# Math Connects Effect on the Measures of Academic Progress Assessment

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Sean P. Langdon

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_____, Faculty Advisor

_____, Date

ABSTRACT

The Wahluke School District adopted the Math Connects math curriculum in 2009-2010. The instructor taught second grade students from two curriculums, Bridges and Mach Connects. Both groups of students received the same treatment. However, the 2009-2010 students were taught from Math Connects while the 2008-2009 students were taught from Bridges. The purpose of the study was to gather evidence supporting the effectiveness Math Connects had on student academic achievement. The Measures of Academic Progress assessment was used to determine significance for $p \geq .05, .01, .001$. The results of the research supported the hypothesis; students that received Math Connects instruction performed significantly better than the students that did not. The null hypothesis was rejected at $p \geq .05$.

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# CHAPTER 1

# Introduction

## Background for the Project

Which math curriculum yielded higher math achievement? The research coordinator for Trends in International Mathematics and Science Study (TIMSS), found that American teachers taught a more broad range of math topics each year compared to teachers in countries with higher math achievement (Uy, 2008). The Wahluke School District (WSD) had the opportunity to adopt a new math curriculum. The WSD reviewed several math curriculums to determine which best reflected Washington State standards, addressed the needs of the student population, and assured higher achievement on state standardized tests in math. After much consideration, the WSD adopted a new math curriculum, Math Connects (MC).

The Strategic Teaching (ST) organization was petitioned by the Washington State Board of Education (SBE) to assess Washington State's math standards (Strategic Learning [ST], 2007). The ST organization found that the standards needed to be more specific to

student outcomes to meet standards (ST, 2007). After the Office of the Superintendent of Public Instruction (OSPI) modified the math standards, OSPI had ST review several math curriculums in order to determine which were most aligned to the new standards (Plattner, 2008). After a rigorous analysis, MC was among the four most highly recommended math curriculums by ST (Plattner, 2008).

The following provided a study of Math Connects impact on academic achievement. The research provided a comparison of MC to the previous math curriculum, Bridges, using the Measures of Academic Progress (MAP) assessment.

Statement of the Problem

Was the recently adopted math curriculum, MC, an effective math curriculum? The author investigated Math Connects impact on student learning. The 2008-2009 students were taught from the Bridges math curriculum, while the 2009-2010 students were taught from MC. The researcher proposed that evidence from the MAP assessment determined the overall effectiveness of MC over other math curriculums. If

the evidence did not yield positive results, the author proposed that teachers needed to consider adapting instruction to the needs of the students to meet Washington State standards.

Purpose of the Project

The purpose of the project was to gather evidence that provided support for how MC increased academic achievement in math. The MAP test gave the researcher measurable data in order to support whether or not MC was significantly better than other math curriculums.

Delimitations

The research occurred in Saddle Mountain Intermediate School in a second grade bilingual classroom. The author initiated the research during the 2009-2010 school year after the WSD adopted MC. The research addressed the differences in math achievement in the 2008-2009 students, and the 2009-2010 students. The teacher instructed the 2008-2009 students from the Bridges math curriculum. The 2009-2010 students were taught MC from the same teacher. Both sets of students, English language learners (ELL), were taught math between 8:45 and

9:45, 60 minutes a day, five days a week. The author compared the 18 2008-2009 students, the control group, to the 21 2009-2010 students, the experimental group. Both groups of ELL students participated in MAP testing in May, generating data for Math Connects effect on achievement in math.

Assumptions

There were a number of factors that were assumed in the research. The treatment group was comparable to the control group. The teacher received WSD training in Sheltered Instruction Observation Protocol (SIOP) in teaching ELL students to support subject matter instruction (Coleman & Goldenberg, 2010). The teacher received MC training. The MC math curriculum was aligned to Washington State standards. The teacher devotedly used MC, a research based, age appropriate math curriculum. The measuring instrument, used to determine the effectiveness of MC, determined the student's aptitude in math.

Hypothesis

The MAP test data provided comparable data of math achievement of students receiving MC and the

Bridges math curriculum. The author hypothesized that second grade students who received MC instruction realized significantly higher achievement on the MAP test than those who did not receive MC instruction.

Null Hypothesis

There was no significant difference in MAP test scores between those that received MC math instruction and those who did not. The data from MAP test scores may not have demonstrated a substantial difference in achievement levels between the two math curriculums. Significance was determined for $p \geq .05$, .01, and .001 (Gay, Mills, & Airasian, 2005).

Significance of the Project

The results in the Washington Assessment of Student Learning exam (WASL) indicated that students were not meeting the standards in math (Office of Superintendent of Public Instruction, 2010). If the MAP, a normative exam, reported that the experimental group outperformed the control group, then the class, school, and district were positively effected. The scope and sequence may have better prepared students for subsequent grades.

If the results of the project did not determine significance to support Math Connects positive effect on achievement, then the class would have not been prepared for the third grade. As for the school, and district, negative results may have required adaptations to MC to meet the Washington State standards.

Procedure

The treatment group received MC for the entire year. Throughout the year, students engaged in MC pretests, posttests, and formative assessments. The teacher, with colleagues, designed lesson objectives to align with second grade Washington State standards. The WSD mandated that teachers provided content and language objectives for each lesson. According to SIOP, language-based objectives supported the ELL's acquisition of subject matter (Coleman, & Goldenberg, 2010). Depending on the student's needs based on pretest, mid-test, or observational data, the teacher provided meaningful additional MC support to assist the students in attaining Washington State math standards.

In May, the experimental group took the MAP assessment. The students were able to use a pencil and paper. However, answers were keyed into the computer. Similar conditions offered to the experimental group were offered to the control group. The experimental group, like the control group, took the MAP test under the same conditions.

The author gathered the data from the MAP assessment. The data was used to generate a *t* score to measure the significance between the two posttests.

Definition of Terms

affective filter. Anything in the learning environment that inhibited learning to occur in the learner (Krashen, 2003).

comprehensible input. Instruction that was given to the learner's level of understanding (Krashen, 2003).

constructivist. A teaching model in which the learner learned to construct and reconstruct his or her own knowledge by personal experience (Ying-Tien & Chin-Chung, 2005).

direct instruction. A teaching model that focused on systematic curriculum design and explicit instruction with continuous student-teacher interaction.

plasticity. The capability the brain that had to accommodate and acquire new language (Saville-Troike, 2008).

scaffolding. Temporary support given to a learner that was gradually taken away until the learner was able successful independently (Vygotsky, 1962).

Acronyms

BICS. Basic Interpersonal Communication Skills.

CALPS. Cognitive Academic Language Proficiency.

ELL. English Language Learner.

ESL. English as a Second Language.

ELPST. English Language Proficiency Standards Team.

LAD. Language Acquisition Device.

L1. Language One.

L2. Language Two.

MAP. Measures of Academic Progress.

MC. Math Connects.

NRC. National Research Council.

NWEA. Northwest Education Association.

OSPI. Office of the Superintendent.

PLC. Professional Learning Community.

SBE. State Board of Education.

SIOP. Sheltered Instruction Observation Protocol.

SMI. Saddle Mountain Intermediate.

SLA. Second Language Acquisition.

ST. Strategic Teaching.

TIMSS. Trends in International Mathematics and Science Study.

TPR. Total Physical Response.

WASL. Washington Assessment of Student Learning.

WSD. Wahluke School District.

ZPD. Zone of Proximal Development.

# CHAPTER 2

## Review of Selected Literature

### Introduction

The author selected literature to support the research. The author found support for the research from a range of research on the following: the second grade learner, the English language learner, Measures of Academic Progress, and Math Connects. The selected literature informed the author's research.

### The Second Grader

Several of the most influential theoretical perspectives on human development served as basis for the author's research on students of the typical second grade student, a seven to eight year child. Papalia, Olds and Feldman (2008) provided a comprehensive range of theoretical perspectives that included the psychoanalytic, learning, cognitive, and contextual points of view. These major perspectives supported the research of the second grader's development.

Erikson's psychosocial theory, a psychoanalytic perspective, posited personality was influenced by

society and developed through a series of crises (Papalia et al., 2008). Erikson modified and extended Freudian theory into eight stages of crisis (Erikson, 1968). The crises needed to be satisfactorily resolved by the individual for healthy development of strengths (Erikson, 1968). Erikson's theory suggested that the second grader was in the industry verses inferiority stage until puberty (Papalia et al., 2008). The industry verses inferiority stage introduced the crisis of learning the skills of the culture (Papalia et al., 2008). Erikson (1968) hypothesized that success at this stage, learning skills of the culture, bestowed competence to the child. Erikson supposed that the elementary years, which were distinguished by this stage, were especially critical for developing confidence (Peregoy & Boyle, 2008). Efficacy played an important role in student's motivation to learn and develop, especially in school (Peregoy & Boyle, 2008).

Learning theorists proposed that development was continuous and quantitative (Papalia et al., 2008, p. 33). Two key learning theories included behaviorism and social learning (Papalia et al., 2008, p. 33).

Behaviorists conceptualized development as a process of forming connections between stimuli and responses (National Research Council [NRC], 2000). Motivation to learn was assumed to be driven by the individual's ambition and external forces, like rewards and punishments (Skinner, 1950). Watson applied Ivan Pavlov's stimulus-response of classical conditioning to children (Watson & Rayner, 1920). Classical conditioning suggested that while children learned what went together, children were able to anticipate what would happen as a consequence (Watson & Rayner, 1920). Skinner formed the principles of operant conditioning (Skinner, 1950). Operant conditioning incorporated reinforcement, a consequence of behavior that increased the likelihood that the behavior would be repeated (Skinner, 1950). Skinner held that reinforcement was positive or negative (Skinner, 1954). Positive reinforcement was a reward, and negative reinforcement was something that could be taken away (Papalia et al., 2008). Classical and operant theories suggested that repeated conditioning could mold the second grader's behavior.

Skinner contended that much of a child's behavior was shaped by factors in the environment that rewarded or punished (NRC, 2000). Skinner offered suggestions to improve learning: give the learner immediate feedback, break down the task into small steps, repeat the directions as many times as possible, work from the most simple to the most complex tasks, and give positive reinforcement (Skinner, 1954). Second graders could be taught any appropriate skill using these basic five principles (Skinner, 1954).

Albert Bandura, a learning theorist, developed principles of the social cognitive theory. Bandura's theory considered the process of modeling, observational learning, as a prime component of children's learning (Bandura, 1989). This theory incorporated both behavioral and cognitive learning. The theory proposed children learned by observing (Papalia et al., 2008). Children, like second graders, formed standards from models for moderating their own actions, and then became more selective in choosing models that exemplified those standards (Bandura, 1989). Bandura (1989) suggested that when children

achieved self-efficacy, they were more likely to regulate their own learning.

The Swiss theoretician Jean Piaget, a cognitive theorist, developed hypotheses on how children constructed knowledge (Papalia et al., 2008). Similar to Bandura's (1989) social cognitive theory, Piaget (1954) created a comprehensive theory of four qualitatively different stages: sensorimotor, preoperational, concrete operations, formal operations. The second grader was in Piaget's stage of concrete operations, which was characterized by the appropriate use of logic (Piaget, 1954). Children at this stage, between seven and eleven, could not think abstractly, but could solve problems logically if focused on the present (Piaget, 1962). "Cognitive growth between the stages occurred through three interrelated process: organization, adaptation, and equilibration" (Papalia et al., 2008, p. 36). Children progressed through these stages as efficacy was achieved at each level. "Piaget contends that the current state of knowledge is temporal, changing as time passes, as knowledge in the past has changed . .

. . It is a process of continual construction and reorganization" (Ying-Tien & Chin-Chung, 2005, p. 3). In learning, whether learning language or other area of knowledge, a link between a person's current mental state and higher order function was the process of constructing ones' knowledge (Saville-Troike, 2008). The basis of Piaget's theory went into creating the constructivist-teaching model, in which the learner learned to construct and reconstruct his or her own knowledge by personal experience (Ying-Tien & Chin-Chung, 2005). In addition, a learner benefited from individualized cognitive guidance through dynamic social interaction of equally able peers (Kim & Baylor, 2006). This interaction fostered cognitive restructuring, and promoted cognitive growth (Kim & Baylor, 2006).

According to the contextual perspective, development was described in the social context (Papalia et al., 2008). Vygotsky understood that the second grader was in middle childhood, in which the child moved from play to learning (Pass, 2008). Vygotsky, like Piaget, stressed children's active

engagement with the environment (Saville-Troike, 2008). However, Vygotsky theorized that cognitive growth was a collaborative process in which children learned through interpersonal interaction (Saville-Troike, 2008). "Vygotsky rejected Piaget's idea that the learner, not the teacher, interacting with the environment was the only thing necessary for new concepts to emerge" (Pass, 2007, p. 281). Vygotsky found that through shared interaction, children learned and adapted to the society's ways of thinking and behaving (Papalia et al., 2008). Vygotsky's sociocultural theory introduced the Zone of Proximal Development (ZPD). "The zone proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978). Through social interaction, the second grader continually developed while temporary support was given. This temporary support, Vygotsky (1962) termed scaffolding, would gradually be taken away until the

child was able to be successful independently. Vygotsky (1962) argued, "What the child can do in cooperation today, he can do alone tomorrow" (p. 188). Like in the MC math curriculum, on a typical day, the teacher began class interaction with some scaffolding questions that activated prior learning experiences from previous learning (ST, 2007). Krashen (2003) understood that interactive learning between peers lowered the affective filter, increasing learning and retention. The second grader's development was influenced by the teacher's ability to provide appropriate support and collaborative learning opportunities with more capable peers (Saville-Troike, 2008).

These basic theories offered various perspectives on human development. Evidence in this research offered a comprehensive representation of the second grade child.

The Second Grade English Language Learner

"Teachers who are not well prepared for English language learners struggle to address their needs in the classroom" (Moreno, 2007, p. 772).

The English language learner (ELL) was defined as students who spoke English as a non-native language (Peregoy & Boyle, 2005). Becoming aware of the students' background was important in teaching the ELL (Peregoy & Boyle, 2005).

Theories on second language acquisition (SLA) facilitated an understanding, and appreciation for the student learning a second language. Krashen (1992) agreed with Chomsky that everyone had a language acquisition device (LAD), the innate ability for language acquisition (P.6). In language acquisition, students exhibited characteristics relative to a particular stage of SLA. Krashen suggested five gradual stages of language development: early production, early production, speech emergence, intermediate fluency, and advanced fluency (Krashen & Terrell, 1983).

The beginner commenced at pre production, the silent period (Krashen and Terrell, 1983). This stage lasted up to six months, and was characterized by exhaustive efforts by the child to try to understand the language, often resulting in silence (Rothenberg &

Fisher, 2006). For example, children in this stage were able indicate a response to a question by pointing to a picture in a book (Hill & Flynn, 2006).

The next stage, early production, lasted another six months (Krashen and Terrell, 1983). This stage was characterized by being able to speak one or two word phrases, or short phrases from memorization (Hill & Flynn, 2006). Krashen (1981) urged teachers to not force productivity, but rather allow students a silent period. In the affective filter hypothesis, Krashen (1981) hypothesized, "People acquire second languages when they obtain comprehensible input and when their affective filters are low enough to allow the input in" (p. 62).

The following stage, speech emergence, was characterized by more development of vocabulary; the ability to communicate with simple phrases and sentences, and even explain reasoning (Rothenberg & Fisher, 2006). Speech emergence occurred within one to three years of language development, which was consistent with most second graders who began English language instruction in kindergarten. In this stage,

the learner was able to complete graphic organizers, read short texts, and even compose brief stories (Rothenberg & Fisher, 2006). In addition, the learner was becoming more fluent in basic interpersonal communication skills (BICS) (Krashen, 1992).

Within the next three to seven years, the learner advanced through the two subsequent stages, intermediate fluency and advanced fluency (Krashen and Terrell, 1983). Most second grade children would not be in either these stages. Children progressed from thinking in the new language to approaching cognitive academic language proficiency (CALPS) (Krashen, 1992). Other gains included the learner moving from being able to understand how to reason to selecting the most important information in problem solving (Hill & Flynn, 2006).

Progression through these stages included overcoming the barriers to language acquisition. "The presence of the affective filter explains how two students can receive the same (comprehensible) input, yet one makes progress while the other does not" (Krashen, 1992, p. 6). The second grader may have been

more amenable to language acquisition. The younger the child, the more capacity the child had to assume the functions that learning a new language demanded (Saville-Troike, 2008). Second graders were less analytical, had more brain plasticity, had fewer inhibitions, and weaker group identity compared to adults (Saville-Troike, 2008).

Extensive research supported best teaching practices for ELLs. Developmental theorists, Piaget and Vygotsky, affirmed much of the most recent research on the ELL and SLA.

Piaget hypothesized that children continually learn, building on previous knowledge. Likewise, the initial state of the second language included knowledge of the first language (Gibbons, 1993). The processes in SLA included the interpretation of the new language in terms of that knowledge (Saville-Troike, 2008). There was also application of what had been acquired as part of general cognitive development, as well as of all prior social experience (Saville-Troike, 2008).

Vygotsky (1962) theorized learning was a "social act" (p.76). The Zone of Proximal Development (ZPD) was evident in "tasks that a child can complete successfully only with the help of an adult or a more capable peer" (Rothenberg & Fisher, 2006, p. 20). In essence, Levykh echoed Vygotsky, "What the child can do in cooperation today, he can do alone tomorrow" (Levykh, 2008, p. 11). Effective interpersonal interaction provided the ELL scaffolding within the ZPD. Saville-Troike (2008) argued, "Scaffolding occurred while the ELL constructed language that exceeded the ELL's competence" (p. 112).

Effective teaching models for ELLs were supported in Piaget's and Vygotsky's theories. Substantial studies proposed that a classroom where children worked together with higher language proficient peers to solve problems and produce projects supported language development (Swain, Knouzi, Lapkin, & Brooks, 2010). Vygotsky's theory supported that, "Students need many opportunities for language interaction" (Herrell & Jordan, 2008, p.2). Saville-Troike (2008) aptly explained this in the following:

> Processing of L2 [second language] input in interactional situations is facilitative, and some think also causative, of SLA. Benefits come from collaborative expression, modified input, feedback (including correction), and negotiation of meaning. SLA is likely to be greatly inhibited if learners are isolated from opportunities for use. Social perspectives generally hold that SLA benefits from the active engagement of learners in interaction, or participation in communicative events. (p. 177)

Students learned in a second language from the use of comprehensible input. Moreno (2007) proposed that traditional learning activities did not address what we knew about how people best learned: "Making connections to what we have learned or experienced previously before we apply our new knowledge in a different setting or context" (p. 773). Similarly, Krashen (2003) purported, "Comprehensible input has been our last resort in language teaching . . . comprehending messages is the only way language is acquired" (p. 40). Comprehensible input was achieved

when the learner was given a surplus of context to understand content so he or she could apply the input to new knowledge (Krashen, 2003). Other factors that increased comprehensible input was the teaching method, and lowering the affective barriers that inhibited learning (Krashen, 2003).

Effective teaching models for the ELL supported the research in how the ELL student learned in a new language. Similar to Piaget's theory, "Comprehension expands as we make connections to prior knowledge, as we analyze language, ideas, or events, and then create a new product using our developing understanding . . . . learning takes place through input and output" (Rothenberg & Fisher, 2006, p.27). Effective teaching models made the content comprehensible and engaging in teaching the academic language, CALPS (Krashen, 2003). Making content comprehensible allowed students to express their understanding, and led the learner to developing dependence in using effective learning strategies (Rothenberg & Fisher, 2006). Sheltered subject matter instruction included content, language, and social/affective objectives in teaching content

(Peregoy & Boyle, 2008). Using this model built in opportunities for the ELL to understand and process the material (Peregoy & Boyle, 2008). The Sheltered Instruction Observation Protocol (SIOP) was a model that was especially effective (Coleman & Goldenberg, 2010). The SIOP model incorporated language development and sheltering techniques to support content instruction at the proficiency levels of the students (Coleman & Goldenberg, 2010).

Vygotsky's sociocultural theory supported sheltered instruction. Social interaction was the causative force in acquisition, which led to higher order, more complex mental functions (Saville-Troike, 2008). The cooperative learning model, which embodied social interaction, may have been especially effective in ELL's success in SLA and learning subject matter (Moreno, 2007).

An especially effective, engaging teaching model was Asher's Total Physical Response (TPR) (Krashen, 2003). The TPR model provided context in the form of pictures, realia, modified speech, and offered the use of movement (Krashen, 2003). Asher published a number

of studies that demonstrated that students who participated in instruction using TPR outperformed students that did not (Krashen, 2003).

By incorporating this research, teachers were able to best serve the ELL student. Krashen (2003, cited in Kohn, 1999, p. 26) quoted that Alfie Kohn had recognized this:

> For all our talk about motivation, I think we often fail to recognize a truth staring us in the face: If educators are able to create the conditions under which children can become engaged with academic tasks, the acquisition of intellectual skills will probably follow (p. 85).

Measures of Academic Progress

Measures of Academic Progress (MAP) was normative data that allowed educators to compare students to millions of others in the nation (Cronin, Kingsbury, Dahlin, & Bowe, 2007). The Northwest Education Association (NWEA) regularly conducted studies to examine the correspondence between MAP and state standardized tests used to measure student achievement (Cronin et al., 2007). The MAP was a multiple choice,

computer-based test that demonstrated stability over a thirty-year period (Cronin et al., 2007). The reliability of the MAP test was determined "in terms of a Pearson product-moment correlation coefficient (*r)*" (NWEA, 2004, p. 2). Evidence in the form of the Pearson correlation coefficient determined concurrent validity (NWEA, 2004).

"Stability . . . is the degree to which scores on the same test are consistent over time" (Gay, Mills, & Airasian, 2005, p. 140). The NWEA (2004) posed a rigorous test-retest over several months to a year to determine test-retest reliability, and stability. The retest was comparable to the first in content and structure, but differed in the difficulty level of items (Northwest Evaluation Association [NWEA], 2004). Over a two to three week period, the retest reliability maintained an average of .80 (NWEA, 2004).

"In general terms, the better a test measures what it purports to measure, the greater its validity is said to be" (NWEA, 2004, p. 4). A strong relationship was indicated in the MAP test in the mid .80s (NWEA, 2004). Relationship within mathematics was

stronger, ranging between an average of .82 and .86 in a study comparing a number of state assessments to the MAP (Cronin et al., 2007).

Standardized testing can serve the purpose of sorting students along a continuum of achievement (Stiggins, 2001). The author's MAP test coordinator specified the MAP assessment served as a tool for educators to design instruction to the needs of the student (T. Coulson, personal communication, February 4, 2010). Students took the MAP test three times a year. The MAP generated a report on the progress made, and areas in which the student needed to make gains (T. Coulson, personal communication, February 4, 2010).

Math Connects

The Wahluke School District (WSD) adopted Math Connects (MC) for grades K-8 in the 2009-2010 school year. When choosing the math curriculum, the WSD included teachers in the process of adopting the math curriculum. The researcher and colleagues determined how closely the proposed math curriculum aligned to Washington State standards. Stiggins (2001) advised

that educators "must clearly define the achievement targets we wish to assess" (p. 102). According to McGraw-Hill (2007) and supporting research, MC was determined to be an effective curriculum, as MC incorporated a variety of approaches for instruction for a wide range of students. The Washington State Board of Education (SBE) had MC reviewed by Strategic Teaching (ST). The findings of ST affirmed MC to be closely aligned to the state standards, and, therefore highly recommended (Strategic Teaching [ST], 2007).

In 2007, the Washington's SBE solicited ST to review Washington State's math standards. The report from ST explained that Washington State's math standards needed to be stronger in content and more rigorous (ST, 2007). The ST offered specific recommendations for improving the math standards (Plattner, 2008). These recommendations were intended to guide the Office of Superintendent of Public Instruction (OSPI) in revising the math standards (Plattner, 2008). Some of the recommendations included "moving more appropriate content to lower grades, and reduce the use of the verb understand to be replaced

with observable verbs that require students to do demanding work" (Plattner, 2008, p. 23). The ST organization also recommended to "Identify those topics that should be taught for extended periods at each grade level, and better show how topics develop over grade levels" (Plattner, 2008, p. 26). William Schmidt, research coordinator for Trends in International Mathematics and Science Study (TIMSS), found that American teachers taught a more broad range of math topics each year compared to teachers in countries with higher math achievement (Uy, 2008). Uy (2008) reiterated William Schmidt, "In other countries, they might spend a month on a topic while we spend days on a topic" (p.2). With the review and recommendations from ST, the SBE included ST in reviewing math curriculums that best corresponded to new Washington State math standards.

The ST organization evaluated seven of the OSPI's highest scoring K-12 math curriculums. The SBE asked ST to do an evaluation of OSPI's curriculum review process, how well the content in OSPI's highest ranking programs matched state standards, and the

soundness of the math program across grade levels (ST, 2007). Although at the elementary level, MC lacked in areas of multiplication, fractions, and areas of a triangle, the ST report found that MC was among the four most highly recommended curriculums by ST (ST, 2007).

The ST report concluded that MC needed some supplementation (ST, 2007). Minor deficiencies were easy to supplement (ST, 2007). Math Connects, according to ST, depended highly on direct instruction, especially at the elementary level (ST, 2007). Direct instruction's goal was mastery. Skinner (1954) may have agreed that direct instruction was an effective teaching model. In direct instruction, the learner benefited from immediate feedback on the smaller components of larger tasks to achieve mastery (Skinner, 1954). Achieving mastery may have been beneficial for the ELL since, "Frequency and practice lead to automaticity in processing, and there free learners' processing capacity for new information and higher-order performance needs" (Saville-Troike, 2008, p. 176). The MC curriculum came with a teacher manual,

student workbooks, and supplemental worksheets. Student hands-on materials and online math activities were also included. The hands on activities included in the teacher's edition were identified as appropriate for use with below grade level students (ST, 2007). However, all students may have benefited from these materials (McGraw-Hill, 2007).

In a study of the effects of constructivist-oriented instruction on elementary students, low achievers and high achievers experienced more growth with the constructivist models than students taught using traditional instruction (Chin-Chung and Ying-Tien, 2005, p. 5). This teaching model especially improved learning for the ELL. "Students are to be actively engaged in learning, have ample opportunities for interaction, and demonstrate their English language proficiency in multiple and varied ways" (PreK-12 English Language Proficiency Standards Team [ELPST], 2006, p. 5). In essence, what was best for all students was involving more hands on activities for all of learners (ELPST, 2006). Although McGraw-Hill's (2007) MC was mostly a direct instruction

curriculum, there were opportunities in each lesson to incorporate constructivist instruction strategies. In a teacher survey, McGraw-hill (2007) found that most teachers did not use the games and other cooperative learning supplies, but teachers planned on using them in the future.

The MC curriculum offered various ways to teach a wide variety of students. Built into MC were diagnostic tests, mid-tests, and posttests. The mid-tests served as a midpoint check, as well as a review of previous standards. While ST (2007) helped align the curriculums to the standards, teachers were encouraged to design instruction that best met the needs of the students (Plattner, 2008). The researcher found that many of the lessons and activities could be adapted to include a number of other teaching models, like cooperative learning, and other models that were especially effective for ELLs. The researcher incorporated Sheltered Instruction Observation Protocol (SIOP), which included content and language objectives to make academic content accessible to ELLs (Coleman & Goldenberg, 2010).

Summary

The research provided a brief description of human development relevant to that of a second grade student. The research reviewed the second grade ELL in SLA. Finally, the research supplied an examination of the measurement instrument, MAP, and the MC math curriculum. The selected literature presented supporting evidence to sustain the author's research.

Piaget, and Vygotsky's research defined the second grade student in the learning environment. According to Piaget, the second grader was in Piaget's stage of concrete operations, which was characterized by the appropriate use of logic (Piaget, 1954). Both Vygotsky and Piaget observed that cognitive growth was a collaborative process in which children learned through interpersonal interaction (Saville-Toike, 2008). Like Piaget and Vygotsky, Krashen (2003) agreed that the second grade ELL benefited from active engagement in the environment, and social interaction. Math Connects provided ample opportunities for the second grade ELL to learn through a variety of learning methods, and learning strategies. In

addition, MC was aligned to meet state standards. The research provided best teaching practices for the second grade learner. Implementing the research into practice was likely to influence positive results on student learning.

# Chapter 3

## Methodology and Treatment of Data

### Introduction

Did Math Connects (MC) have a positive effect on achievement in math? The author's research utilized an experimental method and design. The experimental research provided support for the effectiveness, and improvement, MC had on student achievement in math. The following offered an explanation for how the author realized the research.

At the beginning of the 2009-2010 school year, the Wahluke School District (WSD) adopted the Math Connects math curriculum. The purpose of the project was to gather supporting evidence that determined MC improved academic achievement in math using the Measures of Academic Progress (MAP) assessment. The MAP assessment offered measurable data in order to support whether or not MC was significantly better than other math curriculums. The second graders took the MAP exam once at the end of the second grade. The results in the Washington Assessment of Student Learning exam (WASL) indicated that students were not

meeting the standards in math (Office of Superintendent of Public Instruction, 2010). The MAP assessment, a standardized test, suggested the likeliness of higher achievement in math on the WASL.

The MAP test data provided comparable math achievement data from students learning from two different math curriculums, MC and Bridges. The author hypothesized that second grade students who received MC instruction realized significantly higher achievement on the MAP test than those who did not receive MC instruction.

Methodology

The author employed a modified experimental research method to compare two groups of students' achievement on the MAP test. The experimental method "can test hypotheses to establish cause-effect relationships" (Gay, Mills, & Airasian, 2005, p. 223). The treatment group received MC instruction, the independent variable. The control group received Bridges instruction. The dependent variable, the MAP test data, produced a measurable outcome. The MAP test

results were used to measure the effect of the independent variable on the experimental group.

Participants

The modified random sample for the research consisted of second grade students of SMI, ages seven and eight. The students resided in the small community of Mattawa. The Office of the Superintendent of Public Instruction (2010) concluded that in 2008-2009, SMI grades two through four, was 95.2% Hispanic, 29.3% migrant, and 74.1% of the student body was on free or reduced lunch.

The class was made up of 21 students, 17 girls and four boys. The sample was similar to that of the control group. Both groups of students were English language learners (ELL). Many of the student's were ELLs, with Spanish as the primary language spoken in the home. Consequently, ELLs thrived in an environment conducive to developing language alongside content-based skills. The experimental group was given MC instruction in 2009-2010. The control group received the Bridges math instruction the previous year. With ELL students, the challenge was to modify instruction

to increase comprehensible input as well as proficiency in math skills (Krashen, 2003).

Instruments

The measuring instrument was the MAP test. The Northwest Evaluation Association (NWEA) provided evidence that supported the MAP test was a valid and reliable proficiency test that measured academic progress in various subjects (NWEA, 2004). Over a two to three week period, the retest reliability maintained an average of .80 (NWEA, 2004). More recently, the MAP's reliability coefficient score averaged .80 (Cronin, Kingsbury, Dahlin, & Bowe, 2007). In a 2007 study that compared a number of state assessments to the MAP, testing for validity, the relationship within mathematics was stronger, ranging between an average of .82 and .86 in a study (Cronin et al., 2007). The MAP test provided the investigator with comparable posttest data from the control and treatment group.

Design

The author realized a modified posttest only experimental study. The posttest only design compared

posttest scores to determine the effectiveness of the treatment (Gay et al., 2005).

The author researched the sources of invalidity for the modified posttest only experimental design. "The combination of random assignment and the presence of a control group serves to control for all sources of internal invalidity except mortality" (Gay et al., 2006). Mortality was not controlled due to the absence of pretest data (Gay et al., 2006). The duration of the study was approximately 20 months, with a sample size of about 20 in both the experimental group and the control group.

History, maturation, testing, instrumentation, regression, and selection were controlled for within the design (Gay et al. 2006). Events outside the experiment were not likely to have an effect on the study. Over the course of the 20 months of the experiment, there were no major interruptions that compromised the validity of the experimental research. Students within the experimental and control group may have caused a difference in mortality. Students mature at varied rates, and other students could have

influenced the rate of maturity within each group. Students did not take a pretest, or repeated tests to influence the results of the MAP assessment. In addition, the same test, and circumstances were provided for both groups. Regression was mostly controlled for in the study. The participants in the research were comparable, as both groups were second grade ELLs. However, students did not take a pretest to determine that the experimental group was comparable to the control group. The selection of students was controlled for in the research. Both groups were second grade ELLs. Mortality was a probable threat to validity (Gay et al., 2006). However, the size of the study was constant throughout the study (Gay et al., 2006).

Procedure

The experimental group received MC for the entire 2009-2010 school year. At the beginning of the year, in September, the experimental group took the MC cumulative pretest. Every three chapters these students took a cumulative review test. The cumulative review tests were taken in November, February, and in

May. Throughout 2008-2009 and 2009-2010, the teacher designed lesson objectives to align with second grade Washington State standards. The teacher was member of a committee of colleagues, a professional learning community (PLC). In 2009-2010, the PLC collaborated in designing a logical scope and sequence of MC, and facilitated alignment of MC to the standards. Within each unit, ranging from one to three weeks, students engaged in MC pretests and posttests, and mid chapter checks. These pretests and posttests began in September 2009 and went through the end of May 2010. The results from each of these tests provided a means for developing instruction according to student needs. The teacher taught to the standards that each lesson addressed. The treatment group and the control group were instructed with content and language objectives to support the learning goals of each lesson. Sheltered Instruction Observation Protocol (SIOP) addressed language-based objectives to support ELL's acquisition of subject matter to develop language (Coleman, & Goldenberg, 2010). Depending on the student's needs based on pretest, mid-test, and

observational data, the teacher provided meaningful learning activities provided by MC to assist the students in reaching the Washington State math standards.

The teacher used MC devotedly. Math instruction occurred between 8:45 and 9:50 in the morning. A typical lesson began with scaffolding questions from previous learning. The teacher supplied the students with whiteboards that assisted in student participation in responding to these scaffolding questions. The teacher addressed the content and language objectives for the lesson. The teacher modeled and explained the learning objectives. Students engaged in cooperative learning, direct instruction, and other effective teaching models for ELLs. Students were equipped with MC materials to support learning, like clocks, base-ten blocks, and other supplies. Often, the teacher used MC online support, like games and videos, to teach related concepts. However, as suggested by MC, the instructor supplemented the curriculum with support for second language acquisition to include Asher's Total Physical

Response (TPR), and opportunities for students in interpersonal interaction. Students maintained a personal math dictionary of all mathematical vocabulary. Any new vocabulary would be addressed in class instruction. Lessons ended by recapping the learning objectives.

At the end of each unit, students took the MC posttest. The posttests were identical to the pretest. Students completed the test within 20 to 45 minutes, or until finished.

The same teacher taught the control group and the experimental group. Both groups were taught for the same amount of time, in the morning, five days a week. The teacher taught math from Bridges in 2008-2009. The Bridges math curriculum was a considerably different curriculum from MC. Bridges lacked technology for instruction, worksheets, sound assessments, and other student materials. The teacher did not use Bridges pretests and posttests to measure for growth. Instead, the teacher used teacher made tests to support the Bridges program. The pretests and the posttests were identical. Like MC, the pretests and posttests were

administered from September through May to monitor and improve instruction, and to measure for student learning. Bridges assessments were not aligned to Washington State standards, and the curriculum lacked varied instruction methods. Much of Bridges depended heavily on hands on materials, like math games. Students used the manipulatives and games throughout each unit. Games and manipulates were used from September through May to compliment standards taught in Bridges.

In May, both the control group and the experimental group took the MAP assessment on a computer in the computer lab. The students were able to use a pencil and paper. However, answers were keyed into the computer. Similar conditions offered to the experimental group were offered to the control group. The experimental group, like the control group, took the MAP test under the same conditions, in the same computer lab.

The author gathered the data from the MAP assessment. The data was used to measure the significance between the two posttests. The value of *t*

determined the effect MC had on student's math achievement compared to the students taught from Bridges.

Treatment of the Data

The data from the MAP assessment of the control and experimental group were used to measure the significance between the two group's achievement. The value of *t* accepted or rejected the null hypothesis. As a consequence, the hypothesis was either supported or not supported by the value of *t*. Significance was determined for $p \geq .05$, .01, and .001 (Gay et al., 2005).

Summary

The research followed a precise procedure. The procedure ensured a sound experimental method and design. The experimental research provided evidence to the effectiveness of MC on student achievement in math. The significance was determined for $p \geq .05$, .01, and .001 (Gay et al., 2005). The value of *t* determined whether a significant difference existed between the means of the control group and the experimental group.

# CHAPTER 4

## Analysis of the Data

### Introduction

The author realized an experimental study to determine Math Connects effect on student learning. The experimental research provided support for the effectiveness, and improvement, MC had on student achievement in math.

At the beginning of the 2009-2010 school year, the Wahluke School District (WSD) adopted the Math Connects (MC) math curriculum. The purpose of the project was to gather supporting evidence that supported MC improved academic achievement in math using the Measures of Academic Progress (MAP) assessment. The MAP assessment offered measurable data that supported whether or not MC was significantly better than other math curriculums. Second graders took the MAP exam once at the end of the second grade in spring. The results in the Washington Assessment of Student Learning exam (WASL), a standardized test, indicated that students were not meeting the state standards in math (Office of Superintendent of Public

Instruction, 2010). The MAP assessment, also a standardized test, suggested the probability of higher achievement in math on the WASL.

The MAP test data provided comparable math achievement data from students learning from two different math curriculums, MC and Bridges. The author's research provided statistical evidence that tested the superiority of MC to Bridges.

Description of the Environment

The research was conducted in Saddle Mountain Intermediate School in a second grade bilingual classroom. Upon the adoption of MC, the author initiated the research. The teacher provided instruction to the 2008-2009 students, and the 2009-2010 students. The 2008-2009 students were taught using Bridges, and the 2009-2010 students were taught from MC. Each group of English language learner (ELL) students were taught between 8:45 and 9:45, 60 minutes a day, five days a week. Both groups of students took the MAP test in spring. The MAP test data produced data to measure the effectiveness of each curriculum on student learning.

Hypothesis

The MAP test data provided comparable data of math achievement of students receiving MC and the Bridges math curriculum. The author hypothesized that second grade students who received MC instruction realized significantly higher achievement on the MAP test than those who did not receive MC instruction.

Null Hypothesis

There was no significant difference in MAP test scores between those that received MC math instruction and those who did not. The data from MAP test scores may not have demonstrated a substantial difference in achievement levels between the two math curriculums. Significance was determined for $p \geq .05$, .01, and .001 (Gay, Mills, & Airasian, 2005).

Results of the Study

The results of the study provided data to address the hypothesis of the research. The experimental group and the control group completed the MAP test. The MAP test results were analyzed using the Statpak, producing statistics and associated values. Based on

the analysis, the experimental group demonstrated higher achievement on the MAP test compared to the control group.

Table 1.

*MAP Posttest Data*

| Posttest Data 2008-2009 | Posttest Data 2009-2010 |
|---|---|
| 166 | 198 |
| 169 | 168 |
| 170 | 170 |
| 170 | 183 |
| 171 | 178 |
| 173 | 179 |
| 173 | 182 |
| 175 | 175 |
| 176 | 193 |
| 176 | 186 |
| 176 | 172 |
| 177 | 185 |
| 179 | 197 |
| 182 | 191 |
| 188 | 187 |
| 179 | 188 |
| 184 | 182 |
| 189 | 190 |
| | 182 |
| | 169 |
| | 191 |

A *t* score of 2.73 was determined in the statistical analysis (Gay, Mills, & Airasian, 2005). The means of the control and experimental group's MAP scores determined the value of *t*. The mean of the treatment group was 183.14, and the mean of the control group was 176.28. The degrees of freedom were 37. The evidence suggested the treatment of the experimental group was significantly different from the control group. Clearly, MC made a significant, positive effect on student learning in the MAP assessment.

Table 2.

*Statpak Analysis*

| Statistic | Value |
|---|---|
| No. of scores in Group X | 21 |
| Sum of Scores in Group X | 3846.0000 |
| Mean of Group X | 183.14 |
| Sum of Squared scores in Group X | 705938.00 |
| SS of Group X | 1570.57 |
| No. of Scores in Group Y | 18 |
| Sum of Scores in Group Y | 3173.0000 |
| Mean of Group Y | 176.28 |
| Sum of Squared scores in Group Y | 560025.00 |
| SS of Group Y | 695.61 |
| *t-value* | 2.73 |
| Degrees of freedom | 37 |

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\left(\frac{SS_1 + SS_2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{183.14 - 176.28}{\sqrt{\left(\frac{1570.57 + 695.61}{21 + 18 - 2}\right)\left(\frac{1}{21} + \frac{1}{18}\right)}}$$

*t=2.73*

Significance was determined for $p \geq .05$, .01, and .001 (Gay, Mills, & Airasian, 2005). The calculated value of *t*, which was 2.73, was larger than the threshold value for *t* at .05. The calculated value of *t*, 2.73, was .02 less than the threshold value at .01, which was 2.75. The null hypothesis was rejected at $p \geq .05$, thus supporting the hypothesis (Gay, Mills, & Airasian, 2005, p. 571). The *t* score was only .02 less than the threshold value provided by Gay at .01. Clearly there was a significant difference between Math Connects and Bridges.

Table 3.

*Distribution of t*

| | *p* | | |
|---|---|---|---|
| *df* | .05 | .01 | .001 |
| 37 | 2.042 | 2.750 | 3.646 |

Findings

Students who received MC instruction realized higher achievement on the MAP test than those who did not receive MC instruction. The Statpak analysis calculated a *t* score of 2.73 (Gay, Mills, & Airasian, 2005). The results suggested that students who received MC instruction had a 95% probability of higher academic achievement on the MAP test than students who received Bridges math instruction.

Significance was determined for $p \geq .05$, .01, and .001 (Gay, Mills, & Airasian, 2005). The calculated value of *t*, which was 2.73, was larger than the threshold value for *t* at .05. The calculated value of *t*, 2.73, was .02 less than the threshold value at .01, which was 2.75. The null hypothesis, there was no significant difference in MAP test scores between those that received MC math instruction and those who did not was rejected at $p \geq .05$ (Gay, Mills, & Airasian, 2005, p. 571). The hypothesis, second grade students who received MC instruction realized significantly higher achievement at .05 on the MAP test than those who did not receive MC instruction,

was supported. The *t* score was only .02 less than the threshold value provided by Gay at .01. Clearly there was a significant difference between Math Connects and Bridges.

Discussion

The evidence obtained from the data analysis confirmed the author's expectations. Research suggested that clear learning targets, supportive materials, and a variety of teaching models found in MC may have positively impacted the results of the study. Students taught from MC performed significantly better on the MAP test than those who received other math instruction.

The MC curriculum was thoroughly examined to meet the state standards. The findings from Strategic Teaching (ST) affirmed MC to be closely aligned to the state standards, and, therefore highly recommended (Strategic Teaching [ST], 2007). Having a clear definition of the achievement targets may have influenced the results of the research (Stiggins, 2001).

Math Connects provided a variety of teaching strategies and materials that addressed the needs of the students. The hands on activities included in the teacher's edition were identified as appropriate for use with below grade level students (ST, 2007). However, the author expected the MC hands on activities to improve learning for all learners, not just the below grade level learners.

Within MC, many opportunities for direct instruction may have assisted in achieving higher results on the MAP. Skinner (1954) suggested that the learner benefited from immediate feedback on the smaller components of larger tasks to achieve mastery. Math Connects was designed with ample opportunities for instant feedback on the smaller components of larger tasks. Achieving mastery was beneficial for the ELL since "Frequency and practice lead to automaticity in processing, and there free learners' processing capacity for new information and higher-order performance needs" (Saville-Troike, 2008, p. 176).

Math Connects offered many opportunities for collaboration with peers. Vygotsky (1962) argued,

"What the child can do in cooperation today, he can do alone tomorrow" (p. 188). The research supported that providing opportunities for students to work in cooperative groups increased student capabilities in math. According to McGraw-Hill (2007), and supporting research, MC was determined to be an effective curriculum, as MC incorporated a variety of approaches for instruction for a wide range of students.

Math Connects addressed the needs of the ELL in learning math. Krashen (2003) suggested using language to teach content to develop language. Substantial studies proposed that a classroom where children worked together with higher language proficient peers to solve problems and produce projects supported language development (Swain, Knouzi, Lapkin, & Brooks, 2010). "Students are to be actively engaged in learning, have ample opportunities for interaction, and demonstrate their English language proficiency in multiple and varied ways" (PreK-12 English Language Proficiency Standards Team [ELPST], 2006, p. 5). The evidence from the research suggested that Math Connects supported the ELL in learning math.

Summary

The research provided support for Math Connects positive effect on student learning. Second grade students at Saddle Mountain Intermediate School from 2008-2009, and 2009-2010 completed the MAP test to measure academic progress in math. The MAP tests from each group provided comparable data of students learning from two different math curriculums, MC and Bridges.

The author hypothesized that second grade students who received MC instruction realized significantly higher achievement on the MAP test than those who did not receive MC instruction. The Statpak analysis determined a *t* score of 2.73 (Gay, Mills, & Airasian, 2005). The null hypothesis was rejected at $p \geq .05$ (Gay, Mills, & Airasian, 2005, p. 571). The *t* score was only .02 less than the threshold value provided by Gay at .01. The evidence suggested MC had a significantly superior effect on student academic achievement, therefore confirming support for the hypothesis. Students who received MC had a 95%

probability of attaining higher academic progress on the MAP assessment with MC instruction.

Students taught from MC performed significantly better on the MAP test than those who received other math instruction. Clear learning targets, supportive materials, and varied teaching models may have positively influenced the results of the study. The evidence obtained from the data analysis confirmed the MC research, and the author's expectations.

# CHAPTER 5

## Summary, Conclusions and Recommendations

### Introduction

Which math curriculum yielded higher math achievement? The purpose of the study was to gather evidence supporting the effectiveness Math Connects had on student learning. The Wahluke School District (WSD) had the opportunity to adopt a new math curriculum. The WSD reviewed several math curriculums to determine which best reflected Washington State standards, addressed the needs of the student population, and assured higher achievement on state standardized tests in math. After much consideration, the WSD adopted a new math curriculum, Math Connects (MC).

The Strategic Teaching (ST) organization was petitioned by the Washington State Board of Education (SBE) to assess Washington State's math standards (Strategic Learning [ST], 2007). The ST organization found that the standards needed to be more specific to student outcomes to meet standards (ST, 2007). After the Office of the Superintendent of Public Instruction

(OSPI) modified the math standards, OSPI had ST review several math curriculums in order to determine which were most aligned to the new standards (Plattner, 2008). After a rigorous analysis, MC was among the four most highly recommended math curriculums by ST (Plattner, 2008).

The study addressed Math Connects impact on academic achievement. The research provided a comparison of MC to the previous math curriculum, Bridges, using the Measures of Academic Progress (MAP) assessment.

Summary

The project provided the author with statistical evidence to measure the impact MC made on student learning and progress. In 2008-2009, the author taught from the Bridges math curriculum. In 2009-2010, the author taught from MC. Each group received the same amount of math instruction from different math curriculums. Each group completed a MAP test, producing data to determine effectiveness of MC.

In order to support the investigation, the author reviewed selected research. The author considered the

research to conduct an experimental study. The author completed a modified random sample for the experimental study, comparing MAP test data from two comparable groups of bilingual second grade students.

To measure the effectiveness of each curriculum, the author compared MAP test results from each group. Using the MAP scores, the author performed an experimental research on MC and student achievement. The author hypothesized that students that received MC math instruction realized higher academic achievement on the MAP test than those that received other math instruction. The experimental research produced a *t* score of 2.73. The *t* score rejected the null hypothesis at $p \geq .05$, and therefore supported the hypothesis. The calculated value of *t* confirmed that there was a significant difference between students that received MC instruction and students that did not. The students that received MC instruction performed significantly better on the MAP assessment than the control group.

Conclusions

The results from the research supported the hypothesis that students who received Math Connects math instruction realized significantly higher achievement than students that received other math instruction. The research produced statistically significant results, with a *t* score of 2.73. The calculated value of *t* determined significance at $p \geq .05$ (Gay, Mills, & Airasian, 2005, p. 571). The *t* score rejected the null hypothesis at $p \geq .05$, thus supporting the hypothesis. The data from the research suggested that MC more effective than Bridges in realizing higher results on the MAP assessment.

The author's review of selected research confirmed that MC clearly addressed state standards, met the needs of the ELL in learning math, and provided varied learning opportunities for the second grade learner. Math Connects was designed to incorporate ample opportunities for instant feedback on the smaller components of larger tasks. Math Connects use of direct instruction helped students achieve mastery. Achieving mastery was beneficial for

the ELL since "Frequency and practice lead to automaticity in processing, and there free learners' processing capacity for new information and higher-order performance needs" (Saville-Troike, 2008, p. 176). The MC curriculum provided opportunities for students to learn in varied ways, including hands on learning, direct instruction, and cooperative learning methods. According to McGraw-Hill (2007), and supporting research, MC was determined to be an effective curriculum, as MC incorporated a variety of approaches for instruction for a wide range of students.

Recommendations

The author will consider recommendations based on the results of the study. The author recommends that the research be repeated with more students for a duration of three to five years. More students and more time will provide more support for the hypothesis that students that receive MC instruction realize higher achievement on the MAP test. In addition to repeating the study, the author suggests employing a pretest-posttest design in order to measure for

growth. The author recommends comparing fourth grade student WASL data, and MAP data of students that received MC math instruction. The author will consider comparing MC to other math curriculums in a comparative study. The author recommends comparing second grade student achievement of students learning from MC to students learning from Everyday Math, First Steps, and Saxon Math. Comparisons of varied curriculums, and more students, will yield more sustaining, significant data to support the evidence of this study. Based on the conclusions of the research, the author will seek more opportunities to measure the effectiveness MC has on academic achievement.

REFERENCES

Bandura, A. (1989). *Social cognitive theory.* In R. Vasta (Ed.) *Annals of child development.* Greenwich, CT: JAI.

Coleman, R., & Goldenberg, C. (2010). What does research say about effective practices for English learners?. *Kappa Delta Pi Record*, *46*(2), 60-65. Retrieved from Education Research Complete database.

Cronin, J., Kingsbury, G.G., Dahlin, M., & Bowe, B. (2007). *Alternate methodologies for estimating state standards on a widely used computer adaptive test.* Paper presented at the American Educational Research Association, Chicago, IL.

Erikson, E. H., (1950). *Childhood and society.* New York: Norton.

Erikson, E. H., (1968). *Identity: Youth and crisis.* New York: Norton.

Gay, L., Mills, G., & Airasian, P. (2005). *Educational research: Competencies for analysis and applications.* Columbus, OH: Pearson.

Gibbons, P. (1993). *Learning to learn in a second language.* Portsmouth, NH: Heinemann.

Herrell, A. L., & Jordan, M. (2008). *50 strategies for teaching English language learners* (3rd ed.). Columbus, OH: Prentice Hall.

Hill, J., & Flynn, K. (2006). *Classroom instruction that works with English language learners.* Alexandria, VA. Association for Supervision and Curriculum Development.

Kim, J. (2005). The effects of constructivist teaching approach on student academic achievement, self-concept, and learning strategies. *Asia Pacific Education Review*, 6(1), 7-19. Retrieved from Education Research Complete database.

Kim, Y., & Baylor, A. (2006). A social-cognitive framework for pedagogical agents as learning companions. *Educational Technology Research & Development*, *54*(6), 569-596. doi:10.1007/s11423-006-0637-3.

Kohn, A. (1999). Punished by Rewards*: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes.* Boston: Houghton Mifflin Harcourt.

Krashen, S. D. (1981). Bilingual education and second language acquisition theory. In California Department of Education (Ed.). *Schooling and language minority students: A theoretical framework.* Los Angeles: Evaluation, Dissemination and Assessment Center, California State University.

Krashen, S. D. (1992). *Fundamentals of language education*. Columbus, OH: McGraw-Hill Companies.

Krashen, S. D. (2003). *Explorations in language acquisition and use.* Portsmouth, NH: Heinemann

Krashen, S., & Terrell, D. (1983). *The natureal approach: Language acquisition in the classroom.* Hawayard, CA: Alemany Press.

Levykh, M. (2008). The affective establishment and maintenance of Vygotsky's zone of proximal development. *Educational theory, 58(1), 83-101.* Retrieved from Education Research Complete database.

McGraw-Hill (2007). *McGraw-Hill's math connects kindergarten through algebra Series.* Retrieved from http://www.mhschool.com/math/mathconnects/assets/docs/math_connects_research_base_paper.pdf

Moreno, B. L., (2007). Shared responsibility: Achieving success with English-language learners. *Phi Delta Kappan,* 772-775.

Murphy, A. (2009). Tracking the progress of English language learners. *Phi Delta Kappan*, *91*(3), 25-31. Retrieved from MAS Ultra--Public Library Edition database.

National Research Council (2000). *How people learn: Brain, mind, experience and school* Bransford, J., Brown, J., Cocking, R. (Eds.). Washington, DC: National Academy Press.

Northwest Evaluation Association (2004). Reliability and validity estimates: North west evaluation association level tests and measures of academic progress. Retrieved from http://legacysupport. nwea.org assets/research/NWEA%20Reliability %20&%20Validity.pdf

Office of Superintendent of Public Instruction (2010). *Washington state report card.* Retrieved April 1, 2010, from http://reportcard.ospi.k12.wa.us/ summary.aspx?schoolId=778&OrgType=4&reportLevel=S chool&year=2008-09

Papalia, D., Olds, S., & Feldman, R. (2008). *Human Development* (11th ed.). Boston: McGraw-Hill Humanities/Social Sciences/Languages.

Pass, S. (2007). When constructivists Jean Piaget and Lev Vygotsky were pedagogical collaborators: A viewpoint from s study of their communications. *Journal of Constructivist Psychology*, *20*(3), 277-282. doi:10.1080/10720530701347944.

Peregoy, S., & Boyle, O. (2008). *Reading, writing and learning in ESL: A resource book for teaching k-12 English learners* (5th ed.). Boston, MA: Allyn & Bacon, Inc.

Piaget, J. (1954). *The construction of reality in the child.* New York. Basic. (Original work published in 1937)

Piaget, J. (1962). *The language and thought of the child* (M. Gabain, Trans.). Cleveland, OH: Meridian. (Original work published in 1923)

Plattner, L. (2008). Washington state mathematics Standards review and recommendations. Retrieved from http://www.math.jhu.edu/~wsw/ED/ WAFinalRecommendationsMath8-30.pdf

PreK-12 English Language Proficiency Standards Team (2006). *Prek-12 English language proficiency standards.* Alexandria, VA: Teachers of English to Speakers of Other Languages.

Rothenberg, C., & Fisher, D. (2006). *Teaching English language learners: A differentiated approach.* Columbus, OH: Prentice Hall.

Saville-Troike, M. (2008) *Introducing second language acquisition.* New York: Cambridge University Press.

Skinner, B. F. (1950)) Are Theories of learning necessary? *Psychological Review* 57: 193-216 1950

Skinner, B. F. (1954). The science of learning and the art of teaching. Harvard Educational Review, 24(2), 86-97 (Reprinted in Skinner, 1968).

Stiggins, R. (2001). *Student-Involved Classroom Assessment* (3rd ed.). Columbus, OH: Prentice Hall.

Strategic Teaching. (2007). Independent study of Washington state K-8 curriculum review. Retrieved from http://www.sbe.wa.gov/documents/2008-11-6CurriculumReviewStudy_001.pdf

Swain, M., Knouzi, I., Lapkin, S., & Brooks, L. (2010). Self-scaffolding mediated by languaging: microgenetic analysis of high and low performers. *International Journal of Applied Linguistics*, *20*(1), 23-49. doi:10.1111/j.1473-4192.2009.00227.x.

Uy, Erin. (2008). Experts: U.S. math curriculum lacks focus, logical sequence. *Education Daily*, *41*(19), 2. Retrieved from Education Research Complete database.

Vygotsky, L. S. (1962). *Thought and language.* Cambridge, MA: MIT Press. (Original work published in 1934)

Vygotsky, L. S. (1978) *Mind in Society.* Cambridge, MA: Harvard Press, 79-91.

Vygotsky, L. S. (1978). *Mind in society: The development of the higher psychological process.* Cambridge, MA: The Harvard University Press.

Watson, J.B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology, 3, 1-14.*

Ying-Tien, W., & Chin-Chung, T. (2005). Effects of constructivist-oriented instruction on elementary school students' cognitive structures. *Journal of Biological Education*, *39*(3), 113-119. Retrieved from Education Research Complete database