Dana & Yendol-Hoppey, 2009). Of these three practices, process-product research and qualitative or interpretive research have a long-standing dominance in education research as it pertains to schooling, teaching, and learning. However, both practices are still defined and generated by “outsiders” to the school and classroom.
On the other hand, teacher inquiry “generates valuable insights into the teaching and learning process while including the voices of the people closest to the children – classroom teachers” (Dana & Yendol-Hoppey, 2009, p. 3). As teachers conduct inquiries into their own practices, they are able to “identify discrepancies between their theories of practice and their practices, between their own practices and those of others in their schools, and between their assumptions about what is going on in the classrooms” (Lytle & Cochran-Smith, 1992, p. 458). Thus, teacher inquiry is an essential part of creating an effective teaching practice as it “stimulates, intensifies, and illuminates changes in practice” (p. 458).

Although teacher inquiry is comparatively the newest of the three competing paradigms of educational research, early contributors to the notion of teacher inquiry come from practitioners such as Dewy (2010)¹ and Schön (1983)². Fichtman Dana, Gimbert, and Yendol Silva (2001) add, “Teacher inquiry portrays examples of practitioners’ analysis of classroom struggles from teachers’ own perspectives. The idea of ‘inquiry’ embodies how teachers make explicit and probe further wonderings, reframe and modify their questions and enlighten their perceptions and sense-making of their classroom practice” (p. 51). The benefits of teacher inquiry in educational research are (1) “theories and knowledge are generated from research grounded in the realities of educational practice; (2) teachers become collaborators in educational research focusing on their problems for investigation; and, (3) since teachers play a part in the research

¹ “Dewey (2010) called for teachers to engage in “reflective action” that would transition them into inquiry-oriented classroom practitioners” (as cited in Dana & Yendol-Hoppey, 2009, pg. 5).
² Schön (1983, 1987) “depicts teacher professional practice as a cognitive process of posing and exploring problems or dilemmas identified by the teachers themselves. In doing so, teachers ask questions that other researchers may not perceive relevant and discern patterns that “outsiders” may not be able to see” (as cited in Dana & Yendol-Hoppey, 2009, pg. 5).
process, they are more likely to facilitate change based on the knowledge they create” (p. 53). As teachers reflect and inquire into their own teaching, teacher inquiry becomes a “tool one can utilize to differentiate instruction, ultimately making schools a better place for all students, regardless of their interests, abilities, backgrounds, and learning styles” (Dana & Yendol-Hoppey, 2009, p. 8). In other words, teacher inquiry is a key component in a teacher’s professional development, personal growth and in differentiated instruction as it allows for questioning, making modifications, and sense-making within ones classroom practice (Dana & Yendol-Hoppey, 2009; Fichtman et al., 2001).

**Self-Reflection – Journal Writing**

Personal self-reflection can also be discussed in terms of a teacher’s self-reflection through journal writing. Dewey’s work has also been cited in numerous studies as the theoretical ground for reflective journal writing (Stevens & Cooper, 2009; English & Gillen, 2001; Kerka, 2002). In Dewey’s research (as cited in Farrell, 2013), “informed decision making is based on systematic and conscious reflections because teaching experience when combined with these reflections can only lead to awareness, development, and growth” (p. 466). Stevens and Cooper (2009) state that, “[r]eflection is a path to self-knowledge and to greater personal efficacy. Although there are many ways to reflect, the journal is concrete evidence of one’s evolving thought processes, documenting valuable, often fleeting glimpses of understanding” (p. 3). Likewise, Larrivee (2000) asserts that, “journal writing is a reflective process that allows teachers to chart their development and become aware of their contribution to the experiences they encounter” (p. 297).
With respect to the process, Farrell (2013, p. 466) states that “reflective practice suggests that teachers systematically collect evidence about their teaching and their students’ learning in order to make more informed decisions about teaching.” Similarly, McDonough (1994) maintains that teachers become more aware of “day-to-day behaviors and underlying attitudes, alongside outcomes and the decisions that all teachers need to take” (pp. 64-65) through writing regularly about their teaching.

**Universal Design for Learning and Differentiated Instruction**

Research based strategies have been generally discussed in terms of universal design for learning and differentiated instruction. As of 2014, 45 states nationwide have adopted the Common Core State Standards (CCSS) to allow for consistency across the United States in understanding what students are expected to learn. With the growing competitiveness in a global economy, it is essential that American students be fully prepared for their future. The CCSS “are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers” (Oregon Department of Education, 2011).

However, contemporary America is built on a platform of diversity. In terms of the classroom, this diversity means that students come from different backgrounds, cultures, experiences, learning styles and personalities. Therefore, a critical question arises; how do we approach an initiative that demands uniformity and consistency, when our uniqueness of who we are as a nation is made up of multiple diverse heritages? As Ralabate (2011) shares, “the real challenge for educators, then, is to provide learning opportunities in the general-education curriculum that are inclusive and effective for all
students” (p. 14). Universal Design for Learning and Differentiated Instruction allow for educators to provide these learning opportunities for all students.

A theoretical approach that is based on research from the neurosciences and effective teaching is the Universal Design for Learning (UDL), (Hall, Strangman, & Meyers, 2011). Rooted in the early civil rights and special education legislation, the UDL framework supports the notion that all students have the right to receive a free, appropriate public education in the least restrictive environment (Ralabate, 2011). Although initially set-up to accommodate students with disabilities in an inclusive classroom, “UDL principles provide a blueprint for designing a curriculum that addresses the diverse needs of all learners” (Meo, 2008, p. 21).

“UDL is a research-based set of principles that provide a practical framework for using technology to maximize learning opportunities for all learners” (Blue & Pace, 2011, p. 49). For more than a decade, the Center for Applied Special Technology (CAST) has conducted studies based on the neurological research of synesthesia by Richard Cytowic (1996). In an effort to give all learners (disabled, disadvantaged, English as a Second Language, etc.) an opportunity to succeed, the CAST research specifically utilized UDL principles as a framework for their study. As a result, CAST, and other researchers (Ralabate, 2011; Meo, 2008; Meyer & Rose, 2000), identified three distinct brain systems that are engaged in the learning process: the recognition system, the strategic system, and the affective system. Understanding these three brain systems reinforces the necessity of incorporating flexibility into the teaching curriculum in an effort to accommodate the diversity of learners in our classroom.
The first brain system, the recognition system, identifies patterns (Meyer & Rose, 2000). As the recognition system identifies patterns, adjustments in teaching using UDL gives students numerous and varied opportunities to approach the learning content. According to Ralabate (2011), this principle of UDL provides multiple means of representation. Examples of pattern variability include text, images, text with images, vocal noises, and animation (Meyer & Rose, 2000).

The second brain system, the strategic system, incorporates patterns of speaking, reading, writing, and planning (Meyer & Rose, 2000; Fuster 1997). Like the recognition system the strategic system is divided into subsystems corresponding to one another. This UDL principle provides multiple means of action and expression (Ralabate, 2011). All learners are different, including their ability to adopt and accept routines. Applying the UDL methodology to include multimedia, internet, oral and written feedback and various other tools to monitor ones own learning can have significant impact as a means to sustain flexible learning (Meyer & Rose, 2000).

The third brain system is the affective system. Meyer and Rose (2000) state that this part of the brain “learns patterns of emotional response from experiences over time” (p. 42). Based upon knowledge about the affective system and resultant emotional responses, teachers must be actively seeking multiple tactics of classroom engagement to build opportunities for student motivation.

In today’s classrooms we encounter endless variations of learning styles and performance levels in our students. In order to help foster the goal of helping all learners, “understanding learner differences in the three brain systems helps us to see that disabilities fall along a continuum of differences rather than constituting separate
categories calling for separate kinds of teaching materials and methods” (Meyer & Rose, 2000, p. 43). Understanding the neuroscience of these three brain systems also allows educators to make sense of the specific types of flexibility needed to adapt to diverse students. Meyer and Rose (2000, as cited in Ralabate, 2011), claim that UDL accommodates a variety of learners by providing adjustable and flexible materials and learning experiences that will fit their individual styles of learning and make the most of an individual’s ability to advance all while “providing multiple means of engagement” (p. 17).

Meo (2008), also presents a four-step process for designing and implementing an accessible and effective curriculum that includes goals, methods, materials, and assessments for all learners. Meo indicates that this process is based on what we know about our brain systems and incorporates this knowledge into principles of UDL. The goals that specify what all students must learn and be accountable for are based on the CCSS.

However, through UDL, “it is essential that the means for achieving the goal is separate from the goal itself” (Meo, 2008, p. 23). Thus, in order for teachers to focus on the common core state standards, it is important for students to know and understand their learning goals at the beginning of the lesson being presented so that students can build background knowledge and make connections with any information they have already learned. Rose and Meyer (2002), explain that UDL calls for goals that must be appropriately challenging for all students yet constant in order to meet the CCSS. Methods to include are materials, assessments, and teaching instruction used in the classroom.
It is important that teachers not focus on any particular individual student profile, but rather the class as a whole through “identifying existing barriers in the curriculum that prevent access, participation, and progress for all learners” (Meo, 2008, p. 24) with the understanding that each classroom is made up of a diverse group of individuals. Thus, teaching materials should include a variety of teaching tools that are flexible and allow individual students to make decisions about how they learn best. Materials can include, but are not limited to, using computers, video software, tape recorders, etc. Whether you are a student who learns best kinesthetically, visually, auditorily or any combination of these, providing a variety of opportunities for learning supports student engagement and takes down any existing barriers in the curriculum. Moskowitz (1978, as cited in Furner, Yahya, & Duffy, 2005, p. 22) proposes “classrooms that offer techniques designed to relax students, increase enjoyment of learning, raise self-esteem, and blend self-awareness will increase students’ potential.”

As we acknowledge today’s diverse educational classrooms, “universal design for learning calls for the design of curricula with the need of all students in mind, so that methods, materials, and assessments are usable by all” (Hall et al., 2011, p. 7).

Differentiated instruction is another type of classroom instruction, which “provides students different avenues to acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively” (Tomlinson, 2001). According to Levy (2008), differentiated instruction stresses an educator’s flexibility in content (what we teach), process (how we teach and how students learn), and product (how students demonstrate what they have learned) based on the student’s strength, needs, and learning style (p. 162). Cox (2008) states that differentiated
instruction manipulates all available resources to support learning activities. That is, including differentiated instruction into the teaching instruction allows the teacher to provide opportunities for all students to succeed. Resources can include varying instruction such as flexible grouping, scaffold activities, teacher delivery of lessons, and student interest activities to support the topic being taught. Scaffold activities are activities where the teacher supports the student through variations of complexity while keeping the concepts and skills the same. The teacher’s delivery of the lesson should include a variety of instructional techniques. All the while it is crucial to keep the learning goals clear (Cox, 2008).

Tomlinson (1999) claims that in differentiated instruction classrooms, it is a daily commitment for teachers “to find ways to reach out to individual learners at their varied points of readiness, interest, and learning preference” (p. 3). Similarly, Levy (2008, p. 161) stresses that “the use of differentiated instructional strategies in the classroom will help guide educators in meeting the needs of all learners which in turn helped them to reach and exceed the established state and national standards.” Thus, differentiated instruction is any set of strategies that helps educators meet each student at the particular level they are upon entering the classroom and guiding him or her forward and as far as possible on the student’s educational path (Levy, 2008). In other words, it is merely a way of meeting an individual’s learning style, interest and background and level. The theory of UDL and the research regarding implementation of differentiated instruction strategies allow educators to provide all students the opportunity to comprehend and demonstrate achievement.
Effective Teaching and Instruction

Research-based strategies in teaching instruction also calls for the examination of effective teaching and instruction. A commonly used framework for effective teaching, based on the research on how teachers teach and students learn, can be simplified through Chickering and Gamson’s (1987), “Seven Principles of Good Practice in Undergraduate Education.” According to Chickering and Gamson (1987) the seven principles of good practice in undergraduate education are:

1. Encourage student-teacher contact.
2. Nurture student-to-student interactions.
3. Promote active learning to allow students to make connections through integration of multiple learning styles and multiple intelligences.
4. Encourage feedback in a timely manner that allows students to reflect on what they have learned and what they still want to know.
5. Promote time on task in the classroom.
6. Communicate and set high expectations.
7. Respect diverse learners by supporting students’ opportunities to express their learning in ways that work for them.

Smittle (2003) states that “these seven principles focus on key ideas that educators may use to support effective teaching” (p. 10). While these principles are based on research from higher education, these elements can also be applied to effective teaching in primary and secondary classrooms (K-12) in an effort to improve learning. “In order to help students learn challenging, standards-based mathematics, educators must establish a classroom climate that promotes positive self-beliefs about intelligence and academic ability” (The National Council of Supervisors of Mathematics, 2001). “In education, we need to understand, carefully select, and use combinations of teaching practices that
together increase the probability of helping students learn” (Grouws & Cebulla, 2000, p. 7). In Cawelti’s research (as cited in Grouws & Cebulla, 2000), regular monitoring and adjustments to practice are required as teachers implement strategies to modify their instruction, in order to optimize improvement quality. In attempting to meet the needs of all learners, these seven principles prove fundamental when implementing differentiated instruction strategies and using research-based strategies to guide effective teaching and instruction focusing on the subject area of mathematics.

**Assessment for Learning**

In order to create a positive and flourishing classroom environment for our students, research regarding application of the principles of assessment for learning supports the notion that providing high quality, formative assessment can yield an increase in student achievement (Chappuis & Stiggins, 2002).

Shepard (2000, p. 8) examines the role of assessment in a learning culture and asserts: “if instructional goals include developing students’ metacognitive abilities, fostering important dispositions, and socializing students into the discourse and practices of academic disciplines, then it is essential that classroom routines and corresponding assessments reflect these goals.” Shepard further explains that the “data gathering of these assessments must include observations, reflective journals, collection of student work and students self-evaluations. Teachers must have a systematic analysis of the available resources.”

Traditionally, students are assessed at the end of a lesson or topic by taking a test. This is often referred to as an assessment of learning. Chappuis and Stiggins (2002)
stresses that assessment for learning is distinguished from the traditional assessment of learning in that the assessment is occurring during the teaching and learning process and supports continuous improvement in the learning for all students. For Scriven (1967) and Bloom (1969) (as cited in Wiliam, 2006, p. 284), “the crucial feature of formative evaluations is that the information is used in some way to make changes whether it is a curriculum or student achievement that is being evaluated.”

Shepard (2000) also claims that the use of assessments needs to be a part of the learning process. Assessments should be used in a way that allows for teacher and student to establish shared expectations of finding out what makes sense and what doesn’t. Shepard’s main idea is to change our cultural practice so that students and teachers look to assessments as sources of insight and help as opposed to an occasion for meting out a series of rewards and punishments. In his study, Shepard (2000) discusses several specific assessment strategies that serve a social and motivational purpose as well as a cognitive or informational one. These assessment strategies include the following:

• Prior Knowledge – conversations and connections to real world
• Explicit Criteria – (also known as setting the objective/learning goal) students must have a clear understanding of the criteria by which their work will be assessed.
• Ongoing Assessment – middle of the teaching and learning process
• Feedback – narrowly defined as how well the student is doing
• Self-Assessment – serves cognitive purposes and promises to increase students’ responsibility for their own learning and to make the relationship between teachers and students more collaborative.

Application of research-based strategies reinforces and often overlaps with effective teaching and instruction and assessment for learning in the classroom. Research-based strategies, in terms of setting the objective/learning goal, note-taking and summarizing, feedback, and student self-assessment, support effective teaching and instruction and
assessment for learning by providing the necessary elements for a teacher to deliver explicit instruction.

**Setting the Objective/Learning Goal.**

Setting the objective, also known as the learning goal, is a research-based strategy that is “broadly defined as the process of establishing a direction for learning” (Marzano et al., 2001, p. 93). “Once students understand the parameters of an objective, they should brainstorm to determine what they know and what they want to learn” (Brabec, Fisher, & Pittler, 2004, p. 8). Marzano, Norford, Paynter, Pickering, and Gabby (2001) state that learning goals “narrow students’ focus” (p. 173) which allows them to think about their own learning which, in turn will help guide them in the right direction to ultimately understanding the material.

**Note-taking and Summarizing.**

The research-based strategies of note-taking and summarizing allows students to have a clear understanding of the criteria by which their work will be assessed. Over the past decade, “educational journals and current research support the claim that note-taking is one of the strategies students can acquire to cultivate academic achievement” (Karimi, 2011, p. 806). Note-taking can be done through a variety of formats linguistically and non-linguistically as a way for students to document their learning. “Note-taking is recognized as a critical activity which enhances learning and learning context. As a complex activity, note-taking requires comprehension, selection of information and written production process” (Karimi, 2011, pp. 806 & 807). Marzano et al. (2001) state
that “summarizing and note-taking require students to distill information” (p. 55). When students summarize, they “pick and choose” information that they feel is important and restate the information in their own words. Based on multiple research results for summarizing strategies, Marzano et al. (as cited in Brabec et al., 2004, p. 7) reported “summarizing requires students to analyze information at a fairly deep level, thus strengthening their understanding.” Similarly, Marzano et al. (2001) claim that “Note-taking and summarizing are closely related. Both processes require students to identify what is most important about the knowledge they are learning and then state that knowledge in their own words” (p. 82). This allows the student to think and apply what they are learning to their prior knowledge in order to gain insightful new knowledge and understanding of the curriculum content.

**Feedback.**

Feedback is another research-based strategy that has proven over time to improve teaching in the classroom leading to quantifiable learning gains. Based upon a meta-analysis by Black and Wiliam (1998) (as cited in Nicol, & Macfarlane-Dick, 2006, p. 204) a significant amount of real world classroom studies in the area have continually shown that effective student “feedback [has] produced significant benefits in learning and achievement across all content areas, knowledge and skill types, and levels of education.” Hattie and Timperley (2007, p. 81) conceptualize feedback as “information provided by an agent (e.g. teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding. Feedback is a “consequence” of performance.” To provide
effective feedback, Brabec et al. (2004, p. 8) assert that “[s]pecific, timely, and regular feedback to students enhances their learning. Feedback should include an explanation and be criterion referenced to allow students to understand where they stand relative to a specific target of knowledge or skill.” When proper and effective feedback is provided, combined with effective classroom instruction, it can be very powerful in enhancing learning (Hattie & Timperley, 2007).

**Student Self-Assessment.**

Based on both theoretical and applied research and theory, student self-assessment is a critical skill that enhances student motivation and achievement (McMillan & Hearn, 2008). Boud (1986) and Dearing (1997) (as cited in Taras, 2010) argue that “self-assessment is considered one of the most important skills that students require for effective learning and for future professional development and life-long learning” (p. 200). Likewise, McMillan and Hearn (2008) state that self-assessment “occurs when students judge their own work to improve performance as they identify discrepancies between current and desired performance” (p. 40). This process allows students to self-monitor their work while identifying “further learning targets and instructional strategies that they can then apply to improve achievement” (p. 41).

Similarly, Andrade and Valtcheva (2009) assert that “self-assessment is a key element in formative assessment because it involves students in thinking about the quality of their own work. Self-assessment is a process of formative assessment during which students reflect on the quality of their work, judge the degree to which it reflects explicitly stated goals or criteria, and revise accordingly” (p. 13).
The use of self-assessments also positively relates to student motivation (Black & Wiliam, 1998). According to Pintrich (2000) and Zimmerman and Schunk (2004) (as cited in Andrade & Valtcheva, 2009, p. 13), one of “the primary purposes of engaging students in careful self-assessment is to promote academic self-regulation, or the tendency to monitor and manage one’s own learning.”

Summary

Reflection and teacher inquiry, along with effective teaching and instructional strategies, are critical tools for reaching the needs of all students. “Although the development of curriculum standards is an important task for achieving improved student-learning outcomes, without effective strategies students with diverse learning and curriculum needs” will continue to struggle (Coyne, Kame‘enui, & Carnine, 2011, p. 6). Thus, teachers must make a clear commitment to providing effective teaching and instruction practices in order to accommodate the increasingly diverse population of learners and their individual needs. Theorist such as Dewey, Lewin, and Piaget (as cited in Osterman, 1990, p. 35) contend, “experience is the basis for learning and learning cannot take place without reflection.” Similarly, Blackburn and Lawrence (1995) (as cited in Stevens & Cooper, 2009, p. 3) assert that “self-knowledge appears to be the most powerful influence on productivity for faculty in all their roles: teaching, research, and service.” Therefore, “reflection is the path to self-knowledge and to greater personal efficacy. Journal writing is concrete evidence of one’s evolving thought process, documenting valuable, often fleeting glimpses of understanding” (Stevens & Cooper, 2009, p. 3).
As teachers build their foundational understanding of how to reach today’s diverse student populations, “the real challenge becomes providing learning opportunities in the general-education curriculum that are inclusive and effective for all students” (Ralabate, 2011, p. 14). In that regard, UDL and the research evidence regarding the effectiveness of Differentiated Instruction allow educators to assist more students to experience success in diverse classroom settings (Hall et al., 2011). A diverse classroom means varied ways of learning. UDL and Differentiated Instruction meets each student’s individual learning needs by instructing teachers to include multiple means of representation, expression and engagement (Hall et al., 2011; Hunt & Andreasen, 2011). UDL and Differentiated Instruction complement one another by providing increased flexibility in teaching while also decreasing the barriers that frequently limit student access to learning in the classroom (Hall et al., 2011; Rose & Meyer, 2002).

Building on the theory of UDL and Differentiated Instruction, effective teaching and instruction are also necessary practices for teachers to accommodate their increasingly diverse population of learners. Stiggins and Chappuis (2005) affirm that “evidence gathered over decades reveals strong achievement gains and reduced achievement score gaps when teachers implement student-involved classroom assessment practices in support of student learning in their classroom” (p. 11). This assessment for learning is generally examined in terms of setting the objective/learning goal, note-taking and summarizing, feedback, and student self-assessment. Recognition of UDL and Differentiated Instruction, along with research-based strategies for effective teaching and instruction, continues to grow in educational practice and research as “educators are
continually challenged by the ever-changing classroom profile of students, resources, and reforms” (Hall et al., 2011, p. 20).

Simply put, in order to reach all students in the classroom it is necessary for an educator to be able to blend personal self-reflection, research-based strategies in teaching instruction and student self-assessment reflections into his or her teaching.
CHAPTER 3. TAKING A CLOSER LOOK

My research represents a personal quest to determine if my teaching can impact all learners. In that regard, this qualitative action research project utilized purposive, criterion sampling to gather information that helped refine my instructional approach to teaching math to fifth grade students.

Qualitative action research “is about finding ways to improve your practice and create new knowledge about your practice” (McNiff & Whitehead, 2010, p. 7). This method allowed me to collect data, in a natural setting, through examining documents, observing behavior, and using self designed open-ended questions, as well as field notes and a self-reflective journal (Creswell, 2013; Creswell, 2009). I chose this method as a means toward “improving learning for improving practice and create new, original knowledge” (McNiff & Whitehead, 2010, pp. 7 & 9). This then allowed me to understand how I could enhance my teaching instruction to reach all students in my fifth grade class.

Researchers such as Maxwell (2013), have stated that selection of purposive sampling allows access from “particular settings, persons, and activities that are deliberately selected to provide information that is particularly relevant to your questions and goals” (p. 97).

Due to the limited number of participants in this study – 27 students – purposive sampling also allowed me to achieve representativeness of the setting, individuals and activities selected, adequately capture the heterogeneity in the population, and select participants with whom you can establish the most productive relationships, ones that will best enable you to answer the research questions (Maxwell, 2013).
Throughout the semester, my adjustments were based on recursive reflective practice through the use of research-based strategies in teaching and student self-assessments. Marzano et al. (2001) define research-based strategies as “instructional strategies that have a high probability of enhancing student achievement for all students in all subject areas at all grade levels” (pp. 6-7). I used purposive criterion sampling to provide feedback that helped me better understand how effective my approach was and to learn how I could adjust my approach in the future.

**Data Collection**

Data for this qualitative action research project was gathered from seven selected math lessons, each of which included a student self-assessment (Appendix F), an open-ended questionnaire (Appendix H), pre and post assessment math scores and my own self-reflections kept through a learning journal.

Over the course of the first semester of the school year, delivery of the seven selected math lessons incorporated various research-based strategies such as note-taking/summarizing, setting objectives, self-assessment, pre and post-assessments and immediate teacher feedback. Pre-assessment math problems were used as a baseline to measure knowledge of the mathematical concepts being introduced. Students recorded their notes and work on worksheets. Post-assessment math problem(s) were used as data to measure “learning” while self-assessments were used to gauge students’ response to the teaching method and their learning. I also kept a personal journal as a way to reflect on my teaching practice.
Data was collected through observations and documentation. Observations were done during each of the selected math lessons, which included “field work descriptions of activities, behaviors, actions, and conversations” through gathering field notes whenever possible (Patton, 2003, p. 2). Hand written field notes allowed me to document my teaching and learning of ideas and actions in the social situation I was investigating (McNiff & Whitehead, 2010).

Documentation included a personal learning journal that was used to chart progress of my action research, including successful or unsuccessful action and the personal learning that emerged from my reflections. I kept the learning journal to record my ideas and observations about my actions, which enabled me to modify my lessons throughout the semester. Documented data also included classroom artifacts. These included student pre/post assessment test scores and a questionnaire with open-ended questions to allow my students to “express a broader range of their ideas” (McNiff & Whitehead, 2010).

In addition, contemporaneously with each lesson, pre, post and self-assessments were recorded by the students to ensure an accurate record of what transpired. At the end of the seven selected math lessons, students were then asked to provide a written reflection on each of the teaching strategies used. While all of the students in the class were taught using the recommended best practice approach, only input and data from those students whose parents had agreed to participate in the project was gathered and analyzed (Appendix D & E). Data of the seven math lessons was kept by me for reflection as to the success and/or effectiveness of the teaching method.
The data for this qualitative action research project was collected from August 2013 through November 2013 during the first semester of 2013-2014 school year using multiple sources of evidence to provide an in-depth picture (Creswell, 2013).

**Data Analysis**

During the data analysis process, I looked for themes and patterns. Shank (2000) (as cited in Hendricks, 2009) calls this process thematic analysis and involves building general themes from specific examples in the data. Based on Berg’s (2001) description of thematic analysis, the following steps were taken in analyzing my data:

1) All data was in textual form and gathered together.

2) Textual data was studied for patterns to determine ways to code the data.

3) Textual data and codes were analyzed so that patterns and themes could be developed.

4) Answers to research questions were offered based on themes found in the data.

According to Maxwell (2013), the goal of coding in qualitative research is to break up the data and “rearrange them into categories that facilitate comparison between things in the same category and that aid in the development” of patterns and themes (p. 107). From these patterns and themes I was then able to draw and validate conclusions by triangulating the data. Triangulating data requires analyzing multiple data sources that point to the same result (Hendricks, 2009).
Who We Are – Valley Elementary School

In order to understand and draw conclusions from this qualitative research, it is essential to understand who we are on both a macro and micro level. Who we are includes our school, our classroom as a whole, and the individual student participants. This qualitative action research was conducted at Valley Elementary School, which is one of 283 public and charter schools in the HIDOE. The participants in this action research consisted of twenty-seven students from one fifth grade class. Of the twenty-seven students, nine were identified as “below benchmark” based on the beginning of the year 5th grade diagnostic math test.

Valley Elementary School is located in the State of Hawaii on the Island of Oahu in a historic residential neighborhood east of downtown Honolulu. Valley Elementary School is a part of the Honolulu School District.

While about 44 percent of the 588-student population lives outside of the school’s designated geographical boundaries, most have some family roots in the surrounding geographical area of the school. Our student population is made up of a multiplicity of socio-economic status, ethnicities and family households.

Valley Elementary School’s demographic population includes: 16.2% of students who receive free or reduced-cost lunch; 7.0% of students enrolled in Special Education; 2.6% of students are of limited English Proficiency; and 96% of kindergarten students who have attended preschool. Valley Elementary School’s multi-ethnic student population is made of approximately 70% Asian (Chinese, Filipino, Japanese, Korean, or other Asian), 13% White, 13% Native Hawaiian or Pacific Islander, and 4% mixed-race (“other”). Valley Elementary School does not have a high transient or multilingual
population and classrooms consistently stay intact throughout the school year. In fact, student profile data from the 2012-2013 school year showed that 97% of the students at Valley Elementary School are enrolled for the entire school year.

The vision at Valley Elementary School is “Giving Life to Learning,” we believe:
• Everyone can learn
• Each person is a valued individual with physical, social, emotional and intellectual needs
• Learning is a life long process
• Family and community involvement are vital to the success of our students and school

(HIDOE, 2014)

At Valley Elementary School, we encourage student participation in enrichment programs such as gifted and talented, student government, library club, and an international friendship exchange program with a school in Japan. We also have community partnerships with the city and county parks and recreation, a local sector of Lions Club International, and a backyard arboretum and botanical garden.

Valley Elementary School has consistently exceeded proficiency levels for the State’s benchmarks on the Hawaii State Assessment for reading and math. For the 2012-2013 school year, 94% of our students met the Reading proficiency benchmark and 85% met the Math proficiency benchmark. Fourth grade data reveals that 87% of students met the HSA Reading proficiency benchmark while 82% of fourth grade students met the HSA Math proficiency benchmark (HIDOE, 2014).

Valley Elementary School, Grade 5, Room 10.

I am in my eleventh year of teaching in the State of Hawaii Department of Education (HIDOE) system and my seventh year at Valley Elementary School. During the 2013-2014 school year, I taught a fifth grade classroom. Key participants in my action
research project included 27 fifth-grade students from one self-contained classroom. As opposed to a departmentalized structure, they stayed with me from 8:00 AM – 2:15 PM, Monday through Friday. Students were identified, contacted and recruited for this study based on the 2013-2014 school class list for fifth-grade, room 10 that was assigned to me. Participants were from a heterogeneous class composition and were between the ages of 10 and 11 years old and included 11 females and 16 males. Of our 27 students in room 10, 4 students (15%) received free or reduced-cost lunch, 6 students (22%) were identified as limited English Proficiency, 22 students (81%) were Asian (Chinese, Filipino, Japanese, Korean, or other Asian), none of the students were White, 5 students’ (19%) were Native Hawaiian or Pacific Islander, and none of the students were identified as “other”.

**Students not meeting fifth grade math benchmark in grade 5, room 10.**

There were 9 students in grade 5, room 10, who were identified as “below benchmark” based on the beginning of the year 5th grade diagnostic math test. This student population included 6 males and 3 females. In addition, of these 9 students, 2 were identified as disadvantaged – students who received free or reduced lunch, 2 were identified as having limited English Proficiency, 7 were identified as being Asian (Chinese, Filipino, Japanese, Korean, or other Asian), and 2 were identified as Native Hawaiian or Pacific Islander. Also, 4 of the 9 did not meet their fourth grade math benchmark during the 2012-2013 school year.
Summary

In order to refine my instructional approach to teaching math to fifth grade students, and ultimately answer my action research questions, a step-by-step approach was required. Information was obtained through purposive, criterion sampling. Data was gathered using multiple sources. This data was then analyzed by looking for themes and patterns with the particular demographics of my classroom as a guiding influence.

The following chapter will focus on my analysis of the data that was collected during the first semester of the 2013-2014 school year at Valley Elementary School using the methodologies discussed above.
CHAPTER 4. TRIAL AND ELEVATE: VOICES FROM THE CLASSROOM

This chapter contains my analysis of the data that was collected during the first semester of the 2013-2014 school year at Valley Elementary School and identification of the themes that developed during this process. The data consists of the following: an open-ended questionnaire; students’ self-assessment for each of the seven selected math lessons; pre and post benchmark assessment scores; and my learning journal entries used for reflecting.

Pre-assessment data prior to the implementation of the intervention showed that nine out of twenty-seven students (33%) did not pass the fifth grade benchmark math test. Nineteen of the twenty-seven students said they liked math (70%), while eight students (30%) expressed their dislike for the subject. At the end of the data collection period the number of students who did not pass the fifth grade benchmark math test dropped to three out of twenty-seven students (11%). At the same time, the number of students who indicated they liked math increased to twenty-five out of twenty-seven students. Two of three students who did not pass their benchmark test also said they did not like math.

An analysis of the data shows that, on the whole, student achievement did improve during the integration of effective teaching instruction and the use of research-based strategies in one fifth grade classroom. However, deeper analysis of the data shows that student achievement is further dependent upon four distinct themes: (1) Culturally Responsive Classroom, (2) Teacher-Student Relationships (3) Classroom Management, and (4) A Different Approach to Math.

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3 These three students were also part of the original nine students who did not pass their pre-assessment math test at the beginning of the semester.
Culturally Responsive Classroom

Creating a culturally responsive classroom that supports and encourages all students in the learning process is essential for meeting the ultimate goal of maximizing student achievement. Montgomery (2001) states, “culturally responsive classrooms specifically acknowledge the presence of culturally diverse students and the need for these students to find relevant connections among themselves and with the subject matter and the tasks teachers ask them to perform” (p. 4). As discussed in the literature review, “universal design for learning calls for the design of curricula with the need of all students in mind, so that methods, materials, and assessments are usable by all” in today’s diverse classrooms (Hall et al., 2011, p. 7).

At the beginning of the semester, students were asked during classroom discussion to comment on “What has your past math experiences been like?” Almost half of the students raised their hands immediately. One student shared, “it’s boring and hard!” A few students nodded in agreement while another student enthusiastically shouted with her hands in the air, “I hate math! I hate math! I hate math!” Other students described the classroom culture of their past math classes as, “in fourth grade, the teacher lectured from the book and we copied her notes from the projector.” Mateo⁴ voiced his concern that “in the younger grades they got to play with manipulatives and work in centers, but not anymore.” In total, the majority of the students’ comments supported their common experience of the teacher lecturing while they copied notes from the white board and then completed problems assigned for homework.

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⁴ All names utilized are pseudonyms
Based upon these student responses, I asked questions to myself regarding my own teaching practice and how I could teach math in a way that wouldn’t elicit the same type of student feedback. Throughout the semester, I engaged in reflection and teacher inquiry as a way to adjust my teaching habits and also adjust the math curricula to meet the needs of all my students. Ultimately, the use of technology, multiple research-based strategies, teacher-created teaching tools, and math centers were incorporated into the lessons.

One student sincerely remarked that, “Math this year is different. I am enjoying it. I like the way [my teacher] guides me through the lessons step by step. The teaching tools allow me to go back and figure out which step I am confused with. I can also ask [my teacher] for help anytime I have questions.” Similarly, another student happily relayed that, “This year math class is cool. [The teacher] teaches the lesson using PowerPoint and the interactive white board. We watch videos too. I like learning this way because it makes it easier for me to see and pay attention.” Student reflections on the seven selected math lessons revealed that most of the students felt that this year’s math class was different from their past experiences. They sensed a different classroom culture. As a result, they felt more confident about themselves and their abilities in math.

Teacher-Student Relationships

The research-based strategy of immediate feedback in teaching instruction allowed me to openly communicate with my students. Fifteen of the twenty-seven students (55%) reported the research-based strategy they found most beneficial this semester in math was feedback. In turn, it promoted a comfortable and nurturing
classroom environment, which helped build relationships between the teacher and students, among the students themselves and between the teacher and parents.

One student mentioned “feedback is helpful so I know what I need to work on when I’m in different topics and lessons. It makes it easier to ask [the teacher] questions because it [feedback] tells me what I get and don’t get.” A handful of students also expressed an increase in their personal engagement in their math activities and awareness of their own learning. Arianne shared that, “I like when the teacher provides feedback to me because it makes me work towards being successful in math. Her [the teacher] feedback guides me in the right direction and allows me to make corrections when I do not understand something. It also tells me that I do understand some things.” Similarly, another student said, “the strategy feedback allows me to know how I am doing and seeing myself succeed makes me want to do math more.”

In my personal reflection journal I noted that giving feedback to the students seemed to motivate them to work harder in meeting their goals. It also appeared that the students were asking questions and seeking additional help from me. During the midpoint of the semester, I had a “lunch bunch” of ten students who would voluntarily forgo their lunch recess in favor of my assistance in reviewing long division with them.

In the middle of the semester, I asked the students during a classroom discussion the following: “Is there any specific way [the teacher] can help you succeed in math?” “No, just continue the way we are doing math in this class,” was the common thought that 63% of the students (17 students) expressed. In particular, students in this group responded as follows: “No, I feel that you are a great teacher and you help us a lot by creating different activities. I really appreciate it. Thank you for making math different;”
“Keep teaching this way. I feel comfortable;” “I actually think you can keep doing it the same way because I’m learning and understanding. When doing math, the activities I like and are effective for me are math centers and math lab.”

Six students (22%) requested a little more of the activities and strategies that are already embedded into my teaching curriculum. One student in this group commented, “Maybe a little more note-taking. It helps me to remember when I write things down.” Another student in this group responded, “Give us more pre-assessments. It helps me prepare for the lesson and when I take the post-assessment I can see how much I learned. I also like your videos, maybe include a video a day.”

Parent emails also noted that their children were enjoying math class and my teaching style. One parent wrote, “Congratulations on the successful start of your new school year! Liam says you are the best math teacher ever! He seems to be enjoying his new class and we are very happy about that.” Another parent wrote the following e-mail to me:

What did you do differently in class today? I ask because we’ve struggled with division for a week now. Today, all of a sudden, Olivia was totally getting it…completing problems all on her own and with ease! It was a real WOW moment and I praised her a lot. So, very glad but also puzzled as to what caused this sudden turn around. Let me know if you have any thoughts. By the way, we did not get to complete the Math worksheet today, but will do it tomorrow.

In response to this particular e-mail, I shared with the parent how our math class is structured to follow a daily routine and that on this particular day the math center activities focused on solving long division using multiple tools such as technology, paper and pencil, and verbal explanation with partners.
However, this lesson was a repeat from the day before due to a majority of students not showing an understanding of the material based upon their exit pass from the previous day. The exit pass allows me to formatively assess my students understanding of the daily lesson before moving on. Along with the set-up of using research-based strategies, I then created an interactive step-by-step long division activity for the re-lesson that the students participated in during math centers. In my observation of the re-lesson, I noticed that students worked cooperatively with each other and were on task to complete the assignment and shared their personal explanations through “student talk.” As a result, twenty-two students (81%) passed the selected math lesson #5 post-assessment after I retaught the lesson, compared to only eight students (30%) who passed the day before.

**Classroom Management**

As the semester progressed, classroom management proved to be an integral part of the Universal Design for Learning theory and Differentiated Instruction activities. According to Tomlinson (2003), differentiated instruction “is an approach to teaching that advocates active planning for student differences in classrooms” (p. 1). The theory of UDL and the researched implementation of differentiated instruction strategies allow for educators to provide all students the opportunity to comprehend and demonstrate achievement. However, classroom management becomes critical when trying to effectively implement differentiated activities.
My journal entry for Monday, August 26 reflected on the following:

We are only four weeks into the school year and already I am feeling exhausted. I spent most of this weekend creating my interactive lessons for the week. Time is never on my side and with only forty-five minutes in the morning to teach math, how am I suppose to cover everything in a day’s lesson? On top of that, this class is quite a handful. I feel as through I am spending too much time addressing behavior issues. This class needs structure!

**Routines and Expectations.**

During the first month of the semester I created various routines within our math class. The first routine focused on expectations of the students’ behavior in the school setting in general and during our math period in particular. This eventually led to integrating center activities, math lab, and games into my teaching curriculum. Each piece needed to be implemented one at a time to allow the students to learn how to effectively work with one another and to understand the expectations of each activity.

My journal entry for Wednesday, September 4 reflected on the following:

Today’s math center activity seemed to have gone well. The students were engaged in the various “mental math to multiply” activities. I grouped them ahead of time so each group was of mixed ability. As I observed and facilitated the class, I noticed that every student was engaged and participating either with their teammates or working on solving problems individually and sharing their strategies and solutions. I was pleased to see Addison who is fairly successful in math assisting Madelyn and taking the time to explain his thinking of why his strategy worked. Madelyn then tried another problem on her own and smiled as they compared answers.

Eventually the routines that I implemented allowed for more effective use of teaching and classroom time. In particular, center activities allowed me to become a facilitator in the classroom and I was able to provide “instructional intervention” to those students who needed it. Two students who I often helped during math centers mentioned
that the small group setting made them feel comfortable with the learning process. During
one of our math centers I asked the question, “How do you feel about math centers?” One
student responded,

“I feel better working in a small group during math centers. I like that we
have roles and everyone has to participate. I feel slightly better about math
because we can work with our team and ask our classmates questions.
Sometimes when [the teacher] explains things it can be confusing, but
when your classmates explains things, it’s easier to understand. When [the
teacher] helps us one to one is good too. I won’t give up when [the
teacher] is working with us like this,”

Another student added,

“Yes, I like when [the teacher] helps us one on one during math centers.
We work to our pace. I don’t feel rushed and I can always ask [the
teacher] questions when I don’t understand. Math centers are fun.
Everyone has a job to do and everyone works together.”

Similarly, a written schedule was created that informed my students when
additional time had been set for a continued math period. This schedule was implemented
three times a week on Monday, Wednesday, and Friday from 1:45 – 2:15 p.m. Awareness
of when additional time was set for math allowed the students to anticipate and plan for
the core subject and maximize my instruction time. Less time was wasted on logistical
questions and issues, such as “Are we having more math today?” from numerous
students.

The seven selected math lessons also followed a structure during the semester that
included: Common Core State Standard, rubric, pre-assessment, note-taking with a
teaching tool, PowerPoint as a visual aide, post-assessment and exit pass, and student
self-assessment. The students also used a systematic approach to solving word-problems
that included a six-step process to help them “develop the necessary math concepts and
process skills for everyday life and to provide students with the ability to formulate, apply, and solve problems” (Frank Schaffer Publications, 2009).

During the midpoint of the semester, students were asked during classroom discussion to comment on “What makes or helps you feel successful in math during [the teacher’s] teaching instruction?” A majority of the students reflected on the various activities that I had provided for them such as math lab and math centers as well as the routine of the class and structure of the lessons. Mark shared, “the routines in this class keeps me organized. I like opening the day with a problem of the day, taking notes and learning through a lot of visual aids, and ending the period with an exit pass. I don’t feel so worried about math.” Of the nine students who did not meet the pre-assessment benchmark, two students commented that participating in math lab helped them to feel successful in math. Isabella shared, “I feel successful in math when [the teacher] gives us time for math lab. I like working on the computer. I can practice different topics and focus on the ones that are hard in class.” Three students said they enjoyed math centers. Sophie expressed, “I like math centers because my friends can help me work on my math and correct me if I am wrong.” Four of the nine students reported success using the teacher tools. One particular student mentioned, “I won’t do math without my multiplication table.”

Despite the increased student engagement, providing meaningful lesson activities throughout the semester proved to be a challenge. My journal entry for Friday, October 4 reflected on the following:

Today was the end of the first quarter. Phew! I am pleased to note that this class is coming along. However, one of my challenges continues to be struggling to balance my time, energy, and commitment into creating these classroom lessons. I know that during this upcoming fall intersession I will
be busy preparing for next quarter – creating PowerPoint lessons, teaching tools, math centers…the list goes on and on.

Nevertheless, taking the time to set and teach behavior expectations and routines before diving into the math curriculum benefited my lessons in the long run. Although I was exhausted and felt like time was always against me, students took to the routines, lesson activities, and teaching style favorably.

**A Different Approach to Math**

At the end of the semester, the students were given an open-ended questionnaire regarding the four research-based strategies I incorporated into my teaching curriculum. In particular, the students were asked to rate whether “note-taking and summarizing,” “providing immediate feedback,” “student self-assessment,” and “setting the objective,” helped them “none,” “a little,” “some,” or “a lot.” Overall, the student responses were favorable to the use of these strategies.

Eighteen out of twenty-seven students (67%) reported that *note-taking and summarizing* and *providing immediate feedback* helped them *a lot*. One particular student who struggled in math this semester shared, “the notes I took were good. When I have a hard time, I look back at my notes.” Another student wrote, “note-taking and summarizing helps me check if I actually learned what I needed to for that lesson. Summarizing also helps me to reflect on my math.”

Similarly, sixteen students (59%) responded that *student self-assessment* helped them *a lot*. Theodore explained that, “[student self-assessment] helped me reflect on my past self.” Similarly, Will shared that *student self-assessment* helped, “because I could see how much I improved.”
Finally, thirteen students (48%) circled *a lot* for the strategy *setting the objective*.

At the end of the semester, I also asked the students during classroom discussion to reflect on “What has helped you in math this year that is different from your past math experiences?” Although the student responses varied, the class consensus was that this year provided them a different and enjoyable approach to math. Ten students responded favorably to the *daily routines*. Charlotte expressed, “This class really makes sure we are learning. We have a lot of stuff to learn about. I like having routines in math.”

Seven students mentioned that having a *variety of lesson activities* in math this year was different from past years. Caleb said “this year got a lot harder in math and we have to do a lot more things like really long division. This year [my teacher] taught us different strategies to solve problems. We also got to do a lot of different activities like math lab, math centers, and manipulative workstations.” Another student also expressed her satisfaction with having a variety of lesson activities by sharing, “this year I feel I [am] more successful in math. I am doing more things and learning in different ways. Last year I did a lot of pencil and paper work, but it was always hard for me. Sometimes I like learning with my classmates during [math] centers and sometimes I like working by myself using the [math] manipulatives.”

Five students indicated that *technology integration* in math helped them this year. James shared, “I like [going to the] math lab. It helps me learn. It was something new.” Three students enjoyed incorporating *successful student skills* into math while two students expressed their satisfaction about participating in activities that encourage *student engagement*. In particular, Layla wrote that “SMART\(^5\) goals are different this

\(^5\) SMART is an acronym used to guide the setting of objectives (learning goals) to be Specific, Measurable, Attainable, Relevant and Time-Bound (Doran, 1981).
year. It helps me to set goals that I can reach. I can practice and focus to get to my goal. I can also use SMART goals in my other subjects because I want to do good in school.”

For myself, taking on this different approach to teaching math proved to be a complex journey as reflected in my various journal entries.

Journal entry for Tuesday, August 20:

Today in class the students seemed anxious when I gave them the pre and post-assessment math test. There were more than a few moaning and groaning. The first thing out of Eli’s mouth was “is this a test?” “Oh-oh, not a test…please!” begged Noah. Chloe whispered under her breath, “I don’t like math because it’s hard and I really don’t like math test.” From the response of the class, it was important for me to make them feel less stressed. I talked to them about doing their best and made reference to our successful student skills activities we’ve been working on this quarter. I told them that this pre-assessment would inform us (teacher and student) what they already knew about the lesson objective. I stressed that when doing a pre-assessment, there is no wrong answer and it is okay to write “idk” – I don’t know. Funny how just a little acronym like “idk” made a few students smile. Ella even expressed her liking to my “coolness.” I told them at the end of the lesson, they will be able to see how much they’ve learned and understood the lesson objective from their post-assessment. I also explained to the students that these pre and post-assessments would become part of our daily routine in math so they will be able to see and analyze their growth in knowledge and confidence.

Journal entry for Monday, September 16:

Students are given interactive teaching tools that I’ve been creating to assist them during the note-taking process and also when solving problems. I think of it as an organization tool. Last night in preparation for today’s lesson, I stayed up late trying to tier the teaching tool. I wanted to create something challenging for my students who are accelerating and also create something for those who are struggling. However, although I spent a great amount of time and effort trying to make a teaching tool that would assist the students to see the step by step process of dividing by 2-digit divisors, Jackson still had difficulty completing the assignment.

Journal entry for Friday, September 27:

Implementing teaching tools are allowing me to modify and tier my math curriculum. However, recently I struggled with the challenge of re-teaching the lesson differently when the students exit-passes did not yield
passing benchmark scores. It was back to the drawing board, but teaching myself to re-think the problems is proving to be very difficult. I’m going to have to look into additional math resources and try to reexamine how I can revise this curriculum. It’s going to be another long night.

Journal entry for Wednesday, October 2:

I’ve added a variety of math activities incrementally throughout the semester (math centers, math lab, math games, etc.) and I think they are going well. We have been very consistent with sticking to our schedule and dealing with our math time constraints. Today, I was hit with yet another issue…although last night I was prepping my lessons for today, today during class I found myself unsure of how to do a particular math problem with fidelity. Yikes!

In summarizing the above data, both research based strategies and a variety of learning activities both played a role in increasing student achievement and engagement in math. When students were asked to respond in writing about the effectiveness of each of the research-based strategies, a majority of them responded favorably to their use. In contrast, when verbally asked during classroom discussion to generally respond to what was different from past math experiences that helped them this year, many of the students instantly noted the variety of activities imbedded into my teaching instruction.

However, research-based strategies and the use of a variety of learning activities are not mutually exclusive. Rather, effective teaching and instruction incorporates both the use of research-based strategies and the use of a variety of learning activities. This is what led to my different approach to teaching math.

**Summary**

This data analysis reinforces the idea that maximizing student achievement is a complex and fluid process. On the whole, a majority of the students showed improvement
in their math scores over the course of the semester. However, improvement for a few continued to be elusive in spite of the use of effective instruction for all students.

Nevertheless, four distinct themes emerged from the data for the students who showed improvement as compared to the students who stayed the same. The four themes common to the successful students were: (1) Culturally Responsive Classroom, (2) Teacher-Student Relationships (3) Classroom Management, and (4) A Different Approach to Math.

Chapter five will explore my findings based upon this data analysis, the implications of these four themes with respect to the students who did not pass the fifth grade math benchmark and my conclusions and answers to my initial research questions.
CHAPTER 5. GIVING LIFE TO LEARNING

I came into this study asking three questions: (1) How does effective teaching practices and research-based teaching strategies affect students’ assessment scores and meeting the fifth grade math benchmark; (2) What effective teaching practices impact the implementation of research-based teaching strategies; and, (3) What results from a teacher self-study are valuable for professional development and teacher growth?

In this chapter I share findings related to those research questions. I will then discuss the limitations of my study and implications with respect to the students who did not pass their fifth grade math benchmark, my own teaching practice, math instruction, and future research. Finally, I will share my concluding thoughts with regard to my action research project.

Findings

How does effective teaching practices and research-based teaching strategies affect students’ assessment scores and meeting the fifth grade math benchmark?

On the whole, integration of effective teaching instruction and use of research-based strategies affected my students’ achievement scores positively through an overall improvement in their scores. Prior to the implementation of the intervention, only eighteen out of twenty-seven students (67%) passed the fifth grade math benchmark test. At the end of the data collection period, the number of students who passed the fifth grade math benchmark test increased to twenty-four out of twenty-seven students (89%). Of the eighteen students who passed the pre-assessment fifth grade math benchmark,
thirteen (72%) showed additional gains in their post-assessment scores, four (24%) had their scores stay the same, and one saw a one point drop in score.

In describing what they thought helped them the most, eighteen out of twenty-seven students (67%) reported in their end of the semester questionnaire regarding the four research-based strategies that note-taking and summarizing and providing immediate feedback were most valuable.

These results are consistent with the literature over the last decade. The research has consistently noted that, “educational journals and current research support the claim that note-taking is one of the strategies students can acquire to cultivate academic achievement” (Karimi, 2011, p. 806). Also, Marzano et al. (as cited in Brabec et al., 2004, p. 7) has reported that based upon multiple research results “summarizing requires students to analyze information at a fairly deep level, thus strengthening their understanding.”

In addition, a meta-analysis by Black and Wiliam (1998) (as cited in Nicol & Macfarlane-Dick, 2006, p. 204) found a significant amount of real world classroom studies in the area have continually shown that effective student “feedback [has] produced significant benefits in learning and achievement across all content areas, knowledge and skill types, and levels of education.” Proper and effective feedback, combined with effective classroom instruction, can be very powerful in enhancing learning (Hattie & Timperley, 2007).

Similarly, I noted in my journal entry on November 8, 2014, “the students seem to be more organized taking notes in their math journals, which makes it easier for me to check. Having them follow a structured note-taking routine has also allowed me to assess
their understanding. At the end of class, as they take a few minutes to summarize their learning of the daily lesson, I am able to walk around and take a ‘quick check’ of who still needs additional help.”

A handful of students also expressed an increase in their personal engagement in math activities and awareness of their own learning. Arianne shared that, “I like when the teacher provides feedback to me because it makes me work towards being successful in math. Her [the teacher’s] feedback guides me in the right direction and allows me to make corrections when I do not understand something. It also tells me that I do understand some things.” Another student said, “the strategy feedback allows me to know how I am doing and seeing myself succeed makes me want to do math more.”

Overall, fifteen of the twenty-seven students (55%) reported the research-based strategy they found most beneficial this semester in math was feedback. One student mentioned “feedback is helpful so I know what I need to work on when I’m in different topics and lessons. It makes it easier to ask [the teacher] questions because it [feedback] tells me what I get and don’t get.”

In contrast, for the three students who did not pass their post-assessment math benchmark test, effective teaching practices and use of research-based strategies were not able to overcome their negative attitudes toward math and affect achievement. When asked about their feelings toward math and whether there was any specific way the teacher could help them succeed, one student responded that, “[the teacher] needs to work harder. I want rewards, toys, snacks or tiger paws.” Another student replied that, “Math is better from other years, but I still hate it. There is nothing really for [the teacher] to do.”
This continuing sentiment from a few students translated into what appeared as a negative attitude and lack of effort in their math learning. All three students had difficulty completing tasks in a timely manner, exhibited poor note taking, regularly did not turn in homework assignments and were often indifferent to engaging in student/teacher feedback. Unfortunately, in the end, the effective teaching practices and use of research-based strategies that I utilized were not able to positively affect achievement for these three students.

Research supports the importance of positive student-teacher relationships (Baroody, Rimm-Kaufman, Larsen, & Curby, 2014; Hamre & Pianta, 2001). Ang (2005) and Wenzel (2003) (as cited in Baroody et al., 2014, p. 7) state, “[t]eachers show closeness through responsive, sensitive, and respectful interactions with students.” Moreover, “[t]eachers who have closer relationships with students have personal knowledge of students’ interests and academic strengths, encourage students to reflect on their thinking and learning, and offer students instrumental support to help them achieve academic and social objectives.” Perhaps for these three particular students, additional time and resources, such as more relationship building, could have affected their achievement.

For example, one of the three students would regularly stay after school with me in the classroom as I closed up for the day. Sometimes we had short casual conversations and other times she just sat at her desk reading a book. Often times I would ask her if she wanted help with her daily homework, but she always replied, “No, I just want to hang out before I go to [my afterschool program].” This limited time spent with this student afterschool seemed to spark the student/teacher relationship and increase the student’s
comfort level in the classroom. This increased relationship and comfort then resulted in a better attitude than anything she had displayed earlier in the semester. Her mother remarked, “Today, all of a sudden, Olivia was totally getting it.” However, this more positive classroom attitude was sporadic and fleeting. This particular student’s attitude on a day-to-day level remained unpredictable. Nevertheless, there was a glimmer of what she could do and accomplish. Providing these students opportunities early in the semester to develop meaningful relationships with the teacher may have promoted achievement.

Nevertheless, in examining the data from my action research, I can say that integration of effective teaching instruction and use of research-based strategies affected students’ achievement scores and resulted in gains for the majority of my students.

**What effective teaching practices impact the implementation of research-based teaching strategies?**

Analysis of the data shows that my implementation of research-based teaching strategies was impacted by four distinct effective teaching practices: (1) Culturally Responsive Classroom, (2) Teacher-Student Relationships, (3) Classroom Management, and (4) A Different Approach to Math. In the end, I found a symbiotic relationship between utilization of these teaching practices and the acceptance of research-based strategies by individual students and my fifth grade classroom as a whole. The students in the classroom who developed a relationship with me were more willing to use the research-based strategies, as evidenced in the feedback from students. Thereafter, as discussed above, a willingness to accept the research-based strategies positively affected my students’ achievement.
Culturally responsive classrooms support and encourage all students in the learning process. Montgomery (2001) states, “culturally responsive classrooms specifically acknowledge the presence of culturally diverse students and the need for these students to find relevant connections among themselves and with the subject matter and the tasks teachers ask them to perform” (p. 4). Thus, culturally responsive classrooms are not limited to consideration of race or ethnicity. Rather, the concept of a culturally responsive classroom is broader and also considers students’ backgrounds, learning styles and experiences (Weinstein C., Tomlinson-Clarke S., & Curran M., 2004).

One student remarked that, “This year math is cool. [The teacher] teaches the lesson using PowerPoint and the interactive white board.” Similarly, another student responded, “I like watching videos that are related to math. It makes it easier to make connections to the real world.”

During one of our math centers I asked the question, “How do you feel about math centers?” One student responded,

“I feel better working in a small group during math centers. I like that we have roles and everyone has to participate. I feel slightly better about math because we can work with our team and ask our classmates questions. Sometimes when [the teacher] explains things it can be confusing, but when your classmates explains things, it’s easier to understand. When [the teacher] helps us one to one is good too. I won’t give up when [the teacher] is working with us like this.”

Another student shared,

“Yeah, I like when [the teacher] helps us one on one during math centers. We work to our pace. I don’t feel rushed and I can always ask [the teacher] questions when I don’t understand. Math centers are fun. Everyone has a job to do and everyone works together.”

As the semester progressed, I noticed that most of the students were able to find relevance in the subject matter and build connections with each other.
Similarly, with respect to teacher-student relationships, I found that students responded positively to open communication between them and myself in the form of feedback. In turn, this open communication promoted a comfortable and nurturing classroom environment, which helped build relationships between the teacher and students. For those students who took ownership of the concept of open communication, they experienced increased achievement. For example, in the middle of the semester, I asked the students during a classroom discussion the following: “Is there any specific way [the teacher] can help you succeed in math?” “No, just continue the way we are doing math in this class,” was the common sentiment that 63% of the students (17 students) expressed. In particular, students in this group responded as follows: “No, I feel that you are a great teacher and you help us a lot by creating different activities. I really appreciate it. Thank you for making math different;” “Keep teaching this way. I feel comfortable;” “I actually think you can keep doing it the same way because I’m learning and understanding. When doing math, the activities I like and are effective for me are math centers and [going to the] math lab.” Six students (22%) also requested a little more of the activities and strategies that were already embedded in my teaching curriculum.

During the midpoint of the semester, I had a “lunch bunch” of ten students who would voluntarily forgo their lunch recess in favor of my assistance in reviewing long division with them. In my personal reflection journal I noted that it appeared that the students were comfortable and had no hesitation in asking questions and seeking additional help from me.

This finding is consistent with the literature in the field. According to Hattie and Timperley (2007) when proper and effective feedback is provided, combined with
effective classroom instruction, it can be very powerful in enhancing learning. Simply put, the more comfort everyone had with each other, the more sincere and meaningful the feedback seemed to be.

With respect to classroom management, I found that this supported the extent and amount of Universal Design for Learning theory and Differentiated Instruction activities I was able to utilize and incorporate into daily classroom instruction. As the semester continued on, I had to be continually aware of my actions, time management, and resources. Taking the time to set and teach behavior expectations and routines before diving into the math curriculum benefited my lessons. However, there were a few times where the class schedule, student extracurricular obligations or classroom behavior required immediate attention and did not allow me to fully implement various lesson activities into my curriculum for the day. During those times, I was forced to modify and change the planned differentiated instruction lesson quickly or come back to the lesson during the next class day as a way of making up for the time lost. On two separate occasions, based on the students’ exit pass results, I allotted myself extra time to reteach lessons the following day. Nevertheless, in the end, I was able to cover all my lessons for the semester.

Finally, with respect to a different approach to math, Tomlinson (2003) states that differentiated instruction “is an approach to teaching that advocates active planning for student differences in classrooms” (p. 1). In theory, UDL and differentiated instruction call for virtually unlimited strategies tailored to the individual needs of students in order to provide all students the opportunity to comprehend and demonstrate achievement. However, I found that my ability to continually consider and implement differentiated
strategies to reach each and every student was impacted by the realities of life and available resources. Nevertheless, on a whole, implementation of teaching a different approach to math was beneficial and impacted my students’ achievement favorably.

**What results from a teacher self-study are valuable for professional development and teacher growth?**

The literature states that maximizing student achievement is a complex and fluid process. According to Cochran-Smith and Lytle (1993, pp.18-19), “teachers who engage in self-directed inquiry into their own work in classrooms find the process intellectually satisfying; they testify to the power of their own research to help them better understand and ultimately to transform their teaching.” Stevens and Cooper (2009) state that, “Reflection is the path to self-knowledge and to greater personal efficacy” (p.3). Likewise, Larrivee (2000) asserts that, “journal writing is a reflective process that allows teachers to chart their development and become aware of their contribution to the experience they encounter” (p. 297). Therefore, teachers must match this dynamic process with continual professional development and growth through their own self-study.

Over the course of the semester, I engaged in a practitioner/teacher self-study using the theories of reflection and teacher inquiry. This process allowed me to gain a deeper understanding of myself as a teacher using the process of note taking and journal writing. Making contemporaneous notes of my thoughts throughout the school day and then reading back those notes during my reflection time allowed me to consider the “what and why” of my teaching practice, lesson planning, and delivery of math lessons.
In a journal reflection dated Friday, September 20, I wrote the following:

I’ve been finding different resources for teaching the process of dividing by 2-digit divisors. This research process is making me think in new and different ways of doing the step-by-step process of dividing 2-digit divisors. This process of journal writing is also eye opening for me as I become aware of my faults in teaching math due to my lack of fluidity of certain concepts. This study has become a teaching and learning cycle for me as well.

Similarly, my journal entry for Friday, September 27 reflected on the following:

Implementing teaching tools are allowing me to modify and tier my math curriculum. However, recently I struggled with the challenge of re-teaching the lesson differently when the students exit-passes did not yield passing benchmark scores. Teaching myself to re-think and solve the problems differently form how I had learned is difficult.

As a practitioner, it was important for me to continuously re-evaluate my curriculum decisions and instructional practices in order to identify problems and challenges. The data reflected a positive impact on my teaching and student learning.

During class I had observed my students engaged in their math activities and working together to solve problems. In the end, this continual development and growth throughout the semester provided me great satisfaction in my teaching. Based upon my experiences then, a similar self-study would help other teachers with their professional development and growth alongside positively impacting their teaching practice and student learning.

**Limitations**

The outcome of this study is not generalizable to other schools, math programs, locations or populations due to the following limitations: the data collection was limited to one fifth-grade class at Valley Elementary and the data collection period occurred during one quarter of the 2013-2014 school year.
However, findings of my study contribute to the growing understanding about math research-based strategies and can inform other schools with similar philosophies and curricula. Findings of this study also contribute to the literature on the strengths of being a teacher researcher and the role that we play in generating a knowledge base for teacher professional development in pedagogy (Cochran-Smith & Lytle, 1993).

Implications

Implications for Students Who Did Not Pass the Benchmark.

Ultimately, three of my students did not improve their scores enough to pass their fifth grade math benchmark. These students’ achievement may have been impacted by a lack of positive self-belief. According to Pajares and Schunk (2002) “[m]any students have difficulty in school not because they are incapable of performing successfully, but because they are incapable of believing they can perform successfully – they have learned to see themselves as incapable of handling academic work or to see the work as irrelevant to their life” (p. 22). Thus, overcoming pre-determined negative attitudes toward math and building positive self-belief may be the key for these particular students to ultimately succeed in the subject area.

Implications for the three students who did not pass the fifth grade math benchmark could be to identify them early in the semester as students at-risk for math difficulties. If applicable, these students could be offered additional small group math intervention along with effective teaching practices. Literature “on math instruction uses the term math difficulties to refer to students who are currently identified as having a math disability, as well as those students at risk for math” challenges (Doabler & Fien,
During the math intervention time, it would be necessary for the teacher to not only provide explicit math instruction for these students, but also focus on building the teacher/student relationship. As a teacher, my core belief is that every student has the potential to succeed. Therefore, it is important to provide them with a culturally responsive classroom that takes into account their different learning styles. In addition to academic issues, these students may need to be identified and provided with mental or social services outside the classroom.

However, as public education embraces teacher accountability, there could be times when the right learning situation has not yet been found and a student does not want to learn despite the best efforts of the teacher at that time. This raises questions that are outside the scope of this study, but are nevertheless worth additional consideration and discussion. In an educational system where teacher evaluations are heavily emphasized in evaluating teacher performance, what is the responsibility of teachers for students that do not meet achievement scores no matter what a teacher does? In that case, how should teacher performance be measured in light of these students?

**Implications for My Teaching Practice.**

Grouws and Cebulla (2000, p. 8) assert “as teachers seek to improve their teaching effectiveness by changing their instructional practices, they should carefully consider the teaching context, giving special consideration to the types of students they teach.” Within the state, Valley Elementary School represents a strong example of Hawaii’s varied demographic population within a multiethnic community. That is, students come to the classroom with varying backgrounds, abilities and learning styles
(Cox, 2008). In addition, according to Grouws and Cebulla (2000) “the quality of the implementation of teaching practice also greatly influences its impact on student learning” (p. 8).

In my case, I was interested in improving my teaching ability by examining my current practice through the use of reflection and teacher inquiry. This active process allowed my teaching practice to grow personally and professionally and also allowed me to share an “insiders” perspective and knowledge of teaching and learning in a direct classroom setting.

As a result of this action research, I was able to implement effective teaching and instructional practices of a math curriculum to a diverse student population in one fifth grade classroom. Over the semester, I modified and tiered my math curriculum. I incrementally added a variety of math activities, such as math centers, going to the math lab, and math games. My research has also led me to believe that as a part of effective teaching, it is important for teachers to address, early in the semester, students who need additional math intervention.

Ultimately, my research has not changed my core teaching belief that every student has the potential to succeed. Rather, it has only reinforced my belief. In that regard, the Hawaii DOE’s stated mission and vision is to have every Hawaii DOE graduate be college and career ready in our global society. Teaching my students the necessary skills to build self-efficacy and increase academic achievement is my contribution to this stated mission and vision.
Implications for Math Instruction.

The implication for math instruction is that the use of research-based strategies appears to improve learning. These research-based strategies are not math specific. Rather, they can apply to effective teaching for all subject matters. These strategies include: setting the objective/learning goals, note-taking and summarizing, providing feedback and student assessments. If they are taught to students intentionally, in math or any other content area, then learning will occur.

Continuing to provide effective and engaging mathematic instruction is no simple task. There is no one size fits all formula. Instead, flexibility and change from school year to school year, semester to semester and even lesson to lesson must occur within the teaching and learning.

In this high-tech and globally competitive society, it is important that all citizens be confident in their ability to do mathematics. Knowledge of mathematics is an important skill necessary to succeed in today’s world. (Funer et al., p. 16)

Implications for Future Research.

This study can serve as a building block for future study in the area of math pedagogy. At the beginning of this study, I set out to explore approaches to teaching math that would best increase student achievement using two independent theories: (1) effective teaching and (2) research-based strategies.

Effective teaching practice requires one to create a teaching environment that provides all students the opportunity to succeed. Research based strategies are instruction strategies that have a high probability of enhancing student achievement (Marzano et. al, 2001). In the end, I found that application of research-based strategies reinforces and
often overlaps with effective teaching practices in the classroom. In other words, both research-based strategies and effective teaching practices must be present to positively affect student achievement.

This study could be further expanded by extending the instruction techniques and data collection period to a semester and eventually over the course of one school year, as opposed to one quarter. This would provide more time for my students to show gains in their fifth grade math benchmark test. Grouws and Cebulla (2000, p. 8) stress that teachers “should not judge the results of their new practices too quickly. Judgments about the appropriateness of their decisions must be based on more than a single outcome.” The common theory for both effective teaching and instruction and the use of research-based strategies is having the flexibility to modify teaching to best reach the students. Additional time would allow for more opportunity to utilize the concept of “trial and elevate” in my teaching instruction. I would then have greater opportunity to modify the learning activities and tailor instruction to specifically focus on students who are not passing the fifth grade math benchmark or who are identified as needing additional assistance. The allotment of more time for this study could also possibly bridge the achievement gap between students meeting the benchmark and students who are not meeting the benchmark. For students who did not meet the fifth grade benchmark, early identification of being at-risk for math difficulties along with an additional intervention class of mathematics instruction could be offered to supplement their regular math curriculum.
In addition, expanding this study to potentially focus on other subject areas as we address the Common Core State Standards and Teacher Effectiveness System in the Hawaii DOE may also be a next step for future research.

Conclusion

Based upon the results of this study, I believe that achievement gains can be made when teachers themselves engage in a continual “learning” process of their students. As well as when students engage in a continual “learning” process of themselves. To achieve the most learning gains and avoid stagnation in their curriculum, a teacher has to approach the learning process with flexibility in mind.

Research-based strategies and a variety of learning activities both played a role in increasing student achievement and engagement in math in my classroom. When my students were asked to respond in writing about the effectiveness of the research-based strategies I used, a majority of them responded favorably to their use. In contrast, when verbally asked during classroom discussion to generally respond to what was different from past math experiences that helped them, many of the students instantly noted the variety of activities imbedded into my teaching curriculum. As a result, research-based strategies and the use of a variety of learning activities are not mutually exclusive. Rather, effective teaching and instruction incorporates both the use of research-based strategies and the use of a variety of learning activities.

However, while flexibility and variety appear to be the path toward increased student achievement, the question arises as to how sustainable and realistic this teaching practice is given the limitations imposed by real life and the numerous reforms and
mandates handed down from the Federal and State Departments of Education. This action research does not purport to answer this question. However, for myself, I can conclude that although at times I found myself tired and often lacking energy at night, I was determined to make my lessons rigorous and relevant for each student’s ability. In the end, although exhausted, I valued challenging myself to teach in new ways that offered the students excitement and opportunities to learn, which ultimately offered me the greatest personal and professional satisfaction.
APPENDICES

Appendix A. Definition of Terms

Achievement Gap: “differences in scores between various student demographic groups” (Anderson, Medrich, & Fowler, 2007)

Assessment for Learning (formative): “assessment that is specifically intended to provide feedback on performance to improve and accelerate learning” (Sadler, 1998); “occurring while knowledge is being learned” (Marzano, 2006)

Assessment: a method used “to evaluate, measure, and document the academic readiness, learning progress, and skill acquisition of students” (Great Schools Partnership, 2013).

Assessment of Learning (summative): “occurring at the end of a learning episode” (Marzano, 2006).

Differentiated Instruction: “providing students different avenues to acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively” (Tomlinson, 2001).

Proficiency (meeting benchmark): “representing solid academic performance for each grade assessed; to demonstrate competency over challenging subject matter” (“NAEP – The NAEP Glossary of Terms,” n.d.).

Research-based strategies (best practices): “instructional strategies that have a high probability of enhancing student achievement for all students in all subject areas at all grade levels” (Marzano, Pickering, & Pollock, 2001).

Teacher Inquiry: “The role classroom teachers play as knowledge generators; focuses on the concerns of teachers (not outside researchers) and engages teachers in the design, data collection, and interpretation of data around a question” (Dana & Yendol-Hoppey, 2009, pp. 3 – 4).

Universal Design for Learning (UDL): A framework for curriculum design based on goals, materials, methods and assessments that are multiple or flexible that meet the learning needs of a wide range of students (Hitchcock, Meyer, Rose, & Jackson, 2002).
Appendix B. IRB Approval Letter

Office of Research Compliance
Human Studies Program

March 11, 2013

TO: Jill Fujino
   Principal Investigator
   College of Education - Educational Foundations

FROM: Denise A. Lin-DeShetler, MPH, MA
   Director

Re: CHS #21070- "The Use of Research-Based Strategies to Help Improve Learning Outcomes in a Math Class of Fifth Grade Students"

This letter is your record of the Human Studies Program approval of this study as exempt.

On March 11, 2013, the University of Hawai‘i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46.101(b) (1).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/rb/html/manual/appendices/A/belmont.html

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.
Appendix C. HIDOE IRB Approval Letter

OFFICE OF THE SUPERINTENDENT

July 26, 2013

Ms. Jill Fujino

Dear Ms. Fujino:

I am pleased to approve your application for the research project "The Use of Research-Based Strategies to Help Improve Learning Outcomes in a Math Class of Fifth Grade Students" (Study #201236112500), which seeks to examine the influence of research-based strategies in helping to improve math learning outcomes for fifth grade students at Manoa Elementary School.

As described in your application, all students in the targeted fifth grade class will participate in the seven selected 45-minute math lessons on which your research project is focused.

I understand that participation in your research project will not involve any activities beyond those that are a part of regular classroom instruction during these periods; however, the data produced by participating students (those whose parents have consented to their participation and who themselves have assented to participating in the research project) as a result of their participation in the following activities will be used for your research project:

- Pre-assessment math problem to measure knowledge of the mathematical concept being introduced.
- Math journal entry in which the student records his/her learning.
- Post-assessment math problem to measure learning.
- Four-question self-assessment survey.

Please be aware of the following:

- In accordance with the Family Educational Rights and Privacy Act (FERPA), the only student data that you are authorized to use for your research project are those for which you have obtained consent to use from participating students' parents/guardians. Please note that, although you may have access to additional student and non-public HIDOE data in your role as a HIDOE teacher, you may not use these data for your research project without the prior written consent of the students’ parents/guardians and/or an approved HIDOE data request.

Should you wish to use student or non-public HIDOE data beyond those described above, you must submit a research application modification request to the Data Governance Office, along with a

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER
Appendix C. HIDOE IRB Approval Letter (page 2)

Ms. Jill Fujino
July 26, 2013
Page 2

revised parent/guardian consent form or a completed data request form, as appropriate. You may
only use these additional data for your research project after:

1. I have approved your modification request and
2. You have obtained parent/guardian consent using the revised form and/or your data request
   has been approved by the appropriate data steward.

• You are required to conduct your research project in accordance with both the conditions of approval
described in this letter and the document “Affirmation and Acknowledgement of the Processes,
Procedures, and Conditions for Conducting Research in the Hawaii State Department of Education”
(the “Affirmation Form for Researchers”), which you signed and submitted as part of your research
application.

• You are responsible for ensuring that all individuals involved in this research project — both those
affiliated with your organization and those contracted by your organization and affiliated with
external entities or vendors — adhere to all of the conditions of my approval, including those
detailed in this letter and those stipulated by the Affirmation Form for Researchers.

Included for your reference below are some of the processes, procedures, and conditions for conducting
research in HIDOE that are included in this form; please note, however, that this list is not exhaustive. For
the full contents of the form, please refer to your signed copy, which you have attached to Tab 6 of your
research application, or to the blank copy available for download from the HIDOE Research website at
http://apps.hawaii.k12.hi.us/research/Pages/FormResources.aspx.

As stipulated by the Affirmation Form for Researchers:

• Participation in the research project by HIDOE students and personnel will be strictly voluntary and
contingent upon obtaining — prior to their participation in the research project:
  a. The written approval of the relevant school or office administrator(s),
  b. The written consent of all adult participants (which includes students 18 years and older),
  c. The active assent of participants who are minors, and
  d. The written consent of the guardians of all minor participants;

• Oral instructions must be provided for all participant activities related to the research project that
involve minor students;

• After consenting to participate in the research project, participants (and, in the case of minor
participants, their guardians on their behalf) may withdraw at any time, for any reason;

• All activities related to the research project must take place at dates, times, and locations agreed
upon by the administrators of the participating schools and offices;

• Any compensation provided to HIDOE personnel for participation in the research project must be for
activities completed outside of instructional and work hours;

• Copies of the research project’s data collection instruments (e.g., surveys, interview schedules) must
be presented to the administrators of the participating schools and offices for review prior to the
implementation of the research project;
Appendix C. HIDOE IRB Approval Letter (page 3)

Ms. Jill Fujino  
July 26, 2013  
Page 3

- If the research project will involve participants who are minor students, a copy of the relevant data collection instrument(s) must, upon request, be made available to the students’ guardians for review in the office of the participating school prior to the implementation of the research project;

- All data collected during the course of implementing the research project or made available to you by HIDOE for the research project (including, but not limited to, completed surveys, interview responses, video recordings, audio recordings, and HIDOE data sets) must be destroyed when the final report on the research project is complete or at the end of your research project’s one-year approval period (which ends 12 months from the date of this letter), whichever date is sooner;

- At least two (2) weeks prior to printing, publishing or otherwise publicly releasing the final report on the research project, electronic copies of a final draft must be submitted to:
  a. The administrators of the participating schools and offices for their review, and
  b. If the research project involves either participants who are HIDOE students or personnel or the collection and/or receipt of personally identifiable HIDOE student or personnel data, to the Data Governance Office to be screened for the inclusion of personally identifiable HIDOE student and personnel data; and

- Upon request, electronic copies of the final report on the research project must be shared with:
  a. Participants in the research project,
  b. The complex area superintendents of the participating schools, and
  c. The assistant superintendents/directors of the participating HIDOE offices.

Should you have any questions about the above, please contact Jennifer Higaki, HIDOE Data Governance Office, at DOEresearch@notes.k12.hi.us or (808) 440-2854.

Best wishes for a successful research project. We look forward to receiving your findings and recommendations.

Very truly yours,

[Signature]

Kathryn S. Matayoshi  
Superintendent

KSM/bk

c: Ruth Silberstein, Complex Area Superintendent, Kaimuki-McKinley-Roosevelt Complex Area  
  Kerry Higa, Principal, Manoa Elementary School  
  Leila Hayashida, Acting Assistant Superintendent, Office of Curriculum, Instruction and Student Support  
  Data Governance Office
Appendix D. Parent Consent for Participation

University of Hawai‘i at Mānoa
Parental/Guardian's Consent for Child to Participate in Research Project:
The use of research-based strategies to help improve learning outcomes in a math class
of 5th grade students

Dear Parent/Guardian:

My name is Jill Fujino. I am your child's 5th grade teacher at Valley Elementary School. I also am a graduate student at the University of Hawai‘i at Mānoa (UH) in the College of Education doctoral program. During this school year, I will be implementing teaching methods that are new to my classroom in the subject area of math, but which are based on recognized research-based teaching strategies.

One requirement for earning my doctoral degree in education is to conduct a research project. The project that I will be conducting is to gather data to determine whether these new teaching methods help to improve student learning.

I am asking for your permission to have your child participate in this project. If you give such permission, a separate letter will then be provided to your child asking for his or her assent to participate in this project. Participation in this project is entirely voluntary and will not affect your child’s grade in any way or your child’s instruction since the new teaching methods will be implemented on a classroom wide basis in any event. Students in my 5th grade class will be doing the same work and take the same assessments regardless of participation in the research. Participation in the research means student's work and records will be used as part of the research. The following information is provided to you so that you can decide whether you wish to allow your child to participate in this project.

Project Description - Activities and Time Commitment: Data from seven selected math lessons during the school year will be collected. No additional time outside of the 45 minute math period will be taken from your child if you decide to participate in this research. If your child participates, at the start of each math lesson (for a total of 7) s/he will be given a pre-assessment math problem to be used as base-line data to measure their knowledge of the mathematical concept being introduced. During the 45 minute math period, instruction of the math lesson will be delivered by the teacher (Ms. Fujino) using various research-based strategies: setting the objective, note-taking and summarizing, providing immediate feedback and student self-assessment. Your child will record their learning in a math composition book. At the end of the math lesson, your child will be given a post-assessment math problem to be used as data to measure “learning”. Your child will also be given a survey of four questions to allow for student self-assessment of their understanding to the concept being taught. One example of the type of question I will ask is, “How much has the note-taking strategy helped you? Circle one: a little,

6 School name utilized is a pseudonym
some, and a lot. Please give a reason why and/or how? If you would like to preview a copy of all the survey questions that I will ask, please contact me via the phone number or email address listed near the end of this consent form.

**Benefits and Risks:** I do not anticipate any risk or harm to your child in participating in this research project. The results of this project may help me, other teachers, and researchers learn more about students' perspectives on math teaching instruction. If, however, your child becomes uncomfortable or stressed by answering any of the survey questions, we will skip the question, or take a break, or stop, or withdraw from the project altogether.

**Confidentiality and Privacy:** During this research project, I will keep all data in a secure location. Only my University of Hawaiʻi advisor and I will have access to the data, although legally authorized agencies, including the University of Hawaiʻi Human Studies Program, have the right to review research records.

When I report the results of my research project, I will not use your child's name or any other personally identifying information. Instead, I will use a pseudonym (fake name) for your child. If you would like a copy of my final report, please contact me at the number listed near the end of this consent form.

**Voluntary Participation:** Participation in this research project is voluntary. Upon your approval, your child will be asked to give their assent to participate as well. No student will be included in the study without both parent/guardian consent and individual assent. Your child (and you) can choose freely to participate or not to participate. If you choose not to participate, your child will continue to do the activity with the class, as it is a part of the regular math curriculum. However, your child’s work will not be part of the data collection. In addition, at any point during this project, you can withdraw your permission, and your child can stop participating without any penalty of loss of benefits. I recognize that I am the researcher in this project and, at the same time, your child's teacher. Thus, I will ensure that your child's participation or non-participation in my research project does not impact his/her grades, or our teacher-to-student relationship at Mānoa Elementary School.

**Questions:** If you have any questions about this project, please contact me, Jill Fujino, via phone (808) 888-8888 or e-mail fujinoj@hawaii.edu. You can also contact my advisor at the University of Hawaiʻi, Dr. Sarah Twomey, at (808) 956-5898 or via e-mail at twomey@hawaii.edu. If you have any questions about your rights, or the rights of your child as a research participant, you can contact the University of Hawaiʻi, Human Studies Program, by phone at (808) 956-5007 or by e-mail at uhirb@hawaii.edu.

Please keep the prior portion of this consent form for your records.

If you consent for your child to participate in this project, please sign the following signature portion of this consent form and return it to **Jill Fujino**.
☐ I agree to participate in the research project entitled, “The use of research-based strategies to help improve learning outcomes in a math class of 5th grade students.”

☐ I give permission for my child to participate in the research project entitled, “The use of research-based strategies to help improve learning outcomes in a math class of 5th grade students.”

☐ I understand that, in order to participate in this project, my child must also agree to participate.

☐ I understand that my child and/or I can change our minds about participation, at any time, by notifying the researcher of our decision to end participation in this project.

or

☐ I do not agree to participate in the research project entitled, “The use of research-based strategies to help improve learning outcomes in a math class of 5th grade students.”

☐ I do not give permission for my child to participate in the research project entitled, “The use of research-based strategies to help improve learning outcomes in a math class of 5th grade students.”

Name of Parent/Guardian (Print): ______________________________________________

Parent/Guardian's Signature: ________________________________________________

Date: ____________________________

Jill Fujino, MEdT, University of Hawai‘i at Mānoa
Appendix E. Student Assent for Participation

University of Hawaiʻi at Mānoa
Student Assent to take part in a Research Project

Dear Participant:

We are asking you to take part in a project to help Ms. Fujino learn more about how kids learn, and if the use of research-based strategies will help improve learning outcomes in a math class of 5th grade students.

Before you decide whether to take part in this project, it is important that you know:

- It is your choice to be a part of it or not;
- If you decide to join, you can stop at any time; and
- Your parent or guardian must also agree for you to participate.

What you will be asked to do if you join this study?

At the Start of Math Class - At the start of each math lesson (for a total of 7) you will be given a pre-assessment math problem to be used as base-line data to measure your knowledge of the mathematical concept being introduced.

During Math Class - During the 45 minute math period, instruction of the math lesson will be delivered by Ms. Fujino using various research-based strategies: setting the objective, note-taking and summarizing, providing immediate feedback and student self-assessment. You will record your learning on a worksheet.

At the End of Math Class - At the end of the math lesson, you will be given a post-assessment math problem to be used as data to measure “learning”. You will also be given a survey of four questions to allow for student self-assessment of your understanding to the concept being taught. One example of the type of question I will ask is, “How much has the note-taking strategy helped you? Circle one: a little, some, and a lot. Please give a reason why and/or how?”

Who will be given information about you?

During this project, Ms. Fujino will keep all data from the math worksheets and student questionnaire in a secure location. No student names will be used and only Ms. Fujino will have access to the data.

Do you have to be in this study?
You do not have to be in the study if you do not want to. It is up to you. Even if you start, you can stop later if you want. No one will be mad at you.
**How do you get your questions answered?**
If you have any questions about this project, you may contact Ms. Fujino at (808) 888-8888 or send a message to fujinoj@hawaii.edu

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**Agreement to take part in the study:**
Signing your name at the bottom of this form means that you agree to be in this project. You and your parents will be given a copy of this form after you have signed it. If you agree to be in this project, please sign and return this assent form to Ms. Fujino.

**Student’s Name (Print):** ________________________________

**Student’s Signature:** ________________________________

**Date:** ______________________________

**Researcher’s Name (Print):** Jill Fujino, MEdT, University of Hawai‘i at Mānoa

**Researcher’s Signature:** ________________________________ **Date:** ______________________________

---

**Name of Parent or Guardian (print):**
Appendix F. Seven Selected Math Lessons

Appendix F1. Lesson 1, page 1

APPENDIXES - RESEARCH TOOLS
Formative Math Assessment: Topic 2

<table>
<thead>
<tr>
<th>( \text{ME} )</th>
<th>( \text{MP} )</th>
<th>( \text{DP} )</th>
<th>( \text{WB} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add and subtract two large whole numbers, with accuracy</td>
<td>Add and subtract two large whole numbers, with no significant errors</td>
<td>Add and subtract two large whole numbers, with a few significant errors</td>
<td>Add and subtract two large whole numbers, with many significant errors</td>
</tr>
</tbody>
</table>

**Topic 2-5**

Add.
Show your work.

\[ 8,579 + 4,604 \]

Subtract. Check your answer by adding.
Show your work.

\[ 540,064 - 48,945 \]

All math problems in Appendix F are adapted from Scott Foresman-Addison Wesley enVision MATH, grade 5 (Pearson, 2013). Standards adapted from Common Core State Standards Initiative (corestandards.org, 2013).
CCSS. Add and subtract decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

<table>
<thead>
<tr>
<th>ME</th>
<th>MP</th>
<th>DP</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtract decimals to hundredths, with accuracy</td>
<td>Subtract decimals to hundredths, with no significant errors</td>
<td>Subtract decimals to hundredths, with a few significant errors</td>
<td>Subtract decimals to hundredths, with many significant errors</td>
</tr>
</tbody>
</table>

**Topic 2-7**
Subtract.
Show your work.

\[
\begin{array}{c}
9.8627 \\
- 0.823
\end{array}
\]

\[
31.3 - 18.79
\]

\[
31.3 - 18.79
\]
APPENDIX F1. Lesson 1, page 3

APPENDIXES - RESEARCH TOOLS

Formative Math Assessment: Topic 2

<table>
<thead>
<tr>
<th>ME</th>
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<th>DP</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add and subtract two large whole numbers, with accuracy</td>
<td>Add and subtract two large whole numbers, with no significant errors</td>
<td>Add and subtract two large whole numbers, with a few significant errors</td>
<td>Add and subtract two large whole numbers, with many significant errors</td>
</tr>
</tbody>
</table>

Pre-Assessment, Topic 2-5

The table shows the areas of two states. What is the total square mileage of Texas and Delaware? Show your work.

<table>
<thead>
<tr>
<th>State</th>
<th>Area (square miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>268,580</td>
</tr>
<tr>
<td>Delaware</td>
<td>2,489</td>
</tr>
</tbody>
</table>

Use the table below. How many more people were employed as teachers than as lawyers?

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>961,000</td>
</tr>
<tr>
<td>Lawyers</td>
<td>926,000</td>
</tr>
</tbody>
</table>
APPENDIX F1. Lesson 1, page 4

APPENDICES - RESEARCH TOOLS

Formative Math Assessment: Topic 2

Post-Assessment, Topic 2-5

The table shows the areas of two states. What is the total square milage of Alaska and Rhode Island? Show your work.

<table>
<thead>
<tr>
<th>State</th>
<th>Area (square miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>656,425</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>1,545</td>
</tr>
</tbody>
</table>

Use the table below. How many more people were employed as public officials than as natural scientists?

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Officials</td>
<td>753,000</td>
</tr>
<tr>
<td>Natural Scientist</td>
<td>566,000</td>
</tr>
</tbody>
</table>

Student Self-Assessment

Do you feel this lesson was successful towards your learning objective: Computing sums and differences of two large whole numbers? Circle one.

Yes       No

Why and/or how was the lesson successful or not successful for you?
Formative Math Assessment: Topic 2

<table>
<thead>
<tr>
<th>ME</th>
<th>MP</th>
<th>DP</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtract decimals to hundredths, with accuracy</td>
<td>Subtract decimals to hundredths, with no significant errors</td>
<td>Subtract decimals to hundredths, with a few significant errors</td>
<td>Subtract decimals to hundredths, with many significant errors</td>
</tr>
</tbody>
</table>

Pre-Assessment, Topic 2-7

Olivia buys a shirt for $14.69 and a pair of pants for $21.32. How much more does she spend for the pants? Show your work.

Mark made a deposit of $280. His balance is now $630.42. What was his balance before the deposit?
APPENDIX F2. Lesson 2, page 2

Formative Math Assessment: Topic 2

<table>
<thead>
<tr>
<th>ME</th>
<th>MP</th>
<th>DP</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtract decimals to hundredths, with accuracy</td>
<td>Subtract decimals to hundredths, with no significant errors</td>
<td>Subtract decimals to hundredths, with a few significant errors</td>
<td>Subtract decimals to hundredths, with many significant errors</td>
</tr>
</tbody>
</table>

Post-Assessment, Topic 2-7

Sophie buys a shirt for $19.90 and a pair of pants for $40.19. How much more does she spend for the pants? Show your work.

Mark made a deposit of $280. His balance is now $630.42. What was his balance before the deposit?

Student Self-Assessment

Summary of Learning -

Do you feel this lesson was successful towards your learning objective: Compute differences of decimals involving tenths, hundredths, and thousandths? Circle one.

Yes

No

Why and/or how was the lesson successful or not successful for you?
APPENDIX F3. Lesson 3

Formative Math Assessment: Topic 3
CCSS. Fluently multiply multi-digit whole numbers using the standard algorithm.

<table>
<thead>
<tr>
<th>ME</th>
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<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiply multi-digit whole numbers, with accuracy</td>
<td>Multiply multi-digit whole numbers, with no significant errors</td>
<td>Multiply multi-digit whole numbers, with a few significant errors</td>
<td>Multiply multi-digit whole numbers, with many significant errors</td>
</tr>
</tbody>
</table>

Pre-Assessment, Topic 3-1
Matching Vocabulary

• Commutative Property of Multiplication
  • The product of any number and 0 is 0.

• Associative Property of Multiplication
  • Factors can be regrouped and the product remains the same.
  Example: $2 \times (4 \times 10) = (2 \times 4) \times 10$

• Identity Property of Multiplication
  • The product of any number and 1 is that number.

• Zero Property of Multiplication
  • The order of factors can be changed and the product remains the same.
  Example: $3 \times 5 = 5 \times 3$

Post-Assessment, Topic 3-1
Which property of multiplication is used in the multiplication below?
$32 \times 0 = 0$

What number makes the number sentence true?
$5 \times (8 \times 9) = (5 \times 8) \times ____$

Student Self-Assessment
Do you feel this lesson was successful towards your learning objective: Identify and apply the Commutative, Associate, Identity, and Zero Properties of Multiplication? Circle one.

Yes  No

Why and/or how was the lesson successful or not successful for you?
APPENDIX F4. Lesson 4

Formative Math Assessment: Topic 3

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<td>Multiply multi-digit whole numbers, with many significant errors</td>
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Pre-Assessment, Topic 3-5

Mr. Wallace can rent a car for $66 a day. He will need the car for 28 days. What will be the total cost of the rental? Solve. Show your work.

Post-Assessment, Topic 3-5

At a basketball game, there were 37 rows of bleachers. There were 28 people sitting in each row. How many people were in the 37 rows of bleachers?

Student Self-Assessment

Do you feel this lesson was successful towards your learning objective: Multiply two-digit numbers by two-digit numbers? Circle one.

Yes  No

Why and/or how was the lesson successful or not successful for you?
APPENDIX F5. Lesson 5, page 1

Formative Math Assessment: Topic 4

<table>
<thead>
<tr>
<th>ME</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Find whole-number quotients of whole numbers, with accuracy</td>
<td>Find whole-number quotients of whole numbers, with no significant errors</td>
<td>Find whole-number quotients of whole numbers, with a few significant errors</td>
<td>Find whole-number quotients of whole numbers, with many significant errors</td>
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</tbody>
</table>

Pre-Assessment Topic 4-5

Find each quotient.

\[
4 \overline{139} \quad 828 \div 9 = \underline{\hspace{1cm}}
\]

Ella walked for 9 hours to raise money for her favorite charity. She raised $225. How much money did she raise for each hour she walked?

Solve. Set-up your paper when problem solving.
APPENDIX F5. Lesson 5, page 2

Formative Math Assessment: Topic 4

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Post-Assessment Topic 4-5

Find each quotient. Show your work.

\[ 4 \overline{139} \]

\[ 828 \div 9 = \_\_\_\_\_ \]

Suppose there were 8 cowboys that herded 104 cattle. If each cowboys herded the same number of cattle, how many animals was each cowboy responsible for?

Solve. Set-up your paper when problem solving.

Student Self-Assessment

Do you feel this lesson was successful towards your learning objective: Dividing by 1-digit divisors?

Circle one.

Yes  No

Why and/or how was the lesson successful or not successful for you?
Objective: Divide a three-digit number by a two-digit number to find a two digit quotient.

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</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Pre-Assessment Topic 5-6
Find each quotient. Show your work.

\[
\begin{array}{c|c}
47 & 985 \\
\end{array}
\]

\[
678 \div 33 = \underline{_______}
\]

Example notes during class:

\[
\begin{array}{c|c}
16 & 298 \\
\end{array}
\]

Step 1:

Step 2:

Step 3:

Check work:
APPENDIX F6. Lesson 6, page 2

Formative Math Assessment: Topic 5

<table>
<thead>
<tr>
<th>Objective: Divide a three-digit number by a two-digit number to find a two digit quotient.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ME</strong></td>
</tr>
<tr>
<td>Divide a three-digit number by a two-digit number to find a two digit quotient with accuracy.</td>
</tr>
</tbody>
</table>

Post-Assessment Topic 5-6

Find each quotient. Show your work.

\[ \div \]

864 \div 76 = ________

Student Self-Assessment

Do you feel this lesson was successful towards your learning objective: 2-Digit Quotients? Circle one.

Yes \hspace{1cm} No

Why and/or how was the lesson successful or not successful for you?
Objective: Read, write, and compare decimals to thousandths. Use the standard algorithm to divide decimals by decimals.

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Pre-Assessment Topic 7-8

Find each quotient. Show your work.

\[ 4.8 \div 1.5 = \square \]

Find each quotient. Show your work.

\[
\begin{array}{c}
0.5 \underline{25.2} \\
\vspace{0.5cm}
4.8 \div 1.5 = \square
\end{array}
\]

Example notes during class:

\[
\begin{array}{c}
0.25 \underline{1.75} \\
\vspace{0.5cm}
\text{Step 1:}
\end{array}
\]

\[
\begin{array}{c}
\text{Step 2:}
\end{array}
\]

\[
\begin{array}{c}
\text{Step 3:}
\end{array}
\]

Check work:
Formative Math Assessment: Topic 7

Objective: Read, write, and compare decimals to thousandths. Use the standard algorithm to divide decimals by decimals.

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Post-Assessment Topic 7-8

Find each quotient. Show your work.

\[
0.5 \div 2.5 = \underline{0.2} \quad 4.8 \div 1.5 = \underline{3.2}\]

---

Student Self-Assessment

Do you feel this lesson was successful towards your learning objective: *Dividing a Decimal by a Decimal*? Circle one.

Yes

No

Why and/or how was the lesson successful or not successful for you?
APPENDIX G. Student Questionnaire Protocol

The use of research-based strategies to help improve learning outcomes in a math class of fifth grade students

INTRODUCTION
Good Morning/Afternoon!

Thank you for consenting to participate in this research study. Today you will be taking a student self-assessment survey. This is a voluntary activity and your answers are confidential.

If at any time, you need to take a break, please feel free to do so. Also, if at any time you do not want to answer a question or wish to withdraw from participation, please feel free to leave or refrain from answering the question.

Please be as honest and truthful as possible, remembering again that this is confidential, and I will keep all data from this survey in a secure location.

Thank you again for your participation in this study. Are there any questions before we begin?

SEE ATTACHED STUDENT SELF-ASSESSMENT SURVEY

CLOSING
Thank you again for taking the student self-assessment survey. I appreciate your willingness to participate and contribute to this research project. Have a great day!
APPENDIX H. Student Questionnaire

Student Self-Assessment Survey (after Topic 5, 6 & 7) Date:

1. How much has the strategy *setting objectives (learning goals)* helped you? Circle one.
   none a little some a lot

   Please give a reason why and/or how the strategy helped or did not help you.

2. How much has the strategy *note-taking and summarizing* helped you? Circle one.
   none a little some a lot

   Please give a reason why and/or how the strategy helped or did not help you.

3. How much has the strategy *providing feedback* helped you? Circle one.
   none a little some a lot

   Please give a reason why and/or how the strategy helped or did not help you.

4. How much has the strategy of *student self-assessment* helped you? Circle one.
   none a little some a lot

   Please give a reason why and/or how the strategy helped or did not help you.
REFERENCES


