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# Middle School Math Teachers' Perceptions Of Standards, Assessment Literacy, and Professional Learning: A Colorado Case Study

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MIDDLE SCHOOL MATH TEACHERS' PERCEPTIONS OF STANDARDS,

ASSESSMENT LITERACY, AND PROFESSIONAL LEARNING:

A COLORADO CASE STUDY

being

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## ABSTRACT

The purpose of this study was to ascertain the perceptions sixth through eighth grade middle school math teachers in Colorado had of the professional learning they had received related to implementing the Colorado Academic Math Standards (CAMS), and also determine the teachers' level of understanding in each of the following areas: (a) state standards alignment and curriculum, and (b) assessment literacy. The study was designed to demonstrate how each area complemented the other two areas and their collective impact on instructional practices and student learning. The researcher's hope was that the findings of this case study may be helpful, at least in part, in assisting district leaders in various Colorado districts to more fully support teachers in the systemic transition to and implementation of the CAMS, and that the findings of the field study provided statistically significant evidence that well-aligned, strategic professional learning opportunities for state standards and assessment literacy supported increased awareness, understanding, and implementation of the CAMS with greater fidelity. The findings will be useful in the transition and implementation planning for Colorado districts and/or districts in other U.S. states that have recently adopted the Common Core State Standards (CCSS).

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# CHAPTER 1

# INTRODUCTION

What is written in state standards or district curriculum for a subject area, what is actually taught by a teacher, and what is ultimately assessed by state agencies are often very different (Porter, Polikoff & Smithson, 2009). Alignment, "the degree to which two or more elements are in agreement with each other", between curriculum, instruction, and assessment has been an ongoing concern in education (Kurz, Elliott, Webby & Smithson, 2009, p. 2). The state of Colorado, like other states in the union, has adopted and revised their state's curriculum standards, and the movement of the national Common Core State Standards Initiative (CCSSI) has caused a flurry of states to again begin the revision of their state standards (Carmichael, Martino, Porter-Magee & Wilson, 2010).

For Colorado, the first state math standards were formally adopted in 1995 (Colorado State Department of Education, 1995) and subsequently amended in 2005 (Colorado State Department of Education, 2010a). In 2008 West Educational Research for Education Development (WestEd) prepared a report for the Colorado State Department of Education (CDE) that provided guidance for the standards revision process for all content areas (WestEd, 2008). Revision work on the new Colorado Academic Math Standards (CAMS) began in 2008, and the new standards were adopted in 2009 (CDEa, 2010). However, in June of 2010, the CCSSI released the national Common Core State Standards (CCSS) for mathematics, and subsequently, in August of 2010, the Colorado State Board of Education approved the integration of the math CCSS within the newly adopted CAMS (CDEa, 2010). Following a gap analysis of content between the math CCSS and the CAMS, the newly adopted CAMS were revised and reissued by the Colorado State Board of Education in December of 2010, with the intention that the CAMS be fully implemented by schools beginning with the 2011-12 school year (CDEb, 2010). This continual succession of changes to the CAMS requires urgent and continual professional development for the teachers who see the academic achievement bar rising rapidly for students because of the No Child Left Behind Act of 2001 (NCLB, 2002).

The Colorado State Assessment Program (CSAP) was last used in the 2010-11 school year. It was replaced by the Transitional Colorado Assessment Program (TCAP) beginning with the 2011-2012 academic year. According to the CDE (2011), the TCAP items were to represent much of the overlap that existed between the Colorado Model Math Standards (retired standards) and the newly revised CAMS for the 2012 assessment window. The TCAP will again be administered in the spring of 2013 and an assessment pilot will be conducted for the new Colorado Assessment Program (CAP) that is scheduled to be administered in the 2013-14 school year (CDEb, 2010).

With this flurry of changes to the curriculum and assessments in the state of Colorado, it is imperative that sustained, high-quality professional learning for teachers accompany these initiatives. Learning teachers' perceptions of the professional development opportunities, the strengths, weaknesses, and omissions, if any, is critical to the success of teachers, districts, states, and most importantly, the children for whom schools exist.

# CHAPTER 2

# REVIEW OF THE LITERATURE

For the researcher to understand how teachers might best learn, instruct, and assess new standards, it was necessary to conduct a literature review. This review explores current research in three areas: (a) standards alignment and curriculum (b) assessment literacy, and (c) professional learning related to standards, curriculum, and assessment.

## *Standards Alignment and Curriculum*

In 1993, President Bill Clinton successfully lobbied Congress to require every state to create state standards and assess student progress. This increased awareness of standards and assessments in education was further strengthened when President George Bush signed the reauthorization of the Elementary and Secondary Education (ESEA) in January 2002, more famously known as, *No Child Left Behind* (Toch & Tyre, 2010). This argument for standards was a call to accountability for what is being taught in the classroom. According to Achieve (2010), to ensure these standards positively impact student achievement, merely being adopted is not enough; standards must also be implemented with fidelity.

According to Porter et al. (2009) the call for a movement towards voluntary national standards in education began in the 1990’s with support from former President Clinton. Clinton pushed for a national set of standards and assessment because the lack of a strong alignment between states’ standards and also between state and national professional standards existed. For example, an alignment index (AI) that ranged from 0 (no alignment) to 1.0 (perfect alignment) showed that for each subject at fourth and eighth grades, the state-to-state alignment indices were in the 0.20s. The average state-to-state alignment in mathematics was 0.27 for fourth grade and 0.20 for eighth grade, although an improvement did occur in two instances: (a) average between-state alignments of aggregated standards were much higher for the grade-specific standards in math at 0.47, and (b) the mean state-to-National Council of Teachers of Mathematics (NCTM) alignment was 0.42, with a maximum of 0.54 and a minimum of 0.35. However, even with the flagrant differences in the alignment of state standards, the push for national standards failed to materialize under the leadership of President Clinton (Porter et al., 2009).

A study by Carmichael et al. (2010) found no link between the quality of state standards and student achievement associated with those standards. This study showed that standards should be implemented systemically, with fidelity, and aggressively; yet, this oftentimes was not the case. Porter et al. (2009) noted that content standards define the intended curriculum, which is why alignment with the enacted, or taught, curriculum is so crucial in order to increase student achievement on state assessments, which are based on the intended curriculum of the state standards.

Another study by Klein (2005) found that, nationally, the average grade for state standards in mathematics in 1998 was a “D.” However, in a subsequent study (Klein, 2000), the national average grade of state standards in mathematics had improved to a “C” ranking. These grades were determined based on four criteria: (a) clarity, (b) content, (c) reasoning, and (d) negative qualities. The improvement between these research reports of math standards showed that the greatest gains were made in the criteria of *clarity*. The clearer the standards, the better teachers were able to implement them (Klein, 2000).

Klein (2005) gave the state of Colorado a math standards grade of “D”; however, in 2009, Colorado’s new Academic Standards earned a grade of “C” (Carmichael et al., 2010). It should be noted that this grade was earned prior to Colorado embedding CCSS within the Academic Standards. CCSS was embedded in 2010, and new Extended Evidence Outcomes for special needs students were added in 2011. The Extended Evidence Outcomes were unanimously approved by the Colorado State Board of Education on August 3, 2011 (CDE, 2011).

Currently, the U.S. has 50 unique sets of state standards, which makes it statistically impossible to compare student performance between states. The implementation of a national assessment system would rectify this issue because states would then be able to compare student performance using a common metric (Achieve, 2010). To illustrate this, Cronin (2007) examined the proficiency standards in 26 states and found that not only were there large discrepancies in proficiency cut scores between states and also in the vertical articulation of proficiency cut scores, but the level of difficulty between state tests varied widely as well.

Cronin (2007) also found in the same study that math tests were more difficult than reading tests. Even after taking into account differences in subject-matter complexity and children’s academic development, eighth grade math tests were still more difficult to pass than tests in previous grades. Calibrated proficiency cut scores were relatively equal in difficulty across all grades, yet this was not the case in most states, including Colorado, with math proficiency cut scores receiving the lowest average rank of the 26 states in the study.

For example, the Colorado eighth grade CSAP math proficiency standards were found to be 19% more difficult than the Colorado third grade math proficiency standards (Cronin, 2007). This alone is a viable reason for being cautious about making valid inferences and accountability determinations based solely on state assessment data, as one might incorrectly surmise that students receive better instruction in third grade math than in eighth grade math when examining a decline in math assessment proficiency levels from third grade to eighth grade. Corbin's findings also give cause for concern regarding the validity of relative proficiency standards between math and reading. Stakeholders could deem students better in reading than in math when looking strictly at proficiency standard percentages; however, given that math assessments are more difficult than reading assessments (Corbin, 2007), coupled with math having more difficult proficiency standards, such a conclusion would be inaccurate, and resources and interventions could be unintentionally misappropriated as a result.

This "Proficiency Illusion" (Corbin, 2007, p. 9) also posited that two states, Colorado and New Hampshire, had not always used the *proficient* level on their state test to represent proficiency for NCLB. In fact, Colorado counted the *partially proficient* proficiency standard on its state assessment as being *proficient* in regard to NCLB and determining AYP yet while using the higher "proficient" level for internal state evaluation purposes (Cronin et al., 2007).

With a variety of discrepancies existing with state assessments both between states and within states' grade level proficiency standards, there was a rise in avocation for national standards and for the implementation of a national assessment system to ensure fair comparisons between states and grade levels. Therefore, in June of 2010, the CCSSI released the CCS for mathematics (Kober & Rentner, 2011). Carmichael et al. (2010) showed the improvement of such a system, and determined that the new national CCS in mathematics earned a grade of "A-," with the CCS in language arts and mathematics ranking *superior* in 76 of the 102 standards which represented the language arts and mathematics standards in each of the 50 states as well as the District of Columbia.

Porter (as cited by Kurz et al., 2009) identified three types of curricula: (a) intended, (b) enacted, and (c) assessed. Content standards define the intended curriculum, teacher instruction represents the enacted curriculum, and student assessment content represents the assessed curriculum. It is helpful for staff to know the content of each curriculum, as each provides rich information to all stakeholders. The intended curriculum represents the instructional content objectives for the enacted curriculum, which is the content taught by teachers in the classroom, or the content students have the opportunity to learn. The assessed curriculum is a representation of the content areas across which students are tested (Kurz et al., 2009). A fourth type of curriculum, (d) the planned curriculum, is mentioned by Kurz (2009) as being a helpful starting point for professional learning discussions regarding the continuity between the intended and the enacted curriculums. The Kurz (2009) case study further suggested that both the control and treatment groups of teachers adhered to their own planned curriculum first and then secondly to the state's intended curriculum.

Strong alignment between curriculum content standards, instruction, and assessment is essential to generate collaborative discussions about the content students are expected to learn and the content teachers are required to teach. The ability to make valid inferences on student achievement data is predicated on the strength of this alignment, which is magnified further by the accountability brought about by NCLB (Kurz et al., 2009). Smithson's data (as cited by Kurz, et al., 2009) on the alignment between the enacted curriculum and state standards across a large number of teachers, indicated that the average AI values ranged from the high 0.10s to the low 0.20s. For example, in the Data on Enacted Curriculum (DEC) study (Blank et al., 2006), the AI for Miami grade 6 math instruction (treatment schools) with Florida state standards was 0.19.

To ensure alignment to the new standards and assessments, it is necessary to make uniform changes in the curriculum taught in American schools (Achieve, 2010). One way to determine the extent the intended curriculum is enacted in the classroom is through the use of the Surveys of Enacted Curriculum or SEC (Blank et al., 2006), which is one of three alignment methods currently in use by the CCSSI. Two other alignment methods are the (a) Webb model, which is the method Colorado used for alignment purposes between state content standards and state assessments, and (b) Achieve (Martone & Sireci, 2009).

While most states are requiring school districts to implement CCSS, a majority of these states are leaving the curricular decisions up to school districts (Kober & Rentner, 2011). In a study of the relationship between alignment and student achievement (Kurz et al., 2009), formative assessments and state tests were analyzed, with results showing alignment for the planned and enacted curriculum to state standards being low, with no significant differences found between general and special education. Therefore, having a well-aligned system is vital in order for stakeholders to translate the goals of federal policy into effectively informed instructional decision making and practices.

Alignment and student achievement correlations become much stronger only after students have been exposed to the enacted curriculum for a sustained period of time, which Kurz (2009) showed took nearly six months. Gamoran (as cited by Kurz, et al., 2009) pointed out that data suggests the longer students are exposed to an enacted curriculum that is well-aligned with standards, the greater the potential for achievement increases on assessments that are also aligned with the same standards.

As of 2011 CCSS has been adopted by over 40 states, and efforts are underway to create a national assessment system. Two primary national assessment programs are currently being developed: (a) the Smarter Balanced Assessment Consortium (SBAC) and (b) the Partnership for Assessment of Readiness for College and Career or PARCC (Toch & Tyre, 2010). Achieve (2010) is coordinating the PARCC project efforts with the intention of having their national assessment system in place by 2014, while WestEd is serving as the project manager for SBAC with the goal of developing its national assessment system to be in place by 2015 (WestEd, 2010).

As America moves to a national testing system rather than individual state testing systems, assessment literacy of teachers becomes even more crucial as it establishes a norm to compare states' achievement data in the new system. The next section discusses research on assessment literacy.

### ***Assessment Literacy***

Assessments have been part and parcel of the learning process, taking on increased significance as a result of the *A Nation at Risk* report (The National Commission on Excellence in Education, 1983) and even greater importance with the reauthorization of the Elementary and Secondary Education Act in 2002, otherwise known as the *No Child Left Behind Act of 2001* (NCLB, 2002). NCLB increased the amount of testing and, subsequently, the amount of achievement data. This increase in testing and achievement data has heightened the need for teachers to possess a strong foundation in assessment literacy.

In 1993 Plake (as cited in Mertler, 2009) developed a test blueprint of the Standards for Teacher Competence in the Educational Assessment of Students, which was subsequently titled the Teacher Assessment Literacy Questionnaire. The purpose of this questionnaire was to ascertain educators' assessment literacy. Plake's representative sample from 98 districts in 45 states yielded a total usable sample of 555 respondents. The study concluded that teachers were not adequately prepared to assess student learning as confirmed by the average score of 23 out of 35, or 66% of the items being answered correctly. These findings were confirmed in a subsequent study by Campbell (2002) using a modified version of the Teacher Assessment Literacy Questionnaire called the Assessment Literacy Inventory (as cited in Mertler, 2009). A revised version of the

Assessment Literacy Inventory (ALI) in 2003 again confirmed that teachers' comfort level with assessments and their assessment literacy was inadequate (Mertler, 2009).

Results from a similar study by Hoover (2009) used a revised version of the ALI called the Classroom Assessment Literacy Inventory (CALI) and found that assessment literacy had not improved. Assessment literacy had, in fact, showed a slight decline in comparison to the previous assessment literacy studies conducted by Plake and Campbell; and the variance of teachers' knowledge and understanding of assessments was still as wide as it was in Plake's (1993) original study. Hoover (2009) noted the dichotomy of this, in light of the increase in accountability and use of data and assessments over the past decade. Assessment literacy was also noted as one of the three greatest challenges and concerns by the Central Region States' assessment directors (Palmer, 2008).

A national survey of school districts (Means et al., 2010) argued that the greatest perceived need of K-12 districts was identifying models of how to best connect student data to instructional practice. This study found that the most common uses of data in school districts were for school improvement planning and student placement as opposed to teachers using data diagnostically to improve the way they teach. Means', et al. (2010) study of 12 districts and 36 case study schools surfaced great concerns regarding the lack of fundamental knowledge about assessments among the teachers and principals, the lack of knowledge by school staff concerning how to effectively use assessment data to inform instructional decisions of what content to teach, and the need for identifying the best instructional practices of how that content should be taught.

In the Means' (2010) case study, school districts identified that one of the strongest ways to increase the use of data by teachers was to implement the following: (a) embed common interim assessments within a building and across a district, (b) ensure that staff members are given time to collaborate in a safe environment, (c) identify strengths and weaknesses of timely and relevant assessment data, and (d) then use the data to modify their instructional practices accordingly. Recognizing this, Illinois launched an effort to improve assessment literacy and alignment between state learning standards and classroom assessments by implementing the Standards-Aligned Classroom Initiative and measuring the impact through the use of the Teacher Assessment Efficacy Scale (TAES) (Wolfe et al., 2007).

The issue of assessment literacy impacts not only a teacher's ability to interpret data, but it also affects the manner by which a teacher uses such data to inform instruction in the classroom. Using assessments formatively is only as effective as a teacher's understanding of what next steps must be taken that will result in an increase in student achievement (Heritage et al., 2008). However, most teachers formatively use summative data by merely examining measures of central tendency, and to a much lesser degree, disaggregating content standards and subgroup data (Hoover, 2009).

In recent years more and more districts have been incorporating interim or benchmark assessments, thus providing teachers with more timely assessment data to use in their instructional planning efforts (Means et al., 2009). Means also noted that districts in the study perceived the greatest lack of best practice examples in: (a) tailoring instruction to meet students' individual needs, (b) using data to identify which practices work best for which students, and (c) developing curriculum-embedded formative assessments that generate actionable data. In order for data in decision-making to have a positive impact on instruction, it is necessary to identify and implement the effective instructional practices the data requires to increase student achievement (Means et al., 2009).

How districts develop and deliver professional learning to educators will be critical to the achievement of students who will be compared at a national level. The next section explores the research on professional learning related to standards, curriculum, and assessment.

### ***Professional Learning***

Learning Forward, most recently known as the National Staff Development Council or NSDC, published new standards for professional learning in June of 2011 (Learning Forward, 2011). There are seven standards of professional learning: (a) learning communities, (b) leadership, (c) resources, (d) data, (e) learning designs, (f) implementation, and (g) outcomes.

Effective *learning communities* are committed to continuous improvement, collective responsibility, and goal alignment. Quality *leadership* empowers educators to develop capacity, advocate, and create support systems for professional learning. Maximizing *resources* requires prioritizing, monitoring, and well-coordinated efforts for educator learning. A variety of sources and types of student, educator, and system *data* are utilized to plan, assess, and evaluate professional learning. *Learning designs,* such as theories, research, and models of human learning, must also be integrated to achieve intended outcomes. Long term change is achieved when applied research on change and sustained support for *implementation* of professional learning are embedded systemically. In addition, *outcomes* are well-aligned with educator performance and student curriculum standards (Learning Forward, 2011).

Results from the 2007-08 Standards Assessment Inventory (SAI) revealed a variety of data confirming the importance of high-quality professional learning where the word *learning* has replaced the former word *development* (Wei et al., 2009). This study indicated that effective professional learning led to improvements in teachers' knowledge, instructional practice, and student learning outcomes, most often when "teachers were engaged in sustained, collaborative professional development" (Wei et al., 2009, p. 5). The results of another study by Torff and Sessions (2008) indicated that professional development was most effective when it was sustained, intensive and focused on academic subject matter linked to content standards. Unfortunately, according to Black (as cited by Wei et al., 2009), state survey results indicate that well-designed professional learning opportunities are not representative of most U.S. teachers' professional development experiences.

It is typical that teachers who already possess strong content area expertise in mathematics are those primarily receiving professional learning rather than those with a more deficient math background, with very few teachers actually participating in high-quality professional learning at all (Desimone et al, 2006). Teaching experience was found to be the best predictor of teachers' attitudes about professional learning. Teachers become more supportive of professional learning in their first two years of teaching;

however, the support then diminishes until their $10^{th}$ year in the profession when it then reverts to the level of support similar to that of a first year teacher (Torff & Sessions, 2008).

It has been shown that teacher professional learning in mathematics does have significant positive effects on student achievement (Blank & de las Alas, 2009). These effects were confirmed in a meta-analysis of 12 studies that focused on analyzing teacher professional learning in mathematics and the effects on student achievement in mathematics (Banilower et al., as cited by Blank, 2006). This meta-analysis showed a mean effect size of .21 for mathematics studies using a pre-post design. Banilower's research also showed that consistent effects were found when teachers received over 100 hours of professional learning.

As a Council of Chief State School Officers (CCSSO) cross-state study pointed out (Blank et al., 2007), professional learning was more likely to be effective if it was (a) aligned with the state standards for learning objectives, (b) was congruent to the daily operations of schools and teachers, and (c) was compatible with the instructional practices and knowledge teachers needed. The greatest district perceived area of need in professional learning was for models of how to more effectively connect student data to instructional practice (Means et al., 2010). A vast majority of the professional learning opportunities for teachers regarding the implementation of the CCSS will fall on the shoulders of school districts (Kober & Rentner, 2011).

As with any state standards implementation, but in particular with the transition from state standards to new standards incorporating the CCSS, it will be vital to familiarize educators with the new standards via intensive professional learning opportunities. Educators will also need professional learning opportunities to become familiar with the forthcoming new assessment frameworks and subsequent data to make well-informed changes in curriculum and instructional practices, especially in contextualized tasks involving extended analysis, research or communication that have not been typical of older, traditional assessment systems (Achieve, 2010).

This study is intended to learn how middle school math teachers perceive their professional learning and to explore their understanding of the Colorado Academic Math Standards and their assessment literacy, as well as their understanding of professional learning related to standards, curriculum, and assessment. The next section details the methodology to be utilized in this case study.

# CHAPTER 3

# METHODOLOGY AND DATA ANALYSIS

This quantitative study employed a quasi-experimental post-test design. Areas discussed include the following: (a) the research participants, (b) the research site, (c) the instrumentation used in the study, (d) the data collection procedures employed, and (e) the data analysis that was involved when data was collected.

## *Study Participants*

Study participants included teachers from four suburban districts in the Midwest. Thirteen middle school teachers from grades six, seven and eight were invited individually and teachers were asked to solicit other middle school math teacher peers to participate, as well. Completed surveys were received from 42 teachers who taught various grade levels sixth grade through eighth grade and combinations thereof.

Of the 42 who completed the surveys, 57.1% were female while 42.9% were male. Asians comprised 4.8%, Caucasians 88.1%, Hispanic 4.8%, and Other 2.4% of the participants. The mean age was 38.76 years (*SD* = 9.79). Participants had taught a mean of 11.14 years (*SD* = 6.29). A Bachelor's degree was the "highest degree" held by 26.2% while 69.0% held a Master's degree and 4.8% had earned an Educational Specialist degree. For statistical analysis purposes in the study, degrees were categorized as "undergraduate" and "graduate." Thus, 26.2% had an "undergraduate" degree whereas 73.8% had a "graduate" degree.

### *Research Site*

The researcher sought permission to conduct the study in a suburban Midwest district; however, permission was not granted. Given the time constraints in area districts for submitting subsequent case study applications, the study was instead conducted directly with individual middle school math teacher participants from four Midwest suburban school districts.

### *Instrumentation*

The survey instrument consisted of 26 questions (see Appendix A). Names were not used in the survey, nor district names of where the teachers taught math. Nine of the questions on the survey were demographic in nature and included: (a) agreement to complete the survey, (b) age, (c) ethnicity (d) gender, (e) grade levels taught, (f) total years teaching, (g) total years teaching math, (h) highest degree attained, and (i) school email address. The address was only asked to verify there were not duplicate responses, to allow the researcher to send the incentive, and to allow the researcher to verify that the email was associated with a person who actually taught middle level math. Seventeen of the questions were based on a Likert-type response range from (5) Strongly Agree to (1) Strongly Disagree, with a maximum total of 85 points possible and a minimum of 17 points possible.

### *Data Collection Procedures*

Upon receiving IRB approval, the researcher sent in November 2011 an email to thirteen sixth, seventh and eighth grade math teachers in four suburban Midwest school districts with a link to the online consent form and survey (see Appendix A) created with

Google Docs (Google Docs, 2011). Teachers were asked to complete the survey within two weeks. Teachers were informed in the consent form of the survey that by completing the survey, each would receive a gift certificate to any Restaurant.com location of his or her choice. Of the 42 respondents, seven chose not to respond to the offer of the incentive and 35 online gift cards were distributed before the holiday break in December 2011. Teachers who completed the survey also had the opportunity to request a copy from the researcher of the final study findings.

### *Data Analysis Plan*

Survey data analysis began in December and concluded in February 2012. The quantitative data were analyzed using SPSS software (SPSS, 2011) for mean, standard deviation, variance, and effect size. The researcher disaggregated data by (a) gender, (b) age, (c) number of grade levels taught, (d) ethnicity, (e) years of teaching experience, and (f) highest degree attained. These data were analyzed to determine significant findings, if any, that could potentially impact the district’s approach to implementation of standards, assessments, and professional learning. Upon the completion of the data analysis in February 2012, the data were graphed and displayed in figures and tables. Preliminary findings were presented to a psychology assistant professor at a neighboring college to member check and validate the findings.

# CHAPTER 4

# FINDINGS

The chapter presents the results of the study according to teacher survey responses and according to questions in three categories: (a) assessment literacy, (b) standards, and (c) professional learning. The questions in the three research areas are interpreted through quantitative results. The findings of this study are discussed as follows: (a) overview of statistical procedures, (b) description of findings pertinent to each hypothesis, objective, or question, and (c) other findings.

## *Overview of Statistical Procedures*

The statistical procedure used in the study was Spearman rho ($r$). The researcher initially analyzed the quantitative results (Appendix B). A "5" was assigned to "strongly agree" responses, a "4" was assigned to "agree" responses, a "3" was assigned to "neutral" responses, a "2" was assigned to "disagree" responses, and a "1" was assigned to "strongly disagree" responses. Given the Likert format of the survey, a Likert sum of responses for each category (assessment literacy, standards, and professional learning) was used to determine what, if any, statistical significances occurred when bivariate correlations were examined. Tables are provided to illustrate the individual statistically significant correlations in the study.

## *Description of Findings*

There were 42 participants in the study. Of those who participated, 57.1% were female while 42.9% were male. Asians comprised 4.8%, Caucasians 88.1%, Hispanic 4.8%, and Other 2.4% of the participants. The mean age was 38.76 years ($SD$ = 9.79). Participants had taught a mean of 11.14 years ($SD$ = 6.29). A Bachelor's degree was the “highest degree” held by 26.2% while 69.0% held a Master’s degree and 4.8% had earned an Educational Specialist degree. For statistical analysis purposes in the study, degrees were categorized as “undergraduate” and “graduate.” Thus, 26.2% had an “undergraduate” degree whereas 73.8% had a “graduate” degree.

Likert sum totals were used for the groups of questions in each of three categories in the study: assessment literacy (survey items 9-14), standards (survey items 15-20), and professional learning (survey items 21-25). The Likert sum for the six assessment literacy survey items (questions 9 -14) ranged from a minimum score of 6 to a maximum score of 30. The Likert sum for the six standards survey items (questions 15 -20) ranged from a minimum score of 6 to a maximum score of 30. The Likert sum for the five professional learning survey items (questions 21 - 25) ranged from a minimum score of 5 to a maximum score of 25. Of the 28 bivariate comparisons made, it was determined that eight statistically significant results existed. However, one comparison (age and number of years taught) was eliminated due to the causal relationship that naturally existed between those two categories.

The data in Table 1 suggested a statistically significant relationship between the number of years participants had taught and the Likert sum of their assessment literacy responses, $r_s = 0.369$, $N = 42$, $p = 0.016$, two-tailed. Thus, teachers’ understanding and knowledge regarding assessment literacy was positively associated with the number of years they had taught. Therefore, the higher a person's assessment literacy score was, the more years they had taught.

Table 1

*Number of Years Taught and the Assessment Literacy Sums*

| Spearman's rho | | Years Taught |
|---|---|---|
| Sum Assessment Literacy | Correlation Coefficient | .369 * |
| | Sig. (2-tailed) | 0.016 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

The data in Table 2 suggested a statistically significant relationship between the ages of the participants and the Likert sum of their assessment literacy responses, $r_s$ = 0.386, $N$ = 42, $p$ = 0.012, two-tailed. This meant that one's understanding and knowledge regarding assessment literacy was positively associated with their age. Hence, the older a person was, the higher their assessment literacy score.

Table 2

*Ages and the Assessment Literacy Sums*

| Spearman's rho | | Age |
|---|---|---|
| Sum Assessment Literacy | Correlation Coefficient | .386 * |
| | Sig. (2-tailed) | 0.012 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

The data in Table 3 suggested a statistically significant relationship between the gender of the participants and the Likert sum of their standards responses, $r_s$ = -0.352, $N$ = 42, $p$ = 0.022, two-tailed. Overall, understanding and knowledge regarding standards was negatively associated with gender, meaning that females showed greater understanding of standards than males.

Table 3

*Genders and the Standards Sums*

| Spearman's rho | | Gender |
|---|---|---|
| Sum Standards | Correlation Coefficient | - .352 * |
| | Sig. (2-tailed) | 0.022 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

The data in Table 4 suggested a statistically significant relationship between the age of the participants and the Likert sum of their standards responses, $r_s = 0.368$, $N = 42$, $p = 0.016$, two-tailed. It was not surprising that teachers' understanding and knowledge regarding standards was positively associated with their age. It was evident that the older the teacher was, the more knowledge they had of the standards.

Table 4

*Ages and the Standards Sums*

| Spearman's rho | | Age |
|---|---|---|
| Sum Standards | Correlation Coefficient | .368 * |
| | Sig. (2-tailed) | 0.016 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

The data in Table 5 showed a statistically significant relationship between the Likert sum of participants' assessment literacy responses and the Likert sum of their standards responses, $r_s = 0.556$, $N = 42$, $p < 0.001$, two-tailed. Thus, one's understanding and knowledge of assessment literacy was positively associated with their understanding and knowledge of standards. Therefore, the higher a person's assessment literacy score was, the higher their standards score was, showing that understanding assessments was directly correlated with understanding the standards.

Table 5

*Assessment Literacy Sums and the Standards Sums*

| Spearman's rho | | Sum Assessment Literacy |
|---|---|---|
| Sum Standards | Correlation Coefficient | .556 ** |
| | Sig. (2-tailed) | 0.000 |
| | N | 42 |

**. Correlation is significant at the 0.01 level (2-tailed).

The data in Table 6 suggested a statistically significant relationship between the Likert sum of participants' assessment literacy responses and the Likert sum of their professional learning responses, $r_s = 0.312$, $N = 42$, $p = 0.044$, two-tailed. The study found that the teachers' understanding and knowledge of assessment literacy was positively associated with their perceptions of the quality of professional learning they had received. So, understanding assessments helped the teachers to find more meaning and relevance in the professional learning offerings.

Table 6

*Assessment Literacy Sums and the Professional Learning Sums*

| Spearman's rho | | Sum Assessment Literacy |
|---|---|---|
| Sum Professional Learning | Correlation Coefficient | .312 * |
| | Sig. (2-tailed) | 0.044 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

The data in Table 7 found  a statistically significant relationship between the Likert sum of participants' assessment literacy responses and the Likert sum of their professional learning responses, $r_s = 0.358$, $N = 42$, $p = 0.020$, two-tailed. Therefore, teachers' understanding and knowledge of standards was also positively associated with their perceptions of the quality of professional learning they had received. This meant that when teachers understand the standards, that are more likely to find meaning and relevance in professional learning offerings.

Table 7

*Standards Sums and the Professional Learning Sums*

| Spearman's rho | | Sum Standards |
|---|---|---|
| Sum Professional Learning | Correlation Coefficient | .358 * |
| | Sig. (2-tailed) | 0.020 |
| | N | 42 |

*. Correlation is significant at the 0.05 level (2-tailed).

### ***Other Findings***

No statistically significant correlation was found between the professional learning Likert sum and any of the following: gender, age, the number of grade levels taught, the number of years taught, or the type of degree (undergraduate versus graduate) held by survey participants. Furthermore, ethnicity, the number of grade levels taught, and the highest degree held showed no statistically significant correlation with any of the Likert sums of the three categories: assessment literacy, standards, and professional learning.

# CHAPTER 5

# SUMMARY AND DISCUSSION

This chapter presents implications and conclusions derived from the findings of this study. It begins with a review of the research problems. The discussion concludes with limitations of the study, implications, and recommendations for future studies.

## *Summary of Research Problem, Method, and Findings*

The research problem was to identify what, if any, correlations existed when examining participants' demographic data in relationship to their assessment literacy, standards, and professional learning. Potential relationships among participants' responses between and amongst their assessment literacy, standards, and professional learning were also examined, using Likert sums for the questions in each of the aforementioned categories.

A Spearman Rho (*r*) correlation was used to determine any existing relationships. Twenty-eight correlations were examined. Eight of the correlations were found to be statistically significant, although one correlation was ignored due to the causal relationship that existed between age and the number of years taught.

## *Implications*

Placing an emphasis on state standards will likely increase teachers' assessment literacy. Also, using state assessment frameworks will likely increase teachers' understanding of state standards.

Given the noted influence alignment of the four types of curriculum (intended, planned, taught, and assessed) has on student achievement and the statistically significant relationships that exist as demonstrated by the study, educators will benefit from districts and buildings that are strategic in professional learning offerings as they pertain to assessment literacy and standards.

The significant role alignment plays in student achievement also indicates that district personnel, which includes curriculum and instruction as well as assessment leadership, should be ever mindful of alignment between state standards and district curriculum frameworks. In addition, providing staff with professional learning regarding the effective instructional implementation of well-aligned district curriculum leads to higher student achievement.

The study found the number of grade levels taught and whether a teacher had an undergraduate or graduate degree had no bearing on one's assessment literacy, knowledge of state standards, or professional learning. Therefore, it is recommended that a plan of action should be created for all staff members.

### ***Recommendations for Future Study***

One aspect that might be beneficial to examine in a future study is to ascertain the existence of any statistical significances comparing the number of course preparations teachers have, rather than the number of grade levels taught. Another consideration is to conduct a study with math teachers who work primarily with English Language Learners (ELL) or special needs populations in the survey, and compare their assessment literacy and standards literacy with their students' achievement on state assessments.

Examining the quality of alignment between state standards and district standards would be a worthy endeavor. Given the heighted scrutiny of student achievement on state assessment results and their use in judging the quality of instruction, it could be crucial to examine all aspects of alignment: intended, planned, taught, and assessed.

As evidenced in the study, interrelationships exist between assessment literacy, state standards, and professional learning. Since these areas were shown to not be mutually exclusive, opportunities to embed assessment literacy and state standards within professional learning should be a priority.

### ***Limitations***

One limitation of the study was that Likert scales presented a statistical challenge in the study. Thus, the Likert scale sums were utilized to provide a more comprehensive view of each of the three survey categories used in the study: assessment literacy, standards, and professional learning. Furthermore, the inability to secure one district for administration of the survey made interpretation of results a greater challenge since professional development and district cultures vary from one district to another.

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# APPENDIX A

## Teacher Consent and Survey

**PURPOSE:** You are invited to participate in a study of middle school math teachers' perceptions of the Colorado Academic Math Standards (CAMS), assessment literacy, and professional learning.
**PARTICIPANT SELECTION**: 30 or more participants are sought to participate in the online survey. You were selected because you teach at least one section of math grades 6-8 in a Colorado school district.
**EXPLANATION OF PROCEDURES:** Your participation will consist of an online survey that will take no more than 10 minutes. No names will be used in the study.
**DISCOMFORT/RISKS**: During data collection, participants will be encouraged to be open in their responses with the researcher. The researcher will keep all responses confidential. There are no anticipated risks to the participants. All participation will be voluntary, and participants will be apprised of the research purpose and their rights as research subjects.
**BENEFITS:** As a participant in this study, you may benefit from a deeper understanding of what research shows is effective professional learning for assessment literacy and implementing the CAMS. All participants may benefit from having an opportunity to be heard regarding their views on the professional learning associated with CAMS implementation. So that others might benefit from what we learn in the study, we plan to disseminate the results to districts where survey participants teach and through presentations at state and national conferences and publication in scholarly journals. Each participant will receive a $25 gift certificate to a Restaurant.com location of his or her choice. All teachers who complete the survey may also request a copy of the research findings.
**CONFIDENTIALITY:** Any information obtained in this study in which you can be identified will remain confidential and will be disclosed only with your consent.
**REFUSAL/WITHDRAWAL**: Participation in this study is entirely voluntary. Your decision whether or not to participate will not affect your future relations with Fort Hays State University or your employing school district. If you agree to participate in this study, you are free to withdraw from the study at any time without penalty.
**CONTACT:** If you have any questions about this research, you may contact Dr. Regi Wieland, Advanced Education Programs department of Fort Hays State University, Hays, KS, 67601or rwieland@fhsu.edu. If you have any questions pertaining to your rights as a research subject, you can contact the Office of Research Administration at Fort Hays State University, Picken Hall - 306D, Hays, Kansas 67601–4099, (785) 628-4349
Dr. Regi Wieland, Research Advisor…………………………….....(785) 628-5849
Michael Brom, M.S., Researcher……………………………….…(720) 470-7969
Clicking here to participate denotes you have read the information provided above and have voluntarily decided to participate. Please print a copy of this consent form to keep.
___ **Yes**, I agree to participate in this study.___ **No**, I do not care to participate at this time.

1. “Yes, I do agree to participate in this survey” or “No, I do not wish to participate in this survey."
2. My age is ___
3. My ethnicity is: __White__Hispanic__African-American__Native American__Asian__Other
4. My Gender:
   __Female
   __Male
5. I teach the following grade levels: (mark **all** that apply)
   ___6th grade
   ___7th grade
   ___8th grade
6. I have been teaching a total of ___ years
7. I have been teaching 6th, 7th, and/or 8th grade math ___ years
8. The highest degree I have attained is
   __Bachelors
   __Masters
   __Educational Specialist
   __Doctorate

**Please rate the following items on a 5-point Likert-type scale:**
**SA (strongly agree), A (agree), N (neutral), D (disagree), SA (strongly disagree)**

9. I analyze classroom data to inform my instruction
10. I annually analyze previous years’ CSAP data for each student in my classroom
11. I annually analyze CSAP building data by each Math CSAP objective
12. I analyze annual Math CSAP data with building colleagues
13. I feel confident analyzing CSAP data
14. CSAP data is relevant to what I teach in the classroom
15. I have a strong working knowledge of the (old) Colorado Model Math Standards
16. I have a strong working knowledge of the (new) Colorado Academic Math Standards
17. I regularly align my instruction to Colorado Math Standards (old or new)
18. I am knowledgeable in how to construct a quality, standards-based assessment
19. I am confident in my assessment literacy
20. I am confident in transforming my instruction through the use of data
21. Professional learning opportunities are offered to increase my understanding of the new Colorado Academic Math Standards
22. Professional learning opportunities offered increase my understanding and implementation of assessment literacy
23. Professional learning opportunities offered increase and improve my use of data to inform my instructional practices
24. Professional learning opportunities are provided to increase and improve my use of the district-approved textbook
25. Ongoing, sustained professional learning opportunities are offered to increase student achievement in my school
26. Please enter your school email address__________________________________

# APPENDIX B

| Spearman Rho Correlations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Gender | Age | Grades | All Years | Highest Degree | Sum Assessment Literacy | Sum Standards | Sum Professional Learning |
| Gender | Correlation Coefficient | 1 | 0.161 | -0.141 | 0.072 | -0.093 | -0.2 | -.352* | -0.252 |
| | Sig. (2-tailed) | . | 0.309 | 0.374 | 0.652 | 0.557 | 0.204 | 0.022 | 0.108 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Age | Correlation Coefficient | 0.161 | 1 | -0.302 | .762** | 0.24 | .386* | .368* | -0.114 |
| | Sig. (2-tailed) | 0.309 | . | 0.052 | 0 | 0.126 | 0.012 | 0.016 | 0.471 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Grades | Correlation Coefficient | -0.141 | -0.3 | 1 | -0.231 | -0.028 | -0.128 | -0.259 | -0.263 |
| | Sig. (2-tailed) | 0.374 | 0.052 | . | 0.142 | 0.862 | 0.418 | 0.098 | 0.092 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| All Years | Correlation Coefficient | 0.072 | .762** | -0.231 | 1 | 0.211 | .369* | 0.254 | -0.13 |
| | Sig. (2-tailed) | 0.652 | 0 | 0.142 | . | 0.18 | 0.016 | 0.104 | 0.411 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Highest Degree | Correlation Coefficient | -0.093 | 0.24 | -0.028 | 0.211 | 1 | 0.208 | 0.099 | -0.035 |
| | Sig. (2-tailed) | 0.557 | 0.126 | 0.862 | 0.18 | . | 0.186 | 0.533 | 0.826 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Sum Assessment Literacy | Correlation Coefficient | -0.2 | .386* | -0.128 | .369* | 0.208 | 1 | .556** | .312* |
| | Sig. (2-tailed) | 0.204 | 0.012 | 0.418 | 0.016 | 0.186 | . | 0 | 0.044 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Sum Standards | Correlation Coefficient | -.352* | .368* | -0.259 | 0.254 | 0.099 | .556** | 1 | .358* |
| | Sig. (2-tailed) | 0.022 | 0.016 | 0.098 | 0.104 | 0.533 | 0 | . | 0.02 |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| Sum Professional Learning | Correlation Coefficient | -0.252 | -0.11 | -0.263 | -0.13 | -0.035 | .312* | .358* | 1 |
| | Sig. (2-tailed) | 0.108 | 0.471 | 0.092 | 0.411 | 0.826 | 0.044 | 0.02 | . |
| | N | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | | |