EXPLORING THE CORRELATION BETWEEN TEACHERS' MINDSET AND JUDGMENT ACCURACY TO REVEAL THE CUES BEHIND TEACHERS' EXPECTATIONS

by

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DEDICATION

I dedicate this to my husband for your unwavering support, encouragement, positive attitude, and patience. You are the epitome of a growth mindset. I also dedicate this to my children, Mae and Gus, who are the ultimate reason behind why I love being in education and why education should be the best it can be.

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ABSTRACT

Teaching is about constantly evaluating one's students to best situate them for learning and future progress. Based on such evaluations, the academic expectations teachers hold for their students influence their instructional practice and are mediators of student achievement. Forming accurate expectations of students' ability and accurate predictions of performance is instrumental to effectively improving instruction and advancing student learning. Therefore, when teachers form inaccurate expectations of student academic performance, students can suffer academically and personally. When teachers' judgments of student learning are based on accurate information reflecting students and their learning, students can benefit academically and personally. Yet, little research exists that specifically examines teachers' mindsets, and its influence on the cues teachers use to judge student learning. The research questions for this study are: Is there a relationship between a teacher's judgment accuracy and mindset? What are the cues that fixed and growth mindset teachers use to make their judgment of students' learning and academic performance? Does the teacher's mindset influence this cue-usage? The purpose of this study is two-fold: the first quantitative study examines the correlation between teachers' mindset (growth or fixed) and their ability to accurately judge students' academic performance; the second qualitative study explores the cues that teachers with a fixed or a growth mindset use to judge their students' learning and academic performance. The accuracy (or inaccuracy) of teachers' judgment may shed

light on connections between teachers' mindset and expectations, and how well teachers actually know their students, leading to practical implications in teacher education, teaching, and teacher-student interactions.

Keywords: teacher expectations, growth mindset, fixed mindset, judgment accuracy

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CHAPTER 1: INTRODUCTION TO THE STUDY

Background of the Problem

Over the past five decades, teacher expectations have been widely studied in social science, education psychology, sociology, teacher education and policy, and cognitive psychology. The academic expectations teachers hold for their students influence instructional practice and are mediators of student achievement (Brophy & Good, 1970, 1974; Good, 1987; Rubie-Davies, 2006, 2007, 2014; Bandura, 2001; Babad, 1998). Similarly, teachers' expectations can significantly influence teacher behavior, student achievement, students' confidence, self-worth, efficacy, motivation, and overall academic experience (Rosenthal & Jacobson, 1968; Brophy & Good, 1970, 1974; Borko, Cone, Russo, & Shavelson, 1979; Good, 1987; Brophy, 1983, 1985, 1998; Jussim, 1986; Hoge & Coladarci, 1989; Jussim & Eccles, 1992; Babad, 1998; Bandura, 2001; Rubie-Davies, 2006, 2007, 2009, 2014; Weinstein, 2002; Rubie-Davies, Peterson, Sibley, & Rosenthal, 2015).

The main focus of teacher expectation research has been on the level of expectations that a teacher holds, whether they are high or low expectations, and the impacts these levels have on key outcomes. Overall, the research has demonstrated that low expectations can discourage students, diminish their confidence and motivation, and hinder their learning because teachers exposed lower expectation students to fewer learning opportunities and weakened pedagogy; while higher expectations can increase

student motivation, foster confidence and self-efficacy, and promote academic achievement because teachers exposed higher expectation students to more learning opportunities and more effective pedagogy.

Therefore, it matters a great deal *what* teachers base their expectations on. If unfounded or invalid, low or high expectations could allow teachers to ignore, stereotype, or generalize students. Inaccurate expectations can lead to erroneous monitoring of student learning, the perpetuation of deficit modeling, and misguided differentiation of instruction. Ultimately, the appropriateness and academic relevance of *what* teachers base their academic expectations on—regardless of whether high or low—determine the accuracy of expectations. The cues behind the expectation determine the accuracy of expectations and their subsequent effects.

For example, a teacher might place a student or group of students in the lowest achievement group because she continues to expect them to perform below grade-level simply because of their race, behavior, or their reading score on last year's standardized test. Because of these low expectations based on inaccurate, outdated, and/or academically irrelevant qualities, the students could then be exposed to fewer learning opportunities and receive inadequate instruction. Their learning could therefore be inaccurately monitored. In contrast, a teacher may place a student in the highest achievement group because he raises his hand all the time in math class, stays focused on the lesson, and appears engaged. High expectations, based on a student's behavior rather than academically irrelevant qualities, may cause undue stress for this student when in fact, he may need more help from the teacher instead of being placed inappropriately in the advanced math group.

Conversely, teacher expectations—whether high or low—can encourage and promote student learning if accurately based on authentic knowledge of the students and their learning, as garnered through ongoing and meaningful forms of assessment, progress monitoring, and building rapport. For example, when a teacher forms accurate but lower expectations because she recognizes that a student struggles in class with a particular task or skill, this teacher can then provide additional instruction and support to help this student learn and increase his achievement. When expectations are based on academically relevant and current cues, teachers can leverage their expectations as tools for fostering growth and establishing realistic, higher expectations (Brophy & Good, 1974; Babad, 1993; Dweck, 2006). Making strategic and meaningful adjustments to their instruction hinges upon teachers accurately judging and monitoring their students' learning. When teachers astutely differentiate between students who understand the content and lesson and those who do not, their academic expectations beget pedagogical practices tailored to help struggling students and challenge proficient students.

Ultimately, the veracity and academic relevance of *what* teachers base their academic expectations on—regardless of whether high or low—is the antecedent to the accuracy of expectations and judgments of student learning and performance. As stated earlier, the accuracy of teacher expectations trumps all. The cues (the reasons, the bases) teachers use to form their expectations influence their accuracy. The accuracy and thereby validity of teachers' expectations of students' academic achievement is extremely important because of the vast number of decisions teachers make daily about their students based on their academic performance (Demaray & Elliot, 1998).

After examining the teacher expectation research, it is clear that additional research needs to explore precisely *what* teachers base their expectations on, and consequently its *accuracy*. When forming expectations and judging student performance, why does one teacher use academically relevant cues and another teacher use academically irrelevant cues? Perhaps teachers' mindsets influence the cues teachers use to make their academic expectations, and this in turn could affect the accuracy of their expectations. Little research exists that specifically examines the mindsets behind teacher expectations, and whether or not a particular mindset is more conducive to forming accurate expectations because of the specific cues used to form expectations.

Problem Statement

Monitoring accuracy is crucial for effective teaching and academic achievement (Brophy & Good, 1970, 1974; Jussim, 1986; Jussim, Madon, & Chatman, 1994; Good & Brophy, 2003; Rubie-Davies, 2014; Weinstein, 2002). A teacher should form and hold accurate expectations of student learning because in turn these expectations directly and indirectly affect her instruction, which in turn affects student learning (Carpenter, Fennema, Peterson, & Carey, 1988; Südkamp, Kaiser, & Möller, 2012; Demaray & Elliot, 1998). This cycle of cause-and-effect continues, whether the teacher is conscious or not of the academic accuracy and relevance of her expectations. Therefore, the cues teachers use to form their expectations directly and/or indirectly affect their monitoring accuracy. Yet, little research has examined what cues a teacher intentionally or unintentionally uses to predict and judge her students' performance. Furthermore, it is unclear as to whether having a growth or fixed mindset affects cue use.

Purpose of the Study

The purpose of this mixed-methods study was two-fold. The first quantitative study (Study 1) examined whether a correlation existed between teachers' mindset (growth or fixed) and their ability to accurately predict students' academic performance on a mathematics skills and concepts assessment. The follow-up qualitative study (Study 2) investigated the cues teachers use to judge student learning and examined whether fixed and growth mindsets use different cues. Data from Study 1 were used to select the teachers who were interviewed in Study 2. Five teachers who were above average on judgment accuracy and above average growth mindset, and five teachers who were below average on judgment accuracy and above average on fixed mindset were interviewed. The researcher was blind to the teachers' mindsets before and during the interviews, and was not informed of them until after preliminary analysis of the data had been completed.

This mixed-methods study addressed the lack of research examining teacher expectations held by teachers with specific mindsets, as being more conducive to accurately predicting student performance. This study aimed at better understanding the accuracy of teacher expectations and judgments by examining whether the mindsets of teachers influences the cues that teachers use to make their academic expectations and judgments, and if this in turn could affect the accuracy of their expectations, leading to practical implications for teacher education, teaching, and teacher-student interactions.

Figure 1. Graphic representation of study's purpose.

Research Questions

The following research question was examined in Study 1: Is there a relationship between a teacher's judgment accuracy and mindset? This study included two groups: teachers who have been identified as having either a growth or a fixed mindset, as measured and categorized by the Mindset Survey (Appendix C and described in detail in Chapter 3: Methodology). This study entailed the variable of teachers' accuracy of predicting their students' academic performance on math assessments. More specifically, teachers' judgment accuracy was operationalized by computing the intra-individual correlation (Helmke & Schrader, 1987) between students' predicted score and their actual performance on the tests of mathematical skills and concepts. These two variables were then analyzed using a bivariate correlation research design.

To address the subsequent qualitative purpose of this research study, the following research questions were examined in Study 2: What are the cues that fixed and growth mindset teachers use to make their judgment of students' academic performance? Does the teacher's mindset influence the cues used? The qualitative research hypothesis for Study 2 was that fixed mindset teachers are less accurate in their predictions, basing their predictions of students' academic performance on inaccurate and/or academically irrelevant factors, such as students' gender, behavior, effort, and possibly socio-economic

status. Whereas growth mindset teachers were hypothesized to be more accurate in their predictions, basing their predictions of students' academic performance on accurate and/or academically relevant factors, such as students' cumulative folders and academic records of performance, current grades, and the teacher's knowledge of student learning.

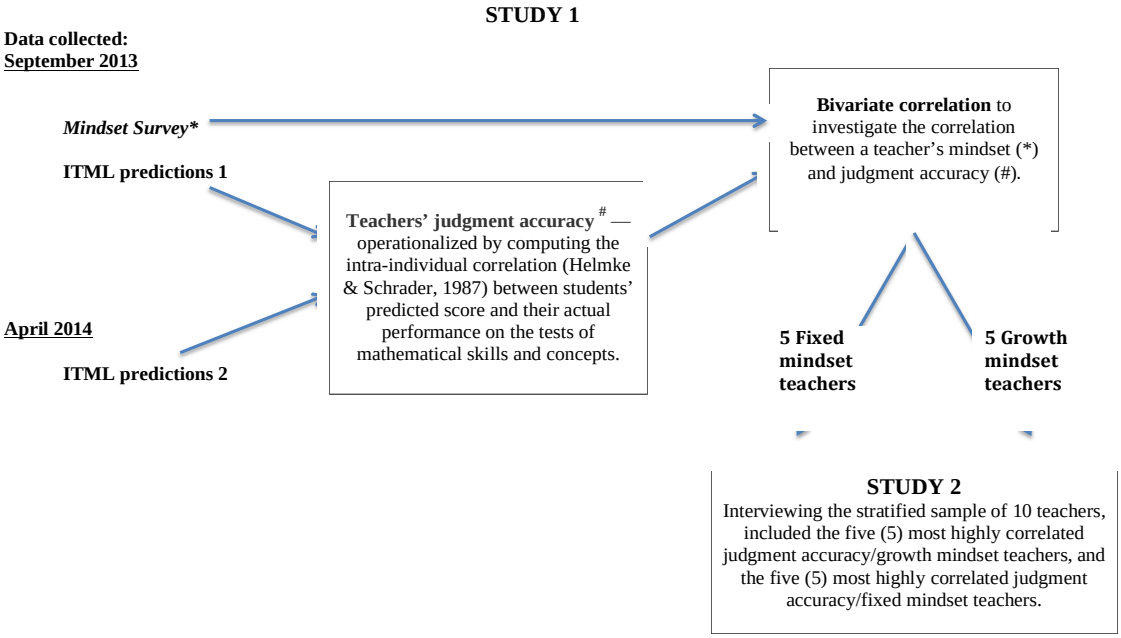

Figure 2. Graphic representation of Study 1 and Study 2.

Nature of the Study

As seen in Figure 1 above, this mixed-methods study used a bivariate correlation analysis for Study 1 to investigate the existence of a correlation between teachers' judgment accuracy and their mindsets and qualitative semi-structured interviews for Study 2.

One variable in this study was teachers who have been identified as either having a *growth mindset*—when the teacher believes that learning and students' intelligence are malleable and could therefore be developed and improved over time through effort and

by tackling challenges; or having a *fixed mindset*— when the teacher believes students' intelligence does not change because it is innate, and therefore challenges are avoided for fear of being judged (Dweck, 1991, 2006, 2013; Dweck & Leggett, 1988; Dweck & Elliott, 1983; Elliott &Dweck, 1988; Dweck, Chiu, & Hong, 1995; Hong, Chiu, Dweck, Lin, & Wan, 1999).

After these teachers were identified and categorized as having a fixed or growth mindset, as measured by the Mindset Survey, this study focused on the data revealing the accuracy of teacher predictions of their students' performance on both a mathematics skills and concepts assessment, administered at the start and end of the 2013/2014 school year. This variable of teachers' judgment accuracy was operationalized by computing the intra-individual correlation (Helmke & Schrader, 1987) between students' predicted score and their actual performance on the tests of mathematical skills and concepts. In this sense, expectation is synonymous with judgment in the sense that the teachers are stating their expectations of how their students will perform on a math assessment at the beginning and end of one school year.

The population of interest for this study was elementary teachers (Kindergarten – 5th grade). The data obtained for Study 1 came from a sample of 90 teachers from two school districts, one in a suburban area and another in an urban area, both in the Mountain West region of the United States. Based on the correlation findings of Study 1, a total of ten (10) teachers (K-5^{th}) were then specifically selected for the semi-structured interviews of Study 2. This stratified sample of 10 teachers was specifically selected because they stood out in the data as the five (5) most highly growth mindset teachers,

and the five (5) most highly fixed mindset teachers. A more detailed description of the study's methodology can be found in Chapters 3 and 5.

Theoretical Framework

Several theories pertaining to teacher expectations and mindsets inform this study. The expectancy effect theory, and more specifically teacher expectancy effect theory (Rosenthal & Jacobson, 1968; Brophy & Good, 1970, 1974) provides a theoretical framework for the acknowledgment of the direct and indirect influential powers that teacher expectations have on student's academic achievement. Expectancy mediation theory (Brophy & Good, 1970, 1974) further supports this study for its demonstration of how differential treatment, varying learning time, and overall inconsistent behavior directly affects learning and the overall learning environment, therefore widening the gap between low and high achieving students.

Expectancy confirmation theory (Jussim, 1986; Jussim, Smith, Madon, & Palumbo, 1998) also informed this study by further supporting the significance of the accuracy of the teacher's expectations and judgments. Within the framework of expectancy confirmation theory, accuracy pertains to the level of the teacher's expertise and ability to evaluate students based on evidence such as grades, test scores, ongoing formative assessments, and teachers' knowledge of students (Jussim, 1986; Jussim et al., 1998).

An individual's self-conception about basic beliefs such as intelligence are what Dweck and colleague's prolific research identify as the implicit theories—the incremental and entity theories (Dweck, 1991, 2006, 2013; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Dweck et al., 1995; Hong et al., 1999). This theoretical

framework supports this study's categorization and comparison of the two levels of teacher mindset—fixed and growth.

Expectancy Effect Theory

This study is informed by expectancy effect theory, more specifically the teacher expectancy theory that teacher expectations can directly and indirectly influence student achievement (Brophy & Good, 1970, 1974). This framework drew much of its empirical findings and theories from psychology (Weinstein, 2002). It focused on demonstrating the actual existence of expectancy effect (Brophy & Good, 1970), and the construct of *expectancy* itself (Bandura, 2001). Students' voices and roles were left out of this teacher-centered linear equation because the main source of evidence about the existence of expectancy processes only favored teacher expectations of performance as measured by students' achievement scores. In this original research, teacher expectations were impersonally framed in the quantifiable input-output business-like model. The goal of this empirically driven research was to "define relationships between what teachers do in the classroom (the process of teaching) and what happens to their students (the products of learning)" (Fang, 1996).

The process (input) of teaching led to the product (output) of student achievement as measured by a test score. Therefore, teacher expectations were defined as teacher perceptions about students' performance and aptitude, and then quantified by test scores (Rosenthal & Jacobson, 1968; Brophy & Good, 1970; Brophy, 1983). Changing the research setting from a science laboratory to a school classroom, and switching from lab rats as subjects to research participants as teachers and students undoubtedly left a clinical residue. Bandura (2001) states this early psychological theorizing of expectancy

was “founded on behavioristic principles, centered on an input-output model… human behavior was shaped and controlled automatically and mechanically by environmental stimuli” (p. 2).

This behavioral paradigm centered more specifically on the concept of self-fulfilling prophecy, the driving force behind this initial research on teacher expectations. Surprisingly, this concept was first coined and defined by the sociologist, Robert K. Merton, in 1948. Merton drew from “the dean of American sociologists, W. I. Thomas’s theorem basic to the social sciences stating that ‘If men define situations as real, they are real in their consequences’” (Merton, 1948, p. 193). A self-fulfilling prophecy is “a *false* definition of the situation evoking a new behavior which makes the original false conception come *true*” (Merton, 1948, p. 195, italics in original). Merton also constructed the model through which this self-fulfilling prophecy manifests: first the beliefs about a situation, then the behaviors that bring about a confirming response, and then the confirming response itself. The hypothesis that teacher expectations can function as self-fulfilling prophecies was the ignition behind this initial stage of research on expectations expectancy effects (Brophy, 1998).

The extensive research *demonstrating* the existence of this effect came under fire for its repetitiveness and overenthusiasm for proof. The prolific amount of research that had surfaced was criticized for being limited to statistical procedures, and thereby “inadequately represents a body of research by placing undue emphasis on the mere existence of the expectancy effect, to the apparent exclusion of its meaning and significance” (Adair, 1978, p. 386).

Such overreliance on experimental and correlational studies also tarnished this prolific amount of research with the absence of independent measures of teacher expectations because teachers were "simply assumed to adopt the expectation-inducing information provided by the experimenter" (Mitman & Snow, 1985, p. 115). This body of work did not capture the "*social process*" that education is because it reduced it to variations in IQ scores, which "merely give indications of potential, not of process" (Rist, 1970, p. 417, italics in original).

It was time for the next strand of research and a departure from the quantitative process-product model of research that narrowly defined teacher expectations as perceptions about students' performance and aptitude, impersonally operationalized by students' test scores or IQ. This next strand of research took place concurrently with its process-product model just described, but their tenets, approach, and application differed greatly. It was time to move away from the backdrop of the laboratory and into the more ecologically valid context of the classroom, where expectancy effects could be tested for in the natural expectations of a teacher instead of in experimentally induced expectations of teachers (Brophy, 1983; Dusek, 1975; Weinstein, 2002).

Expectancy Mediation Theory

Brophy and Good's work ignited a wave of research in 1970, which called for more meaning behind behavior mediation of teachers' differential expectations. Research was called for to demonstrate how such differential treatment, varying learning time, and overall inconsistent behavior directly affected learning and the overall learning environment, therefore widening the gap between low and high-achieving students. Such behavior that communicates the expectancy effects must be conceptualized (Brophy &

Good, 1970). Their seminal paper entitled “Teachers’ Communication of Differential Expectations for Children’s Classroom Performance: Some Behavioral Data” did so by providing the research field with an explicit observational tool that elucidated and operationalized self-fulfilling prophecies “as outcomes of observable sequences of behavior” (Brophy & Good, 1970, p. 365). Researchers, teacher educators, and administrators could now study and actually code the dyadic interactions between classroom teachers and each individual student. Their initial study and use of the observational tool was the first naturalistic studies of teacher interaction with high- and low-achieving students in the classroom, following Rosenthal and Jacobson’s (1968) Pygmalion in the Classroom study (Good, 1987).

Good and Brophy’s (1970) *teacher-child dyadic interactions* model provided a coding system of six steps for how the teacher expectation communication process might work in a classroom. This model for observational work addressed all dyadic contacts between the teacher and the individual student. Therefore, the teacher-child dyad became the unit of analysis, rather than the whole class as a group, making this observational tool especially sensitive to and precise for the study of communication of differential teacher expectations (Good & Brophy, 1970). These researchers firmly believed the observational system had to analyze the teacher-student interaction in order to capture the true behavioral mediation of teacher expectancy effect, because “teachers do treat children differently” (Good & Brophy, 1970, p. 132).

Outlined here by Good and Brophy (1970), the *teacher-child dyadic interactions* offered a model for how the teacher expectation communication process might work in a classroom in six steps: (a) The teacher forms differential expectations for student

performance; (b) The teacher then begins to treat children differently in accordance with the teacher's differential expectations; (c) The children respond differentially to the teacher because they are being treated differently by the teacher; (d) In responding to the teacher, each child tends to exhibit behavior which complements and reinforces the teacher's particular expectations for the student; (e) As a result, the general academic performance of some children will be enhanced while that of others will be depressed, with changes being in the direction of teacher expectations; (f) These effects will show up in the achievement tests given at the end of the year, providing support for the "self-fulfilling prophecy" notion (p. 365-366).

Greatly influential to this field of research, this new research tool could quantify components of the expectancy effect from more of a personal stance in that the teacher behavior communicating expectancy effects was measured rather than the product of student IQ or test score. The impact on students as individuals was now taken into consideration—an element largely ignored in previous research models. This tool also brought to light the behavior evidence of expectancy effect in the more ecologically valid context of the classroom, where expectancy effects could now be tested for in the naturally-occurring expectations of a teacher, instead of in the experimentally-induced expectations of teachers as before (Brophy & Good, 1970, 1974; Brophy, 1985; Weinstein, 2002).

This intense review of the mediation research further zoomed in on Step 2 of the "Brophy-Good model," allowing for further delineation of exactly *how* teachers behave differently towards various students based on their already-formed differential expectations for student behavior and achievement (Good, 1987, p. 34). They identified

seventeen behaviors that indicate teachers' differential treatment towards their high- and low-expectancy students (Brophy, 1983, 1985; Good, 1987). With numerous studies cited under each of the 17 behaviors, examples included differential treatment such as, teachers giving less "wait time" for their low students to answer; supplying low achievers with the answers or calling on a different student rather than rephrasing or repeating the question; seating high achievers closer to the teacher and low achievers farther away; demanding less from low achievers; providing less feedback to low achievers; interacting more privately with low achievers and more publicly with high achievers (Brophy, 1983, 1985; Good, 1987).

Overall, this specification of such discrete behavior was of enormous significance for teacher education (Weinstein, 2002). Especially in light of Brophy's (1983) claim that a teacher's differential treatment of students as a whole class may be more widespread and a "more powerful mediator of self-fulfilling prophecy effect on student achievement" than differential treatment of an individual student (p. 309).

Expectancy Confirmation Theory

This stage of research also saw a critical examination into the accuracy of a teacher's expectation. This accuracy rests in the correlation (not the causation) between the expectations about a student or class and their behavior or achievement, as long as the teacher's expectation did not cause the student's behavior or achievement (Good, 1987; Shavelson & Stern, 1981; Hoge & Coladarci, 1989; Demaray & Elliot, 1998). When expectancy confirmation occurs because of the accuracy of the teacher's expectations, it demonstrates the level of the teacher's expertise and ability to evaluate her students based on evidence such as grades, test scores, ongoing formative assessments, and knowledge

of her students (Jussim, 1986; Jussim et al., 1998). Called *impression accuracy,* it describes the extent to which teachers' expectations parallel the students' actual characteristics or achievement (Jussim, 1986; Jussim et al., 1998). In this case, the accuracy of a teacher's expectation is derived from the teacher's strength of knowing her students (Jussim, 1986).

Accuracy of a teacher's expectation also signifies a reasonable alternate explanation to a self-fulfilling prophecy or bias as evidence that students actually confirm teacher's expectations. Jussim (1986) described *predictive accuracy* as the extent to which the teachers' expectations predict but do not cause student achievement. The accuracy and thereby validity of teachers' expectations of students' academic achievement is extremely important because of the vast number of decisions teachers make daily about their students based on their academic performance (Demaray & Elliot, 1998). Similarly, given the important implications of teacher judgment, the question of their accuracy is critical. "Accurate assessment of students' performance is a necessary condition for teachers to be able to adapt their instructional practices, to make fair placement decisions, and to support the development of an appropriate academic self-concept" (Sudkämp et al., 2012, p. 744).

Expectancy confirmation also involves perceptual biases and a teacher's awareness of them determines their accuracy. When a teacher's expectations lead to perceptual biases, this means that the teacher has interpreted, remembered, and/or explained student achievement and behavior in ways that are consistent with her expectations; therefore, perceptual biases imply that teacher expectations created a certain reality, similar to the process of self-fulfilling prophecy (Jussim et al., 1998). This

subjective reality influences teacher evaluations of student achievement; another important reason accuracy plays an important role when analyzing teacher expectations.

Implicit Theories

An individual's self-conception about basic beliefs such as intelligence are what Dweck and colleague's prolific research identify as the implicit theories—the incremental and entity theories (Dweck, 1991, 2006, 2013; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Dweck et al., 1995; Hong et al., 1999). This theoretical framework supports this study's categorization and comparison of the two levels of teacher mindset—fixed and growth. If you have a growth mindset (and prescribe to the *incremental theory*), a person believes that learning and fundamental attributes such as intelligence are malleable and can be developed with effort, motivation, and effective education and self-instruction. On the contrary, if you have a fixed mindset (and prescribe to the *entity theory*), a person believes that learning and fundamental attributes such as ones intelligence are simply fixed and do not change. Intelligence is seen as innate and constant; therefore, effort is futile and actually is an indication of lower ability. As a result, those with fixed mindsets tend to avoid challenges and situations that may be seen as potentially causing setbacks.

Definition of Terms

Teacher expectations: teacher expectations have been defined as everything from teacher perceptions and predictions about students' performance and aptitude, to beliefs about students' normative behavior in the classroom such as following the rules, being respectful to peers and teachers, cooperating, and being a communicator to solve problems (Borko et al., 1979; Brophy, 1983; Jussim, 1986; Hoge & Coladarci, 1989;

Rubie-Davies, 2007, 2014). For this study, "(t)eacher expectations are inferences that teachers make about present and future academic achievement and general classroom behavior of students" (Brophy, 1998, p. ix).

Growth mindset: when a person believes that learning and ones intelligence are malleable and could therefore be developed over time (Dweck, 1975, 1986, 1991, 2006, 2008, 2013, 2015; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Dweck et al., 1995; Hong et al., 1999).

Fixed mindset: when a person believes that learning and ones intelligence do not change because they are innate and constant (Dweck, 1975, 1986, 1991, 2006, 2008, 2013, 2015; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Dweck et al., 1995; Hong et al., 1999).

Judgment accuracy: operationally defined and measured through the relative standing of two sets of data, the teachers' predictions and the students' performances; accuracy as the agreement between teachers' item-by-item predictions on the (test) and students' actual item-by-item performance (Demaray & Elliot, 1998). In this study, teachers' judgment accuracy was further operationalized as the intra-individual correlation (Helmke & Schrader, 1987) between students' predicted score and their actual performance, as computed across the students in each classroom on the tests of mathematical skills and concepts.

Assumptions and Limitations

The assumption for Study 1 is that the teacher participants completed their predictions of student performance to the best of their abilities. The assumption for Study 2 is that teachers answered each interview question honestly and with thoughtful

reflection.

Using a stratified, convenience sampling for Study 2 could pose a limitation and thereby restrict the generalizability of the results to other school districts and to other populations of teachers and students.

Significance of the Study

This study will contribute to the research base of teacher expectations and judgment accuracy concerning the importance of the cues teachers use to judge their students' learning. As teachers' judgment accuracy informs their teaching practice, which in turn affects student learning (Thiede et al., 2015), it is important to better understand the factors that affect monitoring accuracy—like cue use and mindset. Forming expectations and monitoring student learning based on current and academically relevant information for each student is especially important in today's classrooms. In light of the growing diversity in the population of every classroom, the diversity in students' learning styles, and the diversity in both teachers' and students' backgrounds, accurate expectations need to foster greater academic achievement and stronger accountability from both teacher and students. Revealing the cues that improve teachers' judgment accuracy is especially significant for students for whom teachers have perpetually low expectations.

Accurate expectations of students' academic performance could limit the use of tracking and unnecessary stratification of students in school systems. Furthermore, cultivating the teacher's mindset that is found to correlate with more accurate judgments of their students' academic performance could be of great significance to the teacher education field, as well as professional development for inservice teachers. Effective

teaching could have a new dimension if a correlation exists between teachers' mindset and their ability to accurately predict students' achievement. Developing a better understanding of the factors that affect teachers' judgment accuracy could inform the development of interventions to improve judgment accuracy, which could in turn improve student achievement.

A teacher's deliberate reflection on her expectations and the cues behind them could be part of the solution to deficit modeling and inequities in the school system. Teachers who can accurately assess their students' thinking, learning styles, strengths, and weaknesses have an overall stronger knowledge of their students, which in turn improves the teacher's instruction and student learning (Carpenter et al., 1988).

Summary

Little research exists that specifically examines teachers' mindsets that guide their expectations. Is a particular mindset, growth or fixed, more conducive to accurate expectations and thereby judgments of students' academic performance? If teachers form expectations arbitrarily or invalidly for any number of reasons, biases, or judgments, the students suffer academically and personally. It is a problem in education today if students are not acknowledged for the individuals that they are. Conversely, it is a blessing in the classroom when teacher expectations of student performance are based on accurate and academically relevant information.

The purpose of this mixed-methods study was two-fold. The first quantitative study (Study 1) examined whether a correlation existed between teachers' mindset (growth or fixed) and their ability to accurately predict students' academic performance on a mathematics skills and concepts assessment. The follow-up qualitative study (Study

2) investigated the cues teachers use to judge student learning, and also examined whether fixed and growth mindsets use different cues. Chapter 1 provided a brief summary of the relevant research pertaining to the background of the research problem. The research questions were outlined, as were the theoretical frameworks that will be implemented by this study. Chapter 2 further discusses the literature review and this study's supporting theoretical frameworks. Next, Chapter 3 details the methodology and data collection procedures in Study 1. Chapter 4 articulates the results and discussion of Study 1. Then, Chapter 5 details the methodology and data collection procedures in Study 2, and Chapter 6 articulates the results and discussion of Study 2. Lastly, the overall study's conclusion of Chapter 7 provides general discussion and implications, and future research, as well implications for teacher education programs and in-service teachers' to critically reflect on their practice of expectations.

CHAPTER 2: LITERATURE REVIEW OF TEACHER EXPECTATIONS

Introduction

On a warm, fall evening in September, elementary teachers from all over the area gathered for a professional development meeting on mathematical instruction. Teachers seemed refreshed after the summer, and pleased to start the new school year. Grade levels collaborated on mathematical strategies their students could use to solve particular problems. Teachers shared their thoughts on students' misconceptions and problem solving skills. They shared activities and instructional practices that have been effective in their classrooms, and they brainstormed on ways to apply the professional development to their instruction and to meet their individual students' needs.

This positive collaboration and optimism was abruptly interrupted by one teacher's doomsday pessimism. She indifferently claimed, "My students will never learn math like this. I won't be able to teach them this way. They're all Title One students. There's no way this kind of math will work with them because of that." With that bold statement, the once upbeat contagion of the moment turned to bleak apathy. This one teacher's disbelief in her students' mathematic abilities based on their socio-economic status deflated the momentum of the group's collaboration, and from that moment on the group was divided. A small group of teachers continued their enthusiastic collaboration, while the other teachers (now led by the doomsday teacher) chatted for the remainder of the class about their summers and about their most problematic students.

At that moment, I realized the magnitude of the influence that teacher expectations and teacher perceptions of their students have on education. If teachers stereotype and judge their students based on characteristics out of students' control, they have set a tone and expectation of underachievement. This sets off an endless ripple effect. I became fascinated with the workings of teacher's minds, and how expectations form and can govern educator's instructional practice and interactions.

Similarly, when teachers predict that certain students will receive a low grade simply because of their race, ethnic background, family income, and/or the grade they received on last year's achievement for example, students' have an unfair burden of proof to bear. I witnessed this dismal situation when looking at data from over one hundred elementary teachers. At the beginning of the school year, they were asked to make predictions of their students' performance in mathematical skill and concepts. Teachers were asked to score from 0 to 5, as to how many correct answers each of their students would get. I noticed that several teachers predicted zeros for half of their students and then also assigned some 2's and 3's, and only a few 4's and 5's. The students receiving the 0's were almost unanimously Hispanic last names, and when asked about a few of the other students receiving zeros, a few teachers attributed their predicted score to the students' low socioeconomic status. Conversely, students receiving 4's and 5's were simply, "good kids."

Why Do Teachers' Expectations Matter?

Quality teachers possess affective and effective capabilities. Teachers can positively and adversely shape their students' academic and personal experiences. The "right sort of a teacher can make all the difference" (Notar, Riley, & Taylor, 2009, p. 3).

Teacher expectations are a major factor behind these realities. Who a teacher *is* naturally affects how a teacher *teaches*. This paper will look specifically at teacher expectations and the literature behind it, how expectations were defined, conceptualized, theorized, and operationalized.

The expectations teachers hold for their students can directly and indirectly influence both the teacher's instructional practice and the students' academic experiences. Expectations carry a lot of influential power, whether these expectations are high or low, and whether these expectations are accurately or inaccurately based on a number of criteria. How a teacher expects students to perform academically impacts the outcome of student performance. Teachers can form expectations at the whole-class level, where they do not have expectations specifically for each individual student, but rather for their entire class as a whole. Teachers can also form expectations at the individual-student level, where they can pinpoint and articulate their expectations that they hold specifically and uniquely for each individual student.

Teaching is a sensitive and personal experience for everyone involved. Teaching is sensitive because it is subject to so many internal and external influences and forces, as well as being highly influential itself. Teaching is personal because it (ideally) involves dedication and commitment from all parties involved, and its influential powers reach the hearts and minds of those involved. Therefore, we need to explore and expose this conscious and unconscious, tangible and intangible layer of education called teacher expectations in order to use it as a tool for equitable, powerful, and effective teaching and learning.

Overview of the Teacher Expectation Literature

Over the past five decades, teacher expectations have been under the microscopes of social science, education psychology, quantitative and qualitative methodology, sociology, ethnography, teacher education and policy, and more recently cognitive psychology. The academic expectations that a teacher holds for her students carry a lot of influential power both in her instructional practice and as a mediator of student achievement (Brophy & Good, 1970, 1974; Good & Brophy, 2003; Rubie-Davies, 2014; Weinstein, 2002). The research grew from the need to acknowledge the existence of teacher expectations (especially for differential groups of students) as measured by their impact on student achievement. This need for proof of expectancy effects evolved into research that focused on the teachers themselves, and how they communicated their expectations as mediators in the expectancy process. Then a new paradigm shift occurred with the exploration of teacher expectations' social-cognitive underpinnings, to better explain the complex findings of this complicated realm (Pajares, 1992; Bandura, 2001; Babad, 1998).

This shift from analyzing the existence of teacher expectations, to its manifestation in teachers' behavioral paradigm, and to the social cognitive model marked important benchmarks in this field of research. As a cycle of research, the topic of teacher expectation has paralleled that of teaching and learning, in that it shifted from a linear emphasis on finding correlations between observable educator behavior and student achievement, to an emphasis on educators' beliefs, cognition, and decision-making process (Fang, 1996).

Teacher Expectation Research - Phase One

The first wave of landmark research studies on teacher expectations came during the mid-1960s, as a result of the field of education's acknowledgment of the influential powers that teacher expectations have on student's academic achievement. This movement drew much of its empirical findings and theories from psychology (Weinstein, 2002), and it focused on demonstrating the actual existence of expectancy effect (Brophy & Good, 1970), and the construct of *expectancy* itself (Bandura, 2001).

Overview of the Need for Proof: Process-Product Model

The goal of this empirically driven research was to "define relationships between what teachers do in the classroom – the process of teaching – and what happens to their students – the products of learning" (Fang, 1996). In this original research context, teacher expectations were impersonally framed in the quantifiable process-product, input-output model. Students' voices and roles were left out of this teacher-centered linear equation, because the main source of evidence about the very existence of expectancy processes only favored teacher expectations of performance as measured by students' achievement scores.

Teacher Expectations Defined, Conceptualized, and Theorized

In the 1960s and 1970s era of process-product research, teacher expectations were defined as teacher perceptions about students' performance and aptitude and thereby quantified and operationalized by test scores and IQ (Rosenthal & Jacobson, 1968; Brophy & Good, 1970; Brophy, 1983). The process (input) of teaching led to the product (output) of student achievement. Changing the research setting from a science laboratory to a school classroom, and switching from lab rats as subjects to research participants as

teachers and students undoubtedly left a clinical residue. Bandura (2001) states this early psychological theorizing of expectancy was "founded on behavioristic principles, centered on an input-output model… human behavior was shaped and controlled automatically and mechanically by environmental stimuli" (p. 2).

This behavioral paradigm centered more specifically on the concept of self-fulfilling prophecy, the driving force behind this initial research on teacher expectations. Surprisingly, this concept was first coined and defined by the sociologist, Robert K. Merton, in 1948. Merton drew from "the dean of American sociologists, W. I. Thomas's theorem basic to the social sciences stating that 'If men define situations as real, they are real in their consequences'" (Merton, 1948, p. 193). The self-fulfilling prophecy is "a *false* definition of the situation evoking a new behavior, which makes the original false conception come *true*" (Merton, 1948, p. 195, italics in original). Merton also constructed the model through which this self-fulfilling prophecy manifests: first the beliefs about a situation, then the behaviors that bring about a confirming response, and then the confirming response itself. The hypothesis that teacher expectations can function as self-fulfilling prophecies was the ignition behind this initial stage of research on expectancy effects (Brophy, 1998).

Demonstrating the Expectancy Effect in the Classroom

Twenty years later, the existence of Merton's concept of self-fulfilling prophecy was tested in the classroom by the iconic and controversial *Pygmalion in the Classroom* study by Robert Rosenthal and Lenore Jacobson (1968). This principal-teacher collaboration was the first empirical test specifically set up to examine if this self-fulfilling prophecy truly exists in schools, rather than in laboratory settings. With an

advanced research design for its time, this study was a randomized experiment in a natural setting (school). Modeled after experiments performed with animals in and outside of laboratories, *Pygmalion in the Classroom* challenged the possibility that the *experimenter expectancy effect* exists in the classroom.

When the experimenter sees what he expects to see, this is the *experimenter expectancy effect*, the *unconscious experimenter bias*, and also called the *interpersonal expectancy effect* (Rosenthal & Jacobson, 1968; Brophy & Good, 1970, 1974; Rosenthal, 1997; Babad, 1998). "The unintentional expectations that…teachers…bring to the…classrooms – can wield significant influence on individuals" (Rosenthal, 1997, p. 1). Rosenthal and Jacobson wondered "about the beliefs created in schools – teachers, when they are told a child is educable but slow, deserving but disadvantaged" (Rosenthal & Jacobson, 1968, p. 44). Was the expectancy effect at play in the classroom?

Experimental Study: Pygmalion in the Classroom

To find out the answer to their question, Rosenthal and Jacobson (1968) tested the hypothesis that in any random classroom, a correlation exists between teachers' expectations and their students' achievement. They designed the Oak School Experiment "specifically to test the proposition that within a given classroom those children from whom the teacher expected greater intellectual growth would show such greater growth" (Rosenthal and Jacobson, 1968, p. 61), and counter opposing themes and findings of their day, where "children defined as disadvantaged are expected by their teachers to be unable to learn" (p. 53). Because of this deficit-model thinking so embedded in the culture of this school (and arguably in many schools then and now), their study aimed at demonstrating the concept of self-fulfilling prophecy for growth. *Pygmalion in the*

Classroom sought evidence for whether or not a teacher's expectations (high, in this case) made any difference in either the teacher's evaluation of her students or in their actual performance. Rosenthal and Jacobson wanted to verify whether a teachers' high expectations of students' academic performance actually led to the students performing better academically.

Setting the Stage

At the low-class community "Oak School," twenty percent of the elementary students were chosen from a table of random numbers to be the test group. To establish this group, Rosenthal and Jacobson pretested all of the students at "Oak School" with the (fictitious) "Harvard Test of Inflected Acquisition" IQ test at the end of the summer of 1964. Entirely unrelated to the actual test scores, the top 20 percent scorers were randomly chosen for this experiment and their names were distributed to their new teachers. Eighteen teachers and their classrooms were studied: one teacher from grade levels first through sixth grade, and one teacher at these grade levels from the three tracks, fast, medium, and slow. (Rosenthal noted that students at "Oak School" were grouped and tracked like this, according to ability based on reading performance, with a disproportionate number of Mexican students and students from low-income families in the low group.)

At the beginning of that school year, each of the eighteen teachers was given a list of names (ranging from one to nine students) of the children in her class who were "special" because of their alleged academic potential. The researchers told teachers "as a point of interest" that they had *academic spurters* amongst their students who were ready

to academically bloom; all based on the IQ test given and scored independently by Rosenthal and Jacobson (1968, p. 66).

Teachers were not allowed to discuss this phenomenon with any of their students (including those labeled as *academic spurters*) or with the *academic spurters'* parents. Because these students were chosen completely at random, what is most fascinating about this study is that "(t)he difference between the children earmarked for intellectual growth and the undesignated control children was in the mind of the teacher" (p. 70). It was up to the teachers to implement the "program of intellectual change" that this experiment set out to test.

Findings

Eight months later, at the end of that academic year, Rosenthal and Jacobson came back and re-tested all the students with their fictitious IQ test. Those labeled as the intelligent *academic spurters* across the school as a whole, showed a significantly greater increase in the new IQ re-tests than the other children in the control group, who were not singled out for the teachers' attention. Some students' IQ scores revealed a growth of four grade levels. The study revealed an overall effect size of .15 (correlation between the experimental manipulation and the IQ outcomes) and an average IQ difference of four points between the high expectancy students and the control students (Rosenthal & Jacobsen, 1968; Jussim et al., 1998). The teachers were also asked to rate students on variables related to intellectual curiosity, personal and social adjustment, and need for social approval. The average children who were expected to bloom intellectually were rated by teachers as more intellectually curious, happier, and in less need for social

approval. Rosenthal and Jacobson came back and re-tested all the students two years later to test reliability of their findings.

Historical Impact

This study "created an intense storm, which still reverberates in educational circles, and opened a vast research domain focusing on teacher expectancies" (Babad, 1998, p. 184). The *Pygmalion* study demonstrated the existence of self-fulfilling prophecy in the positive direction in the classroom setting. This was evidenced by the differentiation of the teachers' expectations (and subsequent preferential treatment and instruction) regarding the intellectual performance of these allegedly 'special' children, which actually led to measurable changes in the intellectual performance of these students selected completely at random without any relation to their actual test results.

Yet even more shocking was the discovery that the teachers unfavorably judged the students not expected to make gains in their IQ (those students in the control group) (Rosenthal & Jacobson, 1968; Rosenthal, 1997). This led to the classification of the negative implication of self-fulfilling prophecies: the "Golem" effect where the teacher's negative expectations may actually harm low achievers and minimize their performance below their intellectual potential (Rosenthal & Jacobsen, 1968; Babad, Inbar, & Rosenthal, 1982; Rosenthal, 1997; Babad, 1998). Because this study only manipulated *positive* expectations, it did not even approach the empirical question of the effects of negative expectations (Jussim et al., 1998). "Apparently there were hazards to unpredicted intellectual growth" (Rosenthal, 1997, p. 10). Nonetheless, these "hazards" carry devastating effects, and the *Golem* effect still exists today.

Oak School Experiment and the subsequent book, *Pygmalion in the Classroom: Teacher Expectation and Pupils' Intellectual Development,* have indelibly left their marks on educational psychology, the research on teacher expectations, and education as a whole. This study brought to light the need for more empirical evidence of the equality of educational opportunities by *strongly demonstrating* that teacher expectations had a self-fulfilling expectancy effect on students' intelligence, and by showing the existence of teachers' differential behavior associated with high and low expectations. For decades now, the term *Pygmalion effect* is widely used synonymously with self-fulfilling prophecy in the positive direction, demonstrating the importance of this experiment and book.

This study fit Merton's model from 1948 perfectly of how the self-fulfilling prophecy comes to fruition: first the beliefs about a situation (teachers were told some of their students were particularly bright, a false expectation rendered through the use of psychological tests), then the behaviors that bring about a confirming response (teachers change their behavior to better support these allegedly academically talented students), and then the confirming response itself (some of these particular students' achievement scores rose).

Criticism

Unfortunately this study became highly controversial and heavily criticized conceptually, theoretically, methodologically, and statistically. The data from this study was highly doubted when inspection of the test results by grade level revealed the significant intellectual gains found only in first and second grades (Elashoff & Snow, 1971). Elashoff and Snow (1971) questioned teacher expectations' impact on student IQ,

whereas their impact on achievement they saw as more probably. When Rosenthal and Jacobson re-tested two years later, the results did not show long-term evidence of this experimental manipulation, other than the students who were in fifth grade during the year of the experiment (Elashoff & Snow, 1971, as cited by Weinstein, 2002). The validity of the IQ test was also scrutinized, and administration of the same test was questioned (see Thorndike, 1968; Jensen, 1969; Elashoff & Snow, 1971).

Heavy criticism fell on Rosenthal and other researchers who set out to replicate this study to find further evidence that *induced* teaching expectations influence student academic performance. When these replication experiments never recreated similar achievement gains in any students, Brophy (1983) astutely credited this inability for replication to the teachers' newly gained awareness of "phony information" brought on by the *Pygmalion* study, rendering the replication experiments less credible (p. 632).

Babad (1978) defends the harsh criticism this study received when he said "this study may or may not have been premature and overgeneralized, but the intensity and emotional tone of the attacks was grossly exaggerated, indicating, in my opinion, some underlying problems and biases on the part of psychologist" (p. 388). Yet in the same review, Babad also wittingly sheds light on the flipside of the teacher expectancy effect and self-fulfilling prophecy when expectations are negative (the Golem effect, as described earlier). Clearly the existence of the expectancy effect has been demonstrated for those students slated to intellectually bloom due to implanted positive expectations. But everyday influences work in the opposite direction, where "people are underestimated and performing below potential due to negative expectancies, preconceived notions, and stereotypes" (Babad, 1978, p. 388).

Thus far, the case has been made that expectations in general, and teacher expectations in particular, are educationally relevant. In spite of later criticism, the *Pygmalion* study elucidated the impact teacher expectations can have on student achievement. I highlight this study because it serves as the benchmark study of teacher expectancy effects and continues to be ubiquitously cited.

Inspiring Further Research

To assimilate the influential magnitude of self-fulfilling prophecies, Rosenthal and Rubin (1978) developed and ran a meta-analysis of 345 experimental studies on self-fulfilling prophecies, which they also referred to now as *interpersonal* expectancy effect. Similar to experimenter effect explained earlier with the *Pygmalion* study, *interpersonal* expectancy effect looked at how the expectations held by teachers, therapists, and employers for their students, clients, and workers might also come to serve as interpersonal self-fulfilling prophecies (Rosenthal & Rubin, 1978). These studies under analysis were performed across multiple settings, some laboratory and some "everyday life situations" (p. 377), including schools and therapist offices.

They categorized these studies under eight domains of research, such as studies on effects of sensory restriction under the domain of laboratory interviews; latency of word association under the domain of reaction time; and IQ test scores, verbal conditioning under that domain of learning and ability (Rosenthal & Rubin, 1978). They found that expectancy effect had significant effect sizes of in 39 percent of the 345 studies, and significant effect sizes in 29 percent of the thirty-four studies specifically under the learning and ability domain. Of these learning and ability studies, the five most significant studies had large effect sizes: learning and ability (d = .54), perception (d =

.55), psychophysical judgments (d = 1.05), and everyday situations (d = .88). (As per Fields (2014), the effect size is a standardized measure of the magnitude of observed effects, as measured by the difference between the means of the two comparison group divided by the within-group standard deviation.)

They concluded that after examining the results of these 345 studies of interpersonal self-fulfilling prophecies, some clear conclusions emerged. “The reality of this phenomenon is beyond doubt and the mean effect size is not trivial… the estimated grand mean effect size over eight different areas of research was 0.70” (Rosenthal & Rubin, 1978, p. 385).

Yet with only about one-third of these studies successfully showing the existence of self-fulfilling prophecy, critics claimed the phenomenon did not exist; while proponents took the glass-half-full stance claiming this was evidence of self-fulfilling prophecy because, if only chance differences were occurring, replications would only succeed about 5 percent of the time (Jussim et al., 1998). All the while, this study served as the development of the meta-analysis statistical technique, which is now widely used to summarize the results of multiply studies (Rosenthal & Rubin, 1978; Harris & Rosenthal, 1985).

Because of the heavy reliance on experimenter manipulation to *induce* differentiated expectations (like in *Pygmalion* study and those trying to replicate it), Dusek (1975) urged the differentiation to be made in the research, between *bias effects* and *expectancy effects*. Bias effects are the self-fulfilling prophecy effects of induced expectations, or biases, stemming from *false* information; conversely, expectancy effects are effects on student-teacher interactions and student achievement resulting *naturally*

from the expectations teacher form organically from observing and interacting with their students (Dusek, 1975). In the classroom setting, Dusek (1975) concluded that there was much more widespread evidence suggesting expectancy effects in the ordinary classroom rather than bias expectancy induced by an experiment. This next strand of research followed Dusek's advice and looked at naturally occurring expectations and their effects in the classroom. This distinction between falsely formed and naturally formed expectations was an important turning point in the expectation research (Jussim et al., 1998).

Need For a New Paradigm

Similar to the criticism of the *Pygmalion* study's overgeneralization of the expectancy effect, this extensive research *demonstrating* the existence of this effect came under fire for its repetitiveness and overenthusiasm for proof. The prolific amount of research that had surfaced was criticized for being "limited to statistical procedures" and thereby "inadequately represents a body of research by placing undue emphasis on the mere existence of the expectancy effect, to the apparent exclusion of its meaning and significance… in the absence of theoretical statements tying together research explaining the phenomenon" (Adair, 1978, p. 386).

Such overreliance on experimental and correlational studies also tarnished this prolific amount of research with the absence of independent measures of teacher expectations because teachers were "simply assumed to adopt the expectation-inducing information provided by the experimenter" (Mitman & Snow, 1985, p. 115). This body of work did not capture the "*social process*" that education is because it reduced it to

variations in IQ scores, which "merely give indications of potential, not of process" (Rist, 1970, p. 417, italics in original).

It was time for the next strand of research and a departure from the quantitative process-product model of research that narrowly defined teacher expectations as perceptions about students' performance and aptitude, impersonally operationalized by students' test scores or IQ. This next strand of research took place concurrently with its process-product model just described, but their tenets, approach, and application differed greatly. It was time to move away from the backdrop of the laboratory and into the more ecologically valid context of the classroom, where expectancy effects could be tested for in the natural expectations of a teacher instead of in experimentally induced expectations of teachers (Brophy, 1983; Dusek, 1975; Weinstein, 2002).

Summary of the Need for Proof: Process-Product Model

In summary, this first phase of expectation research focused on *demonstrating* the existence of the teacher expectancy effect through a process-product model (Figure 1). The process of teaching led to a change in the product of student achievement, thereby demonstrating expectancy effects. Teacher expectations were defined as teacher perceptions about students' performance and aptitude, and thereby quantified and operationalized by test scores. This initial research on teacher expectations centered more specifically on the concept of self-fulfilling prophecy, "a *false* definition of the situation evoking a new behavior, which makes the original false conception come *true*" (Merton, 1948, p. 195, italics in original). This extensive research *demonstrating* the existence of teacher expectancy effect came under fire for its repetitiveness and overenthusiasm for proof. The prolific amount of quantitative studies overgeneralized teacher expectancy

effects, and the next wave of research aimed at looking deeper into the reasons behind teacher expectancy effects.

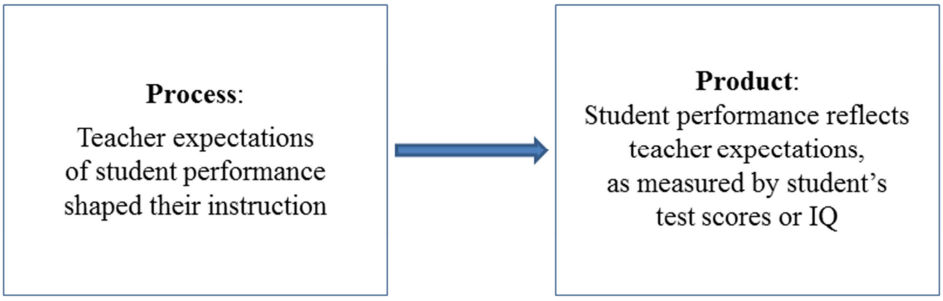

Figure 3. Graphic representation of Phase 1: The process-product model of teacher expectancy effects theory.

In this research model, **teacher expectations** were defined as teacher perceptions about students' performance and aptitude, and thereby quantified and operationalized by test scores (Rosenthal & Jacobson, 1968; Brophy & Good, 1970; Brophy, 1983).

Teacher Expectation Research - Phase Two

With the existence of teacher expectancy effect clearly demonstrated, a new path in research set out to fill in the holes left empty by the empirically driven research on self-fulfilling prophecy. Echoing the criticism of *Pygmalion* study and the process-product approach to expectancy research, this next phase held teacher behavior in their classroom setting as their main focus (Brophy & Good, 1970, 1974).

Overview of Expectancy Mediation

Researchers now explored the concept of expectancy mediation—how a teacher actually *communicates* her expectations—looking for the intervening processes "indicative of the behavioral mechanisms involved when teacher expectations function as self-fulfilling prophecies" (Brophy & Good, 1970, p. 365). This strand of research is

centered on looking for data on the *causal* mechanisms at work with teacher expectation effects, which was merely mentioned in Rosenthal and others' work (Brophy, 1983).

Brushing the surface and without investigating causal connection, Rosenthal and Jacobson's *Pygmalion* study (1968) documented how teachers differentiated their behavior based on expectations in four areas: socioemotional climate (smiling, friendliness, for example), input (actual distance of the student's seat from the teacher, time given to complete problems, and assignment differentiation), output (calling on students, accuracy and length of feedback, wait time for students' response to the teacher's question), and affective feedback (amount of criticism or encouragement, pity or anger directed at perceived low performers). But now it was time to conceptualize the behaviors that communicate the expectancy effects (Good & Brophy, 1970).

Teacher Expectations Defined, Conceptualized, and Theorized

This conceptualization began when Brophy and Good quantified teachers' behavioral analysis in 1970, igniting a long-lasting wave of research. Teacher expectation was still defined as the teacher's perception of student performance, but this next phase of research explored the actual process of how the teacher expectation communication might work in a classroom in six steps. Included in this process of expectancy mediation, teacher's differential treatment, varying learning time, and overall inconsistent behavior on the part of the teacher communicated such perceptions. Their seminal paper entitled *Teachers' Communication of Differential Expectations for Children's Classroom Performance: Some Behavioral Data* did so by providing the research field with an explicit observational tool that elucidated and quantified self-fulfilling prophecies "as outcomes of observable sequences of behavior" (Brophy & Good, 1970, p. 365).

Researchers, teacher educators, and administrators could now study and actually code the dyadic interactions between classroom teachers and each individual student. Their initial study and use of the observational tool was the first naturalistic study of teacher interaction with high- and low-achieving students *in* the classroom, following Rosenthal and Jacobsen's (1968) *Pygmalion in the Classroom* (Good, 1987).

Good and Brophy's (1970) *teacher-child dyadic interactions* model provided a coding system of six steps for how the teacher expectation communication process might work in a classroom. This model for observational work addressed all dyadic contacts between the teacher and the individual student. Therefore, the teacher-child dyad became the unit of analysis, rather than the whole class as a group, making this observational tool especially sensitive to and precise for the study of communication of differential teacher expectations. Good and Brophy firmly believed the observational system had to analyze the teacher-student interaction in order to capture the true behavioral mediation of teacher expectancy effect, because "teachers do treat children differently" (p. 132).

Outlined here by Good and Brophy (1970), the *teacher-child dyadic interactions* offered a model for how the teacher expectation communication process might work in a classroom in six steps. First, (a) the teacher forms differential expectations for student performance; (b) The teacher then begins to treat children differently in accordance with differential expectations; (c) The children respond differentially to the teacher because they are being treated differently; (d) In responding to the teacher, each child tends to exhibit behavior which complements and reinforces the teacher's particular expectations of the child; (e) As a result, the general academic performance of some children will be enhanced while that of others will be depressed, with changes being in the direction of

teacher expectations; (f) These effects will show up in the achievement tests given at the end of the year, providing support for the "self-fulfilling prophecy" notion (p. 365-366).

Greatly influential to this field of research, this new research tool could quantify components of the expectancy effect from more of a personal stance in that the teacher behavior communicating expectancy effects was measured rather than the product of a test score. The impact on students as individuals was now taken into consideration, an element largely ignored in previous research models. This tool also brought to light the behavior evidence of expectancy effect in the more ecologically valid context of the classroom, where expectancy effects could now be tested for in the naturally-occurring expectations of a teacher, instead of in the experimentally-induced expectations of teachers as before (Brophy & Good, 1970, 1974; Brophy, 1985; Weinstein, 2002).

With its six steps, Good and Brophy's (1970) *teacher-child dyadic interactions* model further outlined and more explicitly detailed Merton's (1948) original model of how the self-fulfilling prophecy manifests. First, the teacher forms differential expectations for student performance, then that teacher treats students differently in accordance with the teacher's differential expectations, the students react differentially to the teacher because the teacher is treating them differently, then in response to the teacher, each student tends to behave in ways that compliment and reinforce the teacher's specific expectation for the student. This results in the general academic performance of certain students being enhanced, while that of other students will be lowered, with changes aligning with the direction of teacher expectations. These expectancy effects will show up in the achievement tests given at the end of the school year, thereby supporting the concept of self-fulfilling prophecy.

Experimental Study

Using classroom interaction analysis and their new *teacher-child dyadic interactions* model (Good & Brophy, 1970) as their observation instrument, Brophy and Good (1970) observed the dyadic interactions between students and teachers in four first grade classrooms, in a small Texas school district, serving rural and lower-class population, as well as a large military base nearby. The ethnic composition was representative of the general population of the area with 75% Anglo-American, 15% Mexican-American, and 10% Afro-American. More specifically, Brophy and Good observed the dyadic interactions targeting the six highest and six lowest students, both boys and girls, as rank-ordered by their teacher according to "achievement… vague instructions to encourage the teachers to use complex, subjective criteria in making their judgments" (p. 366).

This initial study focused on the second step of their model, where "given differential teacher expectations, how are they communicated to the children in ways that would tend to cause the children to produce reciprocal behavior?" (p. 366). Teachers were not told their behavior was being observed, instead that the study was focused on the classroom behavior of the children at different levels of achievement.

Findings

Using their observation instrument, they were able to code and analyze the sequence of interaction patterns, discerning between teacher-initiated and student-initiated behaviors, in addition to capturing the different types of teacher behavior (Brophy & Good, 1970). Examples of the student-teacher interactions that communicated the teachers' performance expectations were variables such as number of direct

questions, number of times the teacher called on students, how often the student answers open questions/number of times child raises hand, percentage of correct answers followed by teacher praise, percentage of wrong answers followed by teacher repetition or rephrasing of the question, and percentage of answers (correct or incorrect) not followed by any feedback from teacher (p. 371).

After statistically controlling for student-initiated behavioral differences, Brophy and Good found that "teachers systematically discriminate in favor of the highs over the lows in demanding and reinforcing quality performance" (p. 373). Highs received more specific feedback, especially with incorrect answers, while the lows' incorrect answers were often ignored or the teacher gave the answer or called on another student. All four teachers showed behavior that demonstrated the favoring of the highs over the lows, but they ranged in their degree of differential treatment, with one teacher on either ends of the spectrum. Gender differences appeared, though unrelated to performance expectations and more to the boys' disruptive behavior.

Aware of the limitation of a small sample size, another point of great interest is that this study evidenced that the achievement levels of the classes were in fact related to the teachers' original performance expectations. This satisfied the quality control issue brought up by the criticism of the process-product expectancy research and their lack of independent measures of teacher expectations (Mitman & Snow, 1985).

Brophy and Good's data confirmed their hypothesis that teachers' expectations function as self-fulfilling prophecies, as conveyed by their intervening behavioral mechanisms. Their data demonstrated more specifically the second step of Brophy and Good's model, claiming teachers' behavior communicated their differential performance

expectations of the individual students in ways that would encourage the students to respond and behave in ways that confirm teacher expectations. Their work expanded upon Rosenthal and Jacobsen's (1968) neutral acknowledgement of behavioral mediation of differential teacher expectations through a more explicit interpretation and conceptualization of expectancy mediation and communication through teacher's behavior.

Expectancy Mediation Study on Social Culture of Classroom

Interestingly, that same year Good and Brophy (1970) changed the research paradigm with their *teacher-child dyadic interactions,* Dr. Rist examined the teacher expectancy effect from an anthropological perspective. Very clearly Dr. Rist wanted to explore how the communication of teachers' differential expectations reinforces the class structure of society (Rist, 1970). His two and one-half year longitudinal study observed and followed a group of thirty African-American students from their Kindergarten year through their second grade year, exploring the patterns of teacher expectation and mediating behavior that emerged from the very beginning of those students' first year in the school system, and followed them into each subsequent classroom. Alongside the expectations of performance was "a mutually accepted stratification system delineating those doing well from those doing poorly" where teacher's expectations of potential academic performance "relates to the social status of the student" (p. 413).

Rist (1970) argued that as students of color moved through the school system, each year their new teacher greeted them not as individual students but as group of students already stigmatized by previous years' caste-like interactional patterns, widening the gap of academic achievement and content each year. This perpetually diminishing

record of academic performance due to the caste-like system of school automatically sealed the fate of this group of African-American students. In each subsequent year of schooling, the teacher automatically used this diminished academic performance record as the basis of classroom grouping, rather than using subjectively interpreted data.

In other words, the student's socioeconomic status paved the way for long-term predictive effect of teacher expectations on students' academic performance. The students' seating arrangement was determined by their low, middle, or upper class status, and this leveling predicted their quality of education. Middle and upper class students received higher quality and quantity of education beginning in Kindergarten, while their lower class peers received lower quality and less quantity of education. The achievement gap was literally mapped out by the seating arrangement from the eighth day of Kindergarten, and continued to widen with every school year as this seating arrangement was replicated.

Methodologically, this study was very progressive and unique in that Rist, a white male, specifically chose the atypical format of a longitudinal study to better capture the "complexities of the interaction processes which evolve over time" within classrooms, processes that cannot be captured with shorter timelines and narrower perspective (Rist, 1970, p. 416). Rist also deliberately applied a qualitative method of analysis to better capture the essence of education as the social process that it is, rather than reducing education to "variations in IQ scores over a period of time" (p. 417). The ghetto school where this study took place was typical of urban black neighborhoods, had all-black teachers, and Rist felt strongly about using a longitudinal study as his research method for this particular setting because it would increase his chances of gaining deeper insight

into the “mechanisms of adaptation utilized by black youth to what appears to be a basically white, middle-class, value-oriented institution” (p. 417).

Findings

In the few days leading up to the first day of Kindergarten, the teacher, a middle class and well-educated woman, was only provided with a limited amount of information on her incoming students. Oddly enough, the sources of information were only related to students’ financial status and whether or not they were on welfare, students’ medical information, and structure of students’ families (Rist, 1970). No information relating to the academic potential of the incoming students’ was given to the teacher. Shockingly, by only the eighth day of Kindergarten, Rist observed a seating arrangement of three tables, appearing to be solely based on the income, size, and education of the family, profiled with descriptive variables by Rist such as “families on welfare, families with both parents employed, father who went to college, families with both parents present, and families with six or more children” (p. 421).

The teacher even called her students at Table 1 “fast learners,” and students at the other two tables she described as having “no idea of what was going on in the classroom, both odd labels considering she had no prior formal knowledge of students’ academic potential or capacity for cognitive development” (p. 422). Instead the teacher “made evaluative judgments of the expected capacities of the children to perform” in the first two weeks of school based on social and economic status (p. 422). For the remainder of the entire school year, the classroom remained organized according to the teacher’s expectations of academic success or failure, where students at Table One received obvious preferential treatment, had more contact with the teacher, covered a larger

amount of content material, and the students at the other two tables were ascribed lower status and called “failures” by the teacher (p. 423). Students from Table One ridiculed the other students, and they continuously dominated the classroom, the teacher’s attention, and the content.

What started as a seating arrangement in kindergarten based on the teacher’s definition of success and failure surfaced again and dictated first and second grade. Rist observed this “caste phenomenon in which there was absolutely no mobility upward” where the “fast learners” from *Table One* in Kindergarten were those same students at *Table A* in first and at the *Tigers* table in second grade (Rist, 1970). Because the students at Table One disproportionately received more instruction and content than the other students deemed as failures, those students at the other tables could not demonstrate readiness when entering first grade, thereby perpetuating the seating arrangements metaphorically, academically, and literally. Those students seated at Tables 2 and 3 in Kindergarten who were “failures,” went on to sit at *Table B and* C in first grade, and then at the *Clowns* table in second grade. This pattern of grouping by social economic factors occurring at each grade level demonstrates an institutional reinforcement of self-fulfilling prophecy.

Need for a New Paradigm

Rosenthal and Jacobsen’s (1968) acknowledgement of behavioral mediation of differential teacher expectations was extended by Brophy and Good’s (1970, 1974) more explicit interpretation and conceptualization of expectancy mediation and communication through teacher’s behavior. Research like Rist’s (1970) during this phase also led to the acknowledgement of school’s institutional reinforcement of such self-fulfilling prophecy.

Yet unfortunately during this research period, the qualitative case studies with an anthropological perspective were seldom given the credibility they deserved as evidence of the self-fulfilling prophecy of teacher expectancy effects (Weinstein, 2002). Studies that captured this institutionalization of race and social class differences were not incorporated into the increasing amount of research on teacher expectancy effects at this time.

Instead the focus of the next wave of research extended upon Brophy and Good's work on depicting teacher behavior that communicated expectancy effects, to isolate precisely those teacher behaviors that mediated expectancy effects. Such precision, therefore, was a return to the heavily quantitative approach in search of empirically aggregate findings on teacher behavior (Harris & Rosenthal, 1985).

Summary of Expectancy Mediation

To summarize, expectancy mediation research developed a model to better explain how the process of teacher expectations can be communicated to students in the natural setting of the classroom. Similar to the process-product research demonstrating the existence of teacher expectancy effects, this second phase of research also looked at the effects of teacher expectations as measured by students' test scores. But this expectancy mediation research included a new variable: an actual model to explain how teacher expectations can be conveyed directly and indirectly to students, and create self-fulfilling expectancy effects. The process of how this expectancy mediation unfolds from start to finish in Brophy and Good's six steps allowed researchers to look more deeply in the underpinnings of teacher expectations and their influence in the classroom and on student achievement (Figure 2).

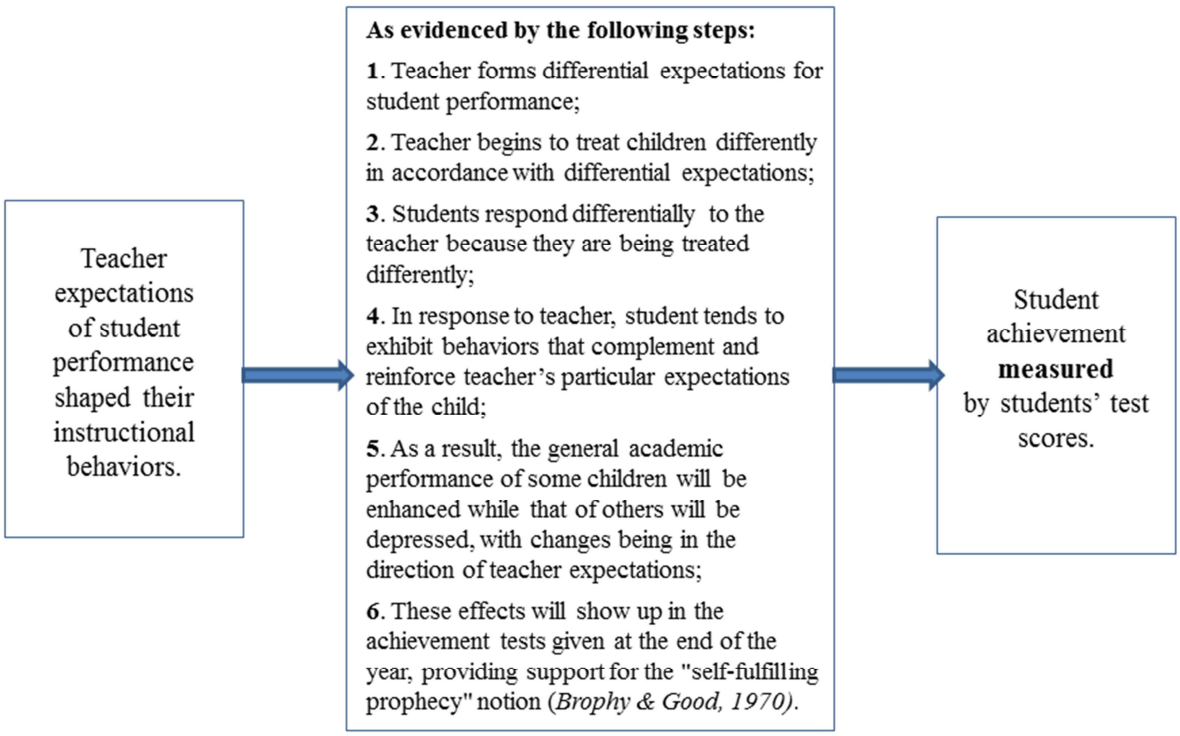

Figure 4. Graphic representation of Phase 2: Expectancy Mediation Model and Theory.

In this research model, **teacher expectations** were defined as teacher perceptions about students' performance and aptitude. But in this model, an additional variable was included: the actual process to explain how expectancy mediation unfolds from start to finish, through Brophy and Good's six steps. Students' test scores were still used to further measure teacher expectancy effects.

Teacher Expectation Research - Phase Three

Brophy and Good's seminal work and their new *teacher-child dyadic interactions* model (Good & Brophy, 1970) for observations prolifically impacted teacher education, social sciences, and the growing research on teacher expectation effects (Brophy & Good, 1974; West & Anderson, 1976; Braun, 1967; Good, 1987). Their model of the expectancy mediation process and their observation tool gave researchers and teacher

educations six components of the process of teacher expectancy to better understand and explore. With such articulation of each aspect came copious research. By the time Brophy compiled an extensive review of teacher expectation research in 1983, over 100 studies had been conducted, demonstrating without a doubt that teacher expectations can have a self-fulfilling prophetic effect.

Overview of the Need for an Inclusive Paradigm

At this third stage of research, few could deny that if a teacher expects a certain behavioral pattern or level of achievement from a student, these expectations can lead to the teacher's treatment of that student in ways that clearly echo the expectations, thereby increasing the chances that the behavior and/or level of achievement will become a reality (Brophy, 1998). Yet the overarching message from the aggregate findings was that the actual magnitude of teacher expectancy effects on student achievement, with student's prior achievement levels adjusted for, was relatively small on average, only making a 5-10% difference in student achievement outcome measures (Brophy & Good, 1974; Brophy, 1983, 1985; Rosenthal, 1989; Weinstein, 2002). Though still practically and statistically significant of an overall finding, this 5-10% difference paled in comparison to the difference in student achievement outcome researchers had sought after for all these years. Therefore, follow-up studies had to clarify and characterize teacher expectancy effects further.

Teacher Behavior Conceptualized Further

With the conceptualization of the process of teacher expectancy effects delineated in Good and Brophy's model (1970), researchers, teachers, teacher educators, administrators, scientists, and audiences from other fields had exposure to the underlying

layers of expectations. With each of the six steps of the *teacher-child dyadic interactions* process clarified, researchers could now examine what was previously considered elusive. Through the use of this more inclusive model of expectancy mediation, each step of the expectancy process could be detailed, observed, and further explained. Brophy and Good (1970) took their own advice they offered back in 1970, when they recommended "(a)dditional indexes of the ways in which teachers discriminate in their classroom behavior are also needed to add to our understanding of the processes involve and to increase the effectiveness of teacher education and classroom intervention in preventing or reducing the problem" (p. 374).

These researchers reviewed decades of mediation studies and the prolific amount of research on the exploration of teacher expectancy effects and its mediation through teacher behavior (Brophy, 1983, 1985; Good, 1987). They cite over one hundred studies that have either explored each of the six underpinning step of the expectancy process as outlined by the *teacher-child dyadic interactions*, or the multitude of variables found in the contexts of teachers, students, and classrooms.

From this extensive meta-analysis and aggregated findings, researchers honed in on step 1 of the of the *teacher-child dyadic interactions* process, and concluded that inservice teachers typically developed accurate expectations about their students when their main source of information is school records; therefore, teachers' predictions about student achievement are typically quite correct (as cited by Brophy, 1983; Brophy & Good, 1974). This claim was also well supported by Hoge and Coladarci (1989), and Südkamp et al. (2012).

That said, it is still unsettling to know that information about students' test performance, track or group placement, classroom conduct, physical appearance, race, socioeconomic status, ethnicity, gender, speech characteristics, and special education labels influence teachers' expectation formation (Brophy, 1983; Brophy & Good, 1974; Dusek & Joseph, 1983; Braun, 1976; and others as cited by Good, 1987).

This intense review of the mediation research further zoomed in on Step 2 of the "Brophy-Good model," allowing for further delineation of exactly *how* teachers behave differently towards various students based on their already-formed differential expectations for student behavior and achievement (Good, 1987, p. 34). They identified seventeen behaviors that indicate teachers' differential treatment towards their high- and low-expectancy students (Brophy, 1983, 1985; Good, 1987). With numerous studies cited under each of the 17 behaviors, examples included differential treatment included teachers giving less "wait time" for their low students to answer; supplying low achievers with the answers or calling on a different student rather than rephrasing or repeating the question; seating high achievers closer to the teacher and low achievers farther away; demanding less from low achievers; providing less feedback to low achievers; interacting more privately with low achievers and more publicly with high achievers (Brophy, 1983, 1985; Good, 1987).

Overall, this specification of such discrete behavior was of enormous significance for teacher education (Weinstein, 2002). Especially in light of Brophy's (1983) claim that a teacher's differential treatment of students as a group or as a whole class may be more widespread and a "more powerful mediator of self-fulfilling prophecy effect on student achievement" than differential treatment of an individual student (p. 309).

Further Research on Inclusive Paradigm

Additional meta-analysis of 136 studies (Harris & Rosenthal, 1985) revealed evidence for the mediating affect of climate (teachers demonstrated warmer behavior towards their high-expectancy students, r = 0.37), input (high-expectancy students were taught more challenging material, r = 0.33), and output (more opportunities for high-expectancy students to respond to instruction and questioning, r = 0.20). Feedback (providing more positive and differentiated performance information for the high-expectancy students) was not a strong mediator of expectancy (r = 0.07).

Rosenthal (1989) constructed his own theory of the mediation of teacher expectation effects, the Affect/Effort Theory. This theory states that a change in the level of expectations held by a teacher for the intellectual performance of a student is translated in a change in the affect shown by the teacher toward that student and, somewhat independently, a change in the degree of effort exerted by the teacher in the teaching of student (Rosenthal, 1989).

The Importance of Accuracy of Expectations

This stage of research also saw a critical examination into the accuracy of a teacher's expectation. This accuracy rests in the correlation (not the causation) between the expectations about a student or class and their behavior or achievement, as long as the teacher's expectation did not cause the student's behavior or achievement (Good, 1987; Shavelson & Stern, 1981; Hoge & Coladarci, 1989; Demaray & Elliot, 1998). When expectancy confirmation occurs because of the accuracy of the teacher's expectations, it demonstrates the level of the teacher's expertise and ability to evaluate her students based on evidence such as grades, test scores, ongoing formative assessments, and knowledge

of her students (Jussim, 1986; Jussim et al., 1998). Called *impression accuracy,* it describes the extent to which teachers' expectations parallel the students' actual characteristics or achievement (Jussim, 1986; Jussim et al., 1998). In this case, the accuracy of a teacher's expectation is derived from the teacher's strength of knowing her students (Jussim, 1986).

Accuracy of a teacher's expectation also signifies a reasonable alternate explanation to a self-fulfilling prophecy or bias as evidence that students actually confirm teacher's expectations. Jussim (1986) described *predictive accuracy* as the extent to which the teachers' expectations predict but do not cause student achievement. The accuracy and thereby validity of teachers' expectations of students' academic achievement is extremely important because of the vast number of decisions teachers make daily about their students based on their academic performance (Demaray & Elliot, 1998).

Expectancy confirmation also involves perceptual biases and a teacher's awareness of them determines their accuracy. When a teacher's expectations lead to perceptual biases, this means the teacher has interpreted, remembered, and/or explained student achievement and behavior in ways consistent with her expectations; therefore, perceptual biases imply that teacher expectations created a certain reality, similar to the process of self-fulfilling prophecy (Jussim et al., 1998). This subjective reality influences teacher evaluations of student achievement; another important reason accuracy plays an important role when analyzing teacher expectations.

Given the important implications of teacher judgment, the question of their accuracy is critical. "Accurate assessment of students' performance is a necessary

condition for teachers to be able to adapt their instructional practices, to make fair placement decisions, and to support the development of an appropriate academic self-concept" (Sudkämp et al., 2012, p. 744). Teachers that can accurately assess their students' thinking, learning styles, strengths and weaknesses have an overall stronger knowledge of their students, which in turn improves the teacher's instruction and student learning (Carpenter et al., 1988).

This marks a turning point in this study because it is under this theoretical framework of expectancy confirmation and accuracy that this study shifts from using expectancy or prediction accuracy to judgment accuracy. Recognizing the overarching framework of teacher expectations, this study conceives of teacher judgment as a cross-sectional approach and look into expectations. Conceptually when teachers predict their students learning and performance, they are making a judgment of student learning and therefore the accuracy of this task is a determining factor.

Summary of the Inclusive Model of Expectancy Mediation

In summary, the first phase of expectation research focused on *demonstrating* the existence of the teacher expectancy effect through a process-product model: the process of teaching based on expectations, leading to the product of student achievement (Figure 1). Good and Brophy's (1970) *teacher-child dyadic interactions* model extended the initial research on expectation, by providing a coding system of six steps outlining how the expectancy mediation process might work in a classroom (Figure 2). Researchers then extended this model of the expectancy mediation process by using a more inclusive model to analyze the behavioral mechanisms involved when teachers' actions (passive and active) communicate expectancy effects (Figure 3). These "observable outcomes" of

teacher behavior became an important variable in the teacher expectation research, because they were now seen as mediators of self-fulfilling prophecies. In addition to students' test scores still quantified to measure teacher expectancy effects, teachers' instructional practices and interactions with students in the classroom were now measured. The accuracy of expectations also played an important role in the expectancy mediation process because the research now called the basis of teachers' expectations into question to reflect this important issue of accuracy.

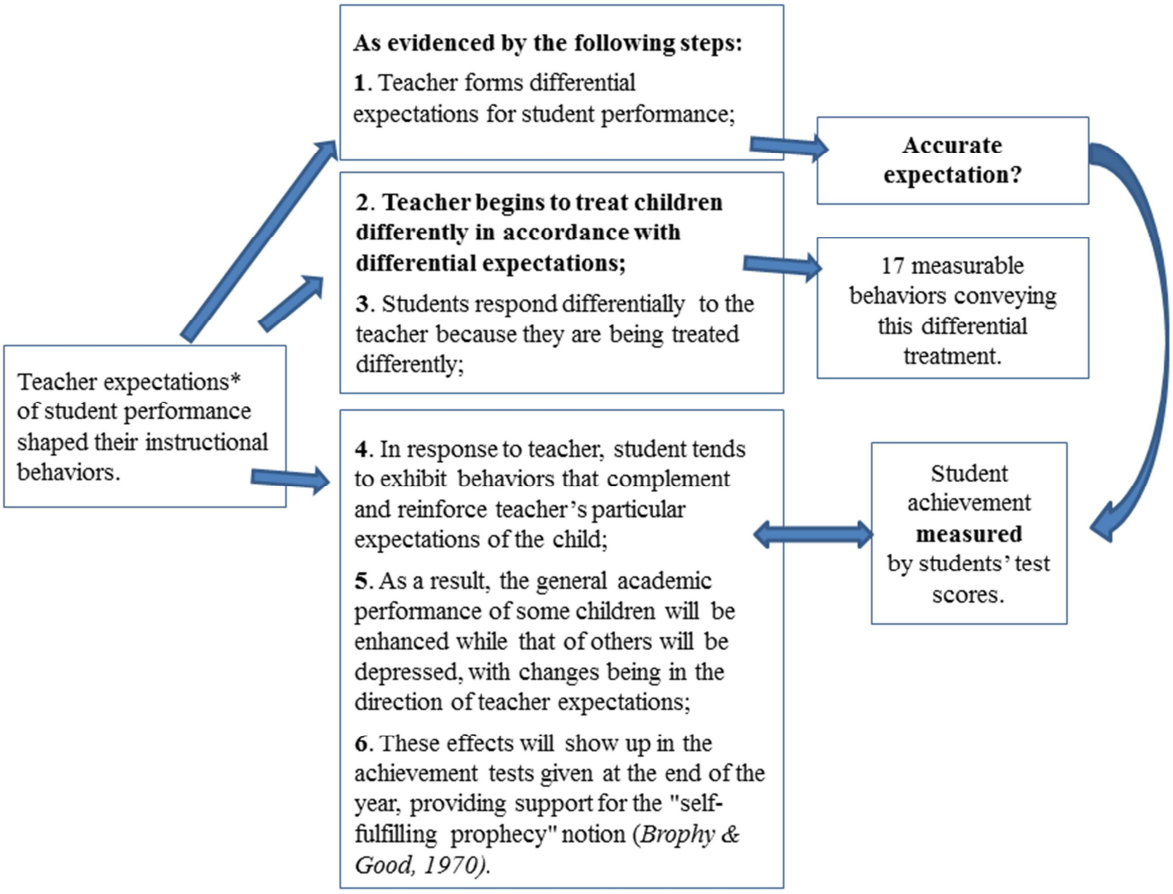

Figure 5. Graphic representation of Phase 3: An Inclusive Model for Expectancy Mediation.

*In this research model, **teacher expectations** were defined as teacher perceptions about students' performance and aptitude. But this model now included the deliberate examination of the six steps of the teacher-child dyadic interactions process. Variables like the teacher's formation of differential expectations, and teacher's differential behavior towards students were now measured. These "observable outcomes" of teacher behavior functioned as communicators of self-fulfilling prophecy. Students' test scores were still used to further measure teacher expectancy effects of the expectancy mediation process.

Teacher Expectation Research - Phase Four

Along with the growing consensus that teacher expectations can and usually do influence teacher-student interactions as well as student outcome, there was growing recognition that the expectancy effects process itself was much more complicated than originally assumed (Brophy, 1983; Cooper & Good, 1983; Dusek, 1975; Jussim, 1986). The need for a new paradigm sprang from the need to make sense of the mystifying variability in both the findings on expectancy effects and on the mediating mechanisms, especially considering their inconsistencies from classroom to classroom, from grade level to grade level.

Overview of the Era of Sociocognitive Constructs

No longer could teacher expectations and teacher behavior be explained by aggregate empirical findings. A socio-cognitive theoretical approach was needed to better explain the social, emotional, psychological, intellectual terrain of education, and the complexities involved with all of these interactions. The research now needed to address teacher beliefs and mindsets, how teachers cognitively formed expectations, how students interpreted and responded to these expectations, and what mix of interactions led to certain expectancy effects.

Experiential aspects of the classroom such as socioemotional environments as well as instructional environments now factored into the mechanisms for teacher

expectancy effects (Cooper, 1979; Harris & Rosenthal, 1985; Dweck, 1975; Rattan, Good, & Dweck, 2012; Rubie-Davies, 2007, 2014). Brophy and Good (1970, 1974) set the stage for such work when they described the correlation between how teacher expectations can affect student achievement both directly (teachers expose lower expectancy students with less curricular material and content) and indirectly (students' level of aspiration and motivation drop). But the addition of Sociocognitive theoretical underpinnings gave more legitimacy to teachers' beliefs and to students' awareness of expectancy cues and effects. The elusive nature of teacher expectations needed this Sociocognitive theoretical support to demystify its complexity.

Teacher Expectations Defined, Conceptualized, and Theorized

Similarly progressive, in his introduction of *Advances in Research on Teaching: Expectations in the Classroom*, Brophy (1998) gave teacher expectations new parameters to include the importance of time spent with students. He redefined teacher expectations to include the value of teacher's experiences with students, by stating, "(t)eacher expectations are inferences that teachers make about present and future academic achievement and general classroom behavior of students" (p. ix). In this new era of research on teacher expectation, a more diagnostic approach was taken to where differentiated expectations were now the appropriate and possibly beneficial approach to meet individual students. Teachers formed differentiated expectations as the appropriate way to meet individual student's academic needs, goals, and ideal learning activities (Brophy, 1998).

Most of the research findings on expectancy effects during the 1970s concluded that all differential behaviors were negative and dangerous due to the overriding goal of

education at that time to have equal treatment for all students (Babad, 1998). As research improved and instructional approaches aimed more towards teaching in heterogeneous classrooms, the climate shifted towards differential behavior as recognized for its ability to "promote educational equity, where some corrective differentiality is legitimate and even desirable" (Babad, 1998, p. 185). Teacher expectations seemed to almost be subsumed and redefined within the construct of *effective teaching*, a shift still taking place today. Similarly, mixed methodology was more widely used and accepted, to bring to light the subtleties and intricacies of teacher expectations and how they play out in the classrooms.

In this new era of research on the teacher expectation phenomena, no longer was it defined and conceptualized as self-fulfilling prophecy effects of teacher expectations, as measured and manifested through student achievement. These social cognitive variables entered the research realm to address some of the layers of complexity involved in the formation, the functioning, and the effects of teacher expectations.

Implicit Theories

No longer were teacher expectations a definable construct in isolation. Instead this era of research, and arguably today's, saw a reconfiguration of teacher expectations through the specific differentiation and theorization of social-cognitive variables, like student motivation and effort (Dweck, 1986, 1991; Dweck & Elliott, 1983; Wigfield & Eccles, 2000), teacher efficacy and student self-efficacy (Bandura, 1977, 2001), and the multitude of educational beliefs and perceptions about learning and instruction (Pajares, 1992). Specifically relevant to this study, the variable of teachers' mindset (see Dweck's extensive body of research in the References) was included in the expectation research

because it was obvious that teachers' beliefs impact their instruction and student outcome.

Dweck (2006) scholarship most relevant to this study focuses on people's beliefs that "include their mental representations of the nature and workings of the self, of their relationships, and of their world" (2008, p. 391). These *basic beliefs* about human nature that people use to understand their world and to guide their behaviors play an important role in how well people function (Dweck, 2013). More specifically, implicit theories pertain to the individual's basic belief that fundamental personal attributes, such as intelligence, are believed to be either malleable or fixed. Dweck's implicit theories describe those with an *entity theory* (a fixed mindset) and those with an *incremental theory* (a growth mindset). These mindsets have "profound consequences on how people function, how they relate to others, and what they achieve" (Dweck, 2013, p. 43).

Components of Implicit Theories

Based on Dweck and colleagues' four decades of scholarship (see References), the implicit theories apply a cognition, affect, and behavior model to demonstrate these components and their resulting patterns (Dweck, 1975, 1986, 1991, 2006, 2008, 2013, 2015; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Dweck et al., 1995; Hong et al., 1999). This social-cognitive approach begins with the cognitive component of holding either a fixed or growth mindset—ones self-conception that believes fundamental personal attributes, such as intelligence, are either fixed or malleable, respectively. Rippling out from here, the behavioral component is the resulting pattern of response due to ones self-conception of a fixed or growth mindset. Ones behavior shows patterns of maladaptive and helpless responses due to having a fixed

mindset; or ones behavior shows patterns of adaptive, mastery-oriented responses due to having a growth mindset. The ripple effect continues with the affective component. Embracing challenges, finding opportunity in the face of setbacks, and establishing learning goals characterize those with a growth mindset. While the avoidance of challenges, defensiveness in the face of setbacks because of a fear of appearing ignorant, and the pursuit of performance goals characterize a person with a fixed mindset.

Cognition component: mindset. A teacher's mindset is her/his basic belief about human attributes, including intelligence and abilities (Dweck, 1975, 1986, 1991, 2006, 2008, 2013, 2015; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988). It makes a significant difference to a teacher's instructional practice and student achievement if a teacher believes intelligence and core attributes are built-in, fixed by nature, and therefore there is not much the teacher can do about it. This is called the *entity theory* showing a *fixed* mindset (Dweck, 1975, 1986, 1991, 2006, 2008, 2013; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Elliott & Dweck, 1988). Teachers with a fixed mindset believe a student's intelligence, intellectual capacities, and abilities came pre-loaded and are static. Some students are smart, and some are not. Therefore, the students are responsible for their learning (and intelligence), and if they do not have what it takes, so be it. Teachers with more of a fixed mindset believe they have little to no influence on students' basic intelligence (Dweck, 2006, 2010a, 2012).

On the other hand, it makes a significant difference to a teacher's instructional practice and to student achievement if the teacher believes intelligence can be developed and nurtured. This is called the *incremental theory* showing a *growth* mindset (Dweck, 1975, 1986, 1991, 2006, 2008, 2013; Dweck & Elliott, 1983; Dweck & Leggett, 1988;

Elliott & Dweck, 1988). Teachers with a growth mindset do not unrealistically perceive all students as the same, or expect them to be the next Einstein (Dweck, 2010b); but they do fundamentally believe students' intellectual capacity and abilities can grow with persistent effort, continued learning, positive mentoring, and good learning strategies. A growth mindset itself can actually be adopted and nurtured—a cognitive change especially valuable for students under negative stereotypes about their abilities, such as Black and Latino students, or girls in math or science classes (Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003; Aronson, Fried, & Good, 2002).

Affect component. Teachers' mindsets then drives the goals they pursue. These goals "create the framework within which they interpret and react to events" (Dweck & Leggett, 1988, p. 256). With intellectual achievement still as the backdrop, these goals are classified as either *performance* goals or *learning* goals, depending on ones mindset shaping such goals and cultivating different behavioral response patterns described next. A fixed mindset aligns with performance goals because a fixed mindset is concerned with appearing intelligent and capable, ultimately begetting the pursuit of performance goals that validate intelligence and abilities (Dweck & Leggett, 1988). Since the fixed mindset does not believe he or she can improve ones intelligence or competence due to its static nature, performance goals offer a chance to demonstrate such fixed attributes. Ultimately, this puts all the oneness on the performance goal (such as a test or final exam) rather than on the person, leading to defensiveness and a fear of failure, and maladaptive behavior patterns described below.

Conversely, a growth mindset aligns with learning goals because a growth mindset is concerned with and motivated by improving intelligence and competence,

ultimately begetting the pursuit of learning goals to grow ones intelligence and abilities. Centering on the fundamental belief that intelligence and similar fundamental attributes are malleable entities, this pursuit of learning goals creates the framework within which growth mindsets interpret challenges and failures as welcomed opportunities for growth, and the framework to maintain an adaptive reaction to events, as discussed below.

Behavior component. Teachers' mindsets shape the goals they pursue, which in turn shape their behavior. Dweck's scholarship revealed that a fixed mindset aligns with *maladaptive, helpless* response behavior patterns, and a growth mindset aligns with *adaptive, mastery-oriented* response behavior patterns. People having a fixed mindset want to avoid appearing ignorant or incapable, therefore they avoid challenges. By setting performance goals, they defensively blame failure on personal inadequacies over which they have no control, therefore casting a pessimistic outlook on future success. Ironically, this framework within which fixed mindsets interpret challenges and failures makes them vulnerable to failure and/or self-sabotage because of their pursuit of performance goals as a way to validate their intelligence, as detailed above. The clear connection with helpless patterns of behavior are strengthen because fixed mindset people generally perceive difficulties as indicative of low ability over which they have little to no control. Therefore, effort is futile, and in fact, a recognition of incompetence and inadequate intelligence.

A growth mindset, however, embraces challenges and mistakes as opportunities for improvement and deeper learning. Failure is optimistically perceived as the mistaken application of ineffective problem-solving strategies, rather than innate intelligence, and therefore a burgeoning new opportunity for further learning ensues. Failure is a chance

for intellectual redemption because it is viewed as an opportunity for mastery through effort and self-instruction. Hence, within the framework of pursuing learning goals, growth mindsets constructively interpret challenges and respond to events with adaptive, mastery-oriented behaviors because of their drive for improvement. Failures or difficulties are seen as indicative of ones adaptive ability to apply solution-oriented strategies, of which effort plays an essential part and is thereby encouraged.

Teachers' implicit theories and the influence they have on the cognition-affect-behavior components are the focus of this study, especially with reference to possible influence implicit theories may have on the cues teachers use to judge student learning. Yet these cognition-affect-behavior patterns discussed here equally and appropriately apply to students. Transpose the word *teacher* for *student*, and the influential relationships become very clear as one understands how self-conception affects conception of other's intelligence (i.e., teachers' mindset affecting how a teacher perceives student's intelligence). Similarly, it becomes clear that a teacher's implicit theory can directly and indirectly shape students' implicit theories of intelligence. Students' are aware of how their teacher views (their) intelligence, and this detectable and influential awareness shapes many academic outcomes.

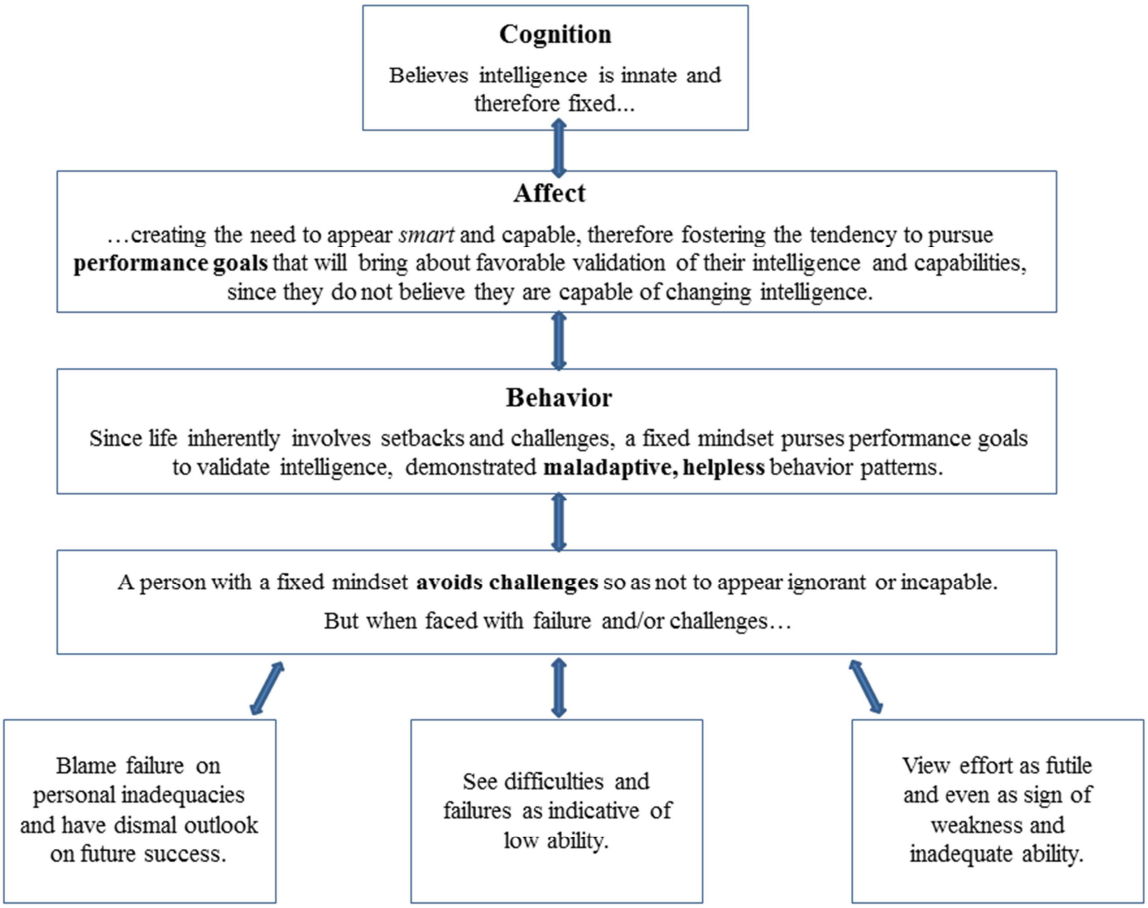

Figure 6. Graphic depicting the Social-Cognitive Model and Processes of a Fixed Mindset (Dweck, 1975, 1986, 1991, 2006, 2008, 2013; Dweck & Leggett, 1988; Dweck & Elliott, 1983; Elliott & Dweck, 1988).

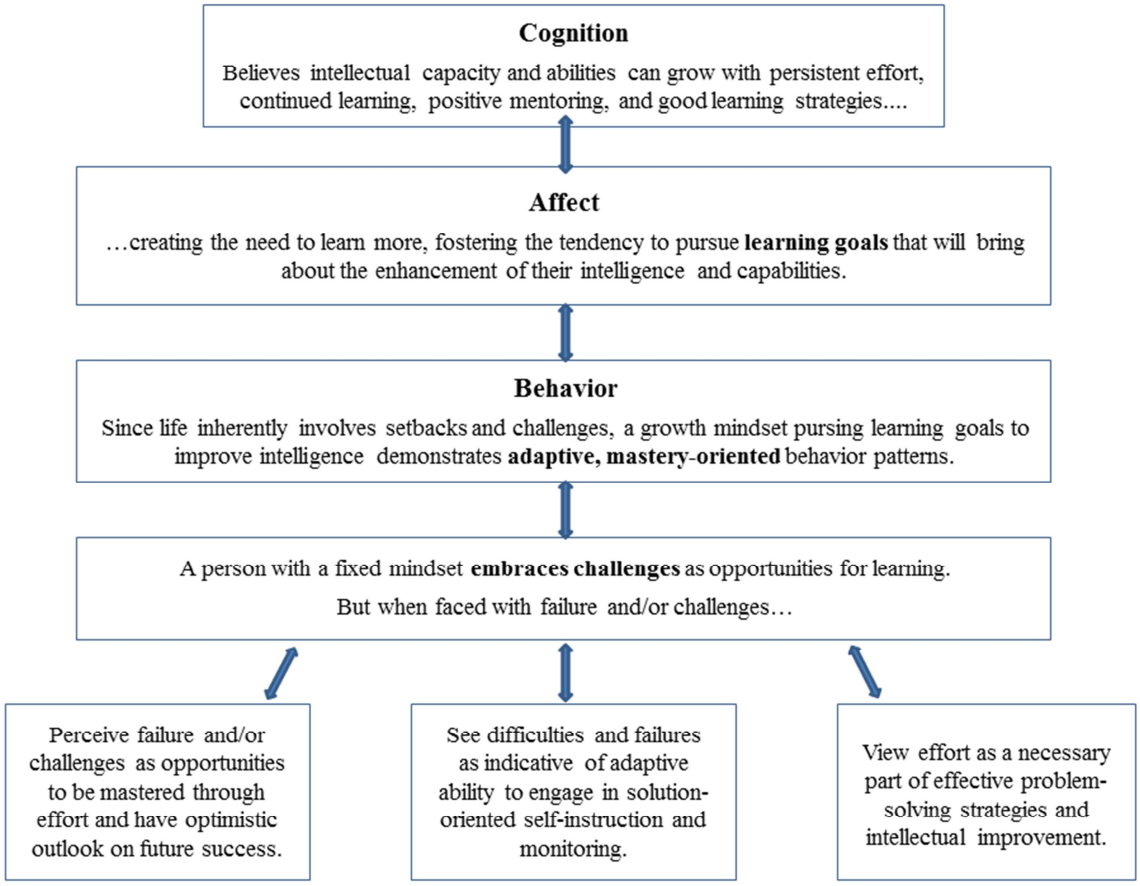

Figure 7. Graphic depicting the Social-Cognitive Model and Processes of a Growth Mindset (Dweck, 1975, 1986, 1991, 2006, 2008, 2013; Dweck & Leggett, 1988; Dweck & Elliott, 1983; Elliott & Dweck, 1988).

Student Awareness of Teacher Behavior

Student perception of teachers' differential treatment plays a critical role in theorizing about the mediation of teacher expectancy effects (Brattesani, Weinstein, & Marshall, 1984; Babad, 1998; Babad, Avni-Babad, & Rosenthal, 2003; Babad & Taylor, 1992; Rattan et al., 2012). Recognizing and validating the students' awareness of their teachers' differential treatment was finally brought to the research table as a viable part of the teacher expectancy equation. Extending beyond the obvious effects on student achievement that teacher's differential treatment has (due to impoverished learning opportunities and minimal content covered for students expected to perform lower, and

the opposite situation for those students expected to perform higher), such differential treatment can also directly and indirectly impact student self-image and motivation (Braun, 1976; Brophy & Good, 1974; Cooper, 1979; Good, 1987; Bandura, 1977; Rattan et al., 2012).

What students do with this direct and/or indirect influence weighs in on the extent to which expectancy effects take place. A student could prevent the teachers' expectations from becoming self-fulfilling by counteracting their effects or changing in a way that forces the teacher to change her expectations (Good, 1987). Students' even have their own self-conceptualization of intelligence, where some believe their intelligence is fixed, while other students believe their intelligence is malleable (Dweck, 1986, 2006). For those students with the fixed conception of intelligence, they have lower motivation to learn and persist in face of cognitive challenges, when teachers erode their confidence. On the contrary, according to Dweck's scholarship, students who believe their intelligence is malleable and who believe that persistence fosters learning in face of cognitive challenges, have more motivation to learn and seek challenges in face of teacher expectations.

Yet what cannot be ignored is that today's teachers perpetuate a modern-day self-fulfilling prophecy because of his/her mindset, regardless of the students' mindsets. Today's version of the 1970s expectancy mediation theory occurs when teachers who identify with the entity theory of intelligence and have a fixed mindset more willingly judge and label students as having low ability, as opposed to those teachers identifying with the incremental theory of intelligence and having a growth mindset (Dweck, 1991; Rattan et al., 2012). A teacher's pedagogical practice has been shown to reflect and

convey that teacher's fixed mindset (as opposed to a growth), resulting in the communication of that teacher's low expectations to students, and thereby locking students with "stable low ability" into long-term low achievement (Rattan et al., 2012, p. 732). High and low-expectation students perceive a teacher's differential evaluation of their work, influencing students' academic outcomes (Cooper, 1979). The causal effects do not stop there. Students adopt their teacher's entity (or incremental theory) of intelligence, resulting in their own fixed (or growth) mindset of their own intelligence, causing students to lower (or raise) their own expectations, motivation, and investment in future learning. This sets the stage for the perpetuation of a self-fulfilling prophecy, either as a vicious cycle of deficit thinking, or a positive feedback loop.

An issue still relevant today, some researchers believe that a teacher's *sustaining* expectation effects could cause indirect or indirect damage on students (Cooper & Good, 1983). In this scenario, teachers expect students to maintain already-established behavior patterns, to where the teacher simply assumes these behaviors as normal and fails to acknowledge and build upon changes in the student's potential (Good, 1987). Such passive and subtle expectations are equally as damaging or promoting as self-fulfilling expectation effects.

What teachers often assume as their subtle behavior, their students immediately perceive as obvious differential expectations. Studies have documented student's perception and understanding of teacher expectations from just a short glimpse of teacher behavior (Babad & Taylor, 1992; Babad et al., 2003). Babad and Taylor (1992) first claimed that teachers, in fact, did not believe their expectations were being expressed. But when three groups of students watched short videos of teachers talking to and about

certain students, all three groups were able to detect the teacher's fondness for the student as well as the student's high expectancy-status, based on the teacher's body language or verbal comments. Students are very aware of their teachers' differential behavior, even subtly communicated through the teachers' nonverbal behavior (Babad et al., 2003). The amount of time students spend in their classroom make them a litmus test for expectancy effects for detecting teachers' biases and differential behavior. Cumulative exposure to teachers' expectations makes students a critical link in the mediation of expectations, a position not to be ignored (Babad & Taylor, 1992; Babad et al., 2003).

Is Pygmalion *Still* in the Classroom Today**?**

If students perceived as higher achieving students receive more constructive feedback and opportunities to learn, how could this have anything but positive impacts on their learning? Naturally, the same is true in the opposite direction where students perceived as low achieving will not learn as much if given fewer opportunities and support. Doesn't it make more sense to give just as much if not more constructive feedback and learning opportunities to those students expected to perform lower?

The differential treatment of a student (or class for that matter) based on teacher expectations can indirectly influence learning by affecting the social-emotional climate and culture and the students' *self-perceptions* (Rubie-Davies, 2007, 2014). A student's sense of confidence, self-worth, self-efficacy (Bandura, 1977, 2001), and personal beliefs about his abilities are impacted by a teacher's differential behavior. Interestingly, if students who are more performance goal oriented have a low assessment of their abilities, they will choose easier tasks to ensure their success and to appear more intelligent; conversely, if students who are more learning goal oriented have a low assessment of

their abilities, they will seek out challenging tasks to acquire skills and knowledge regardless of appearing ignorant (Bandura & Dweck, 1985, as cited by Dweck, 1986).

Teachers vary quite a bit in the *degree* to which they treat low- and high-expectancy students differently, and also in the *nature* of their differential treatment (Babad, 1993; Weinstein, 2002). While some teachers pay more attention to high-expectancy students, others partake in "compensatory" behaviors, focusing more on low-expectancy students (Babad, 1993). No matter the degree or nature of the differentiation, when teachers alter their instructional practice to align with their expectations, students of all achievement levels feel the effects both directly and indirectly, and either positively or negatively depending on the directionality of the expectations (Babad, 1993).

The evidence is compelling that teachers and students are both active players in the expectancy effects process. The combination of individual differences among the teachers and students themselves foster situations and conditions that can either intensify or diminish expectancy these effects. The mediation of classroom self-fulfilling prophecies expectancy effects occur through differential teacher treatment, and across multiple studies cited here teachers have been shown to provide more learning opportunities and more challenging content to those students for whom the teachers held high expectations.

Evidence of the contrary situations was clear for students for whom teachers had low expectations. More than likely, these differences in treatment, academic opportunities, and classroom climate are teacher-driven effects rather than the result of differences in how students interact (Weinstein, 2002). Therefore, research suggests that it is not simply the teacher's beliefs about student ability, but their actions that follow

based on these beliefs that cause self-fulfilling expectancy effects. Therefore, the variable of teacher mindset should be included in the analysis. As demonstrated by Dweck and colleagues' scholarship, it matters greatly if a teacher believes intelligence is fixed by nature—an entity or fixed mindset, or if the teacher believes intelligence can be developed and nurtured through persistent efforts—an incremental theory or growth mindset. Dweck's research on growth and fixed mindsets could have very educationally relevant implications for teacher expectations.

It cannot be stated enough, however, that across all of the studies on teacher expectancy effects, not all teachers demonstrated differential behavior to the same degree, while not all differential behaviors proved significant either. Yet as a collective body of research, even if the self-fulfilling prophecy effects attributable to student achievement are small, perhaps a 5-10% difference per student in raw scores on achievement tests (Brophy, 1983), this percentage difference grows each year students are in school. This accumulated difference adds up to a large effect size on students' achievement, student motivation, and students' desire to stay in school—variables not to be ignored. In the quest for aggregate findings across studies of expectancy effects, the obsession with isolating specific teacher behaviors eclipsed the studies (and the greater need for more studies) on the culture of the classroom, as identified by anthropological and longitudinal approach like Rist (1970). In its press for empirical data, more quantitative methods have been preferred to explore expectancy effects, with an emphasis on brief time periods and using cross-sectional studies, whereas longitudinal studies could capture the interactive nature of expectancy effects as well as any cumulative, long-term effects.

A similar eclipse happened with the ignoring of political scientists and sociologist who pressed for research into how institutions allocate curriculum and educational opportunities (Rist, 1970; Weinstein, 2002). Not withstanding, this arena may actually hold much insight into the origins or mechanisms that foster or mitigate expectancy effects. The ripple effects of low expectations and how students internalize them become interwoven in the hidden curriculum and perpetuate deficit-model language and messaging of education, assessment, and organization of schools.

Summary of the Era of Socio-Cognitive Constructs

In this socio-cognitive research model, teacher expectations were defined as "inferences that teachers make about present and future academic achievement and general classroom behavior of students" (Brophy, 1998, p. ix). But this socio-cognitive model now includes the possible constructs explaining teacher expectations and the possible reasons behind these "inferences" (Figure 4). Students' test scores were still used to measure teacher expectancy effects to some degree. But more qualitative and mixed-methods research focused on these expectation constructs, rather then empirical data of student test scores. Effects on student motivation, students' beliefs in self-efficacy and self-worth, and teachers' beliefs in their efficacy to improve student learning, were the focus of measurement regarded as more important than student test scores. This era of research continues today, and its educational relevance continues to interpret the once elusive entity of teacher expectations.

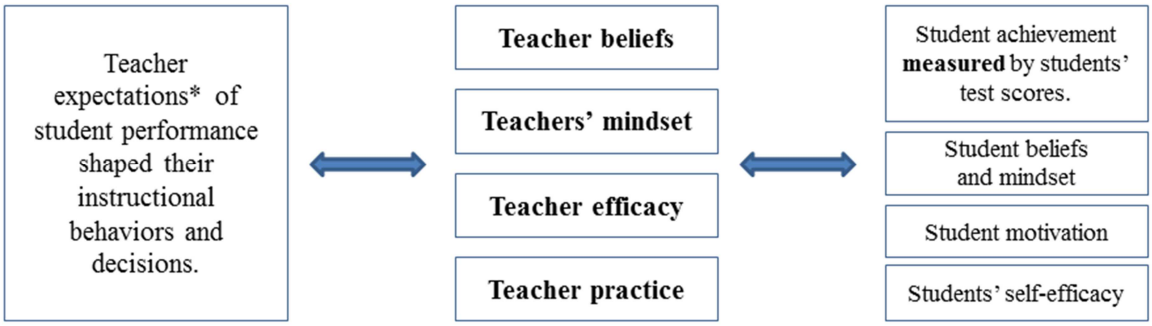

Figure 8. Graphic representation of Phase 4: Socio-cognitive theory and model.

*In this research model, **teacher expectations** were defined as "inferences that teachers make about present and future academic achievement and general classroom behavior of students" (Brophy, 1998, p. ix). But this socio-cognitive model now includes the possible constructs explaining teacher expectations and the possible reasons behind these "inferences."

Students' test scores were still used to further measure teacher expectancy effects of the expectancy mediation process. But more qualitative and mixed-methods research focused on these constructs, rather then empirical data of student test scores.

Teacher Expectation Research - Phase Five

Teacher expectation as a construct itself was deemphasized in more recent research and literature because it became embedded as constructs of education reform and efforts to bring equitable education to all students. Still recognizable in its process-product model, the teacher expectation phenomenon today is packaged in the discourse of and fixation on research-based, best practice, and most effective instructional practices (the process) that lead to high student achievement for all (the product).

Teacher Expectations as Reform

Currently, huge efforts are made to raise the quality of America's educational status and students' performance on international assessments of academic achievement (Brophy, 1998; Weinstein, 2002; Rubie-Davies, 2014). The adoption by of the Common Core State Standards (CCSS) demonstrates this modern packaging of teacher

expectations, now defined by the curricular scope and sequencing of content that students at each grade level are expected to know.

Current research has reframed the teacher expectation construct within the *effective teaching* arena to show that certain teaching strategies and styles have been found to be effective in raising student achievement scores (Weinstein, 2002; Rubie-Davies, 2007, 2009, 2014; Rubie-Davies et al., 2015). Yet these effective instructional strategies and styles, though targeted for the whole-class context, cannot be effective without taking the individual student's needs and abilities into account. Therefore, the level of expectations becomes a messy construct (Pajares, 1992). Especially considering the increasingly diverse population of students in today's classrooms, the importance of accurate expectations is all the more necessary.

Professional Development Policy

Now more than ever teachers need even more support through effective professional development that is written into their contract and part of their professional agendas through education reform efforts. They should be provided with effective professional development that helps them to strengthen teacher/student relations and interactions, and to build community. Teachers would benefit immensely from effective professional development that helps them to be critically aware of their biases, assumptions, and perceptions that could lead to differential and erroneous expectations of students and their abilities.

Perhaps the unprecedented CCSS will necessitate the professional development that is so desperately needed to embed a teacher's practice of expectations into the standards, curriculum, content, pedagogy, and instructional practice. Perhaps with these

new standards comes the avenue to establish equitable and reflective practice of expectations, where the "achievement gap" is no longer a self-fulfilling prophecy. Now is the time to emphasize the need for high expectations paired with the high standards. Because negative teacher expectations account for 5-10% variance in student achievement and are shown to contribute to achievement gaps between white and minority students (Education Commission of the States, 2013), isn't it time to reverse this correlation so we see high, realistic, and accurate expectations erasing the achievement gap? Is this not the same 5-10% difference in students' raw scores on achievement tests that Brophy estimated back in 1983, that self-fulfilling prophecy affects student achievement? Thirty-one years later, this percentage difference continues to grow each year students are in school.

One particular research-based professional development, Teacher Expectations Student Achievement (TESA), gained popularity in the 1980s when it was first piloted in Los Angeles County (Kerman, Kimball, & Martin, 1980). This teacher-training program was originally called "Equal Opportunity in the Classroom," and was funded by an Elementary-Secondary Education Act (ESEA) Title III grant (Gottfredson, Marciniak, Birdseye, & Gottfredson, 1995). TESA focused on establishing and sustaining high expectations for all students through 15 interactions that research touted as *effective teaching practices* used with students perceived as high achievers rather than with perceived low achievers (Kerman et al., 1980). These specific 15 interactions were believed to improve the "strands" of teaching behavior: questioning, feedback, and student self-esteem (Kerman et al., 1980). Training, group discussion, and reflection on

the effectiveness of each *strand*, peer observation, and peer feedback were part of the program.

In theory, by understanding and tracking the nature and quality of their interactions with students, teachers can change their behavior to establish and convey high, realistic, and accurate expectations for all students. Yet since its inception in 1980, only one educational research study has actually evaluated TESA's impact on student achievement. Gottfredson et al. (1995) revealed no significant changes in student achievement following the TESA program, and concluded that their "study provides little support for a positive effect of the TESA program" (p. 162). Interestingly enough, however, the Education Commission of the States (2013), "Teacher Expectations of Students" report, urged education leaders and policymakers to implement TESA as part of reform initiatives.

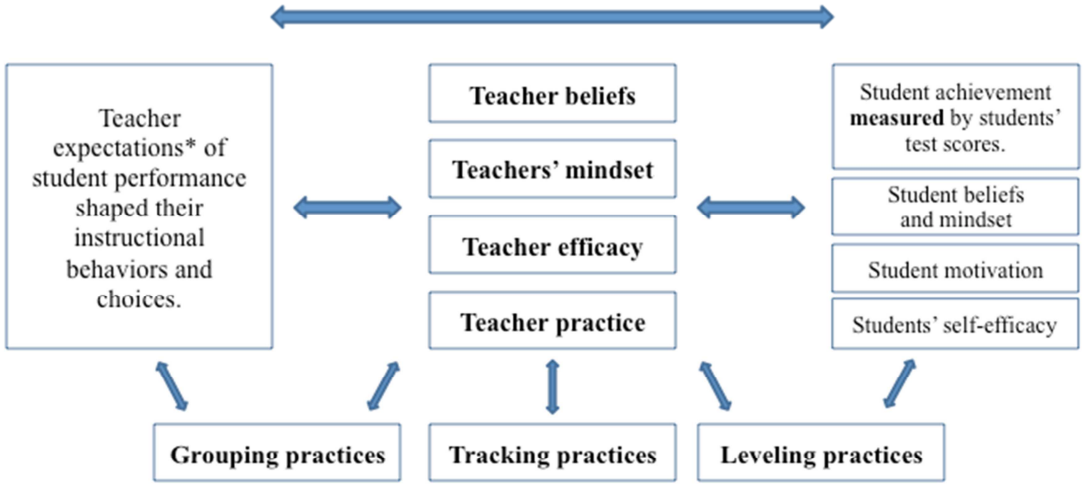

Figure 9. Graphic representation of Phase 5: Education reform and effective instruction.

Conclusion

Throughout the past five decades, teacher expectation research went through many transformations, and continues to evolve even today. Research began as a linear analysis to quantify teacher expectancy effects on student achievement. The existence of teacher expectations, especially in the form of the self-fulfilling prophecy, drove much of the initial research. This framework was then extended into the analysis of the behaviors that teachers exhibited, covertly and overtly, then conveyed their differential expectations and thereby treatment of students. The accuracy of teacher expectations was called into question, and soon the socio-cognitive framework redefined and cross-sectioned teacher expectations because it was too complex and complicated to be examined as a construct in isolation. Teacher factors, student factors, beliefs, mindsets, motivation theories, efficacy theory, and other layers of teacher expectations rose to the surface to help expose the multitude of constructs. This evolution continues today, as teacher expectations now fall into effective teaching discourse and practices.

Yet despite the federal push for "high quality" teachers, the culture of education has not fully embraced the concurrent need for teachers with "high quality" expectations for their students. The findings have not made their way into the classroom to the full extent that they should. As a result, pre-service teachers need to learn and cultivate a *practice of expectations* purposefully, deliberately, and consciously. What needs to happen is this – "there needs to be a new expectancy created. The new expectancy may be that children can learn more than had been believed possible… The new expectancy, at the very least, will make it more difficult when they encounter the educationally

disadvantaged for teachers to think, 'Well, after all, what can you expect?'" (Rosenthal & Jacobson, 1968, p. 182).

As a culture, we need to demand rigorous teacher preparation that includes the development and refinement of a practice of high and equitable expectations, so that we can expect more out of our teachers and they can do the same for their students. Teachers also need to have high expectations of themselves and other teachers. Then, once in the classroom, a teacher's expectations can positively influence students' academic achievement as well as their social-emotional experiences and their feeling of self-worth and value as a member of the class.

Teacher expectations hold power. When unfounded and invalid, they can be discouraging and divisive. When accurately high, teacher expectations can be encouraging and promotional. When accurately low, a teacher can use her expectations as a tool for fostering growth and establishing higher expectations (Brophy & Good, 1974; Babad, 1993). A teacher's deliberate *practice of expectations* could help transform the achievement gap into achievement growth. It could possibly put a stop to teacher comments such as "My students can't learn math like this. They are Title One."

CHAPTER 3: STUDY 1 METHOD

The data in this study were collected during the second year (2013-2014) of a three-year project funded by the U.S. Department of Education's Institute of Education Science. The Improving Teachers Monitoring of Learning (ITML) project designed and evaluated a program of professional development to improve teachers' skills in monitoring student learning, mathematics instruction, and formative assessment.

A key outcome variable for the project was teachers' judgment accuracy. Each participating teacher predicted their students' performance on two tests of mathematics: one of skill and one of conceptual understanding. The students then completed the two tests. Teachers' judgment accuracy was operationalized as the intra-individual correlation between a teacher's predicted student performance on a test of mathematics and actual student performance on the test (for results of the first year of the project, see Thiede et al., 2015). As a result, each teacher had an accuracy measure for mathematical skill and conceptual understanding.

As part of the project, a wide range of data on teacher characteristics were also collected, including measures of growth and fixed mindset. The purpose of Study 1 was to examine the relation between teachers' judgment accuracy and their mindset.

Setting

Data for Study 1 was collected from 109 teachers at nine different public elementary schools (Kindergarten – 5th grade). These schools had a diverse population of

students, and were in a suburban school district in the Mountain West region of the United States.

These nine schools in Study 1 had participated in the ITML program during the 2013/2014 school year. The ITML program worked with numerous schools—two schools participated in the formative assessment professional development, three schools participated in Developing Mathematical Thinking (DMT) professional development, two schools participated in both formative assessment and DMT professional development, and two schools served as the controls and did not participate in any professional development.

Participants

One hundred nine Kindergarten - 5th grade teachers participated in Study 1. Of the 109 participating teachers, 13 had missing data on judgment accuracy and 9 had missing data on mindset. There were a total of 90 participating teachers with complete data. These teachers were largely Caucasian (97%, 87 of 90), and female (90%, 81 of 90). They had anywhere between 1 and 39 years of teaching experience, the mean years of experiences was 13.7 (Standard Deviation = 7.8). Twenty-nine percent of the teachers had earned advanced degrees. The participants were teachers who had volunteered for the ITML professional development mentioned above.

The above demographics were included to better isolate important teacher characteristics (gender, years experience, education level) for their potential impact on teacher expectations of student performance. Recognized as a limitation, this study utilized convenience sampling. Therefore, the demographics above were also included to better ensure that this sample had adequate representation, and to reduce the effects of

extreme scores and any extraneous factors potentially inherent within convenience sampling. These measures were taken to potentially offset any threats to validity and reliability caused by convenience sampling.

Research Design and Approach

The purpose of Study 1 was to examine the relationship between a teacher's judgment accuracy (her ability to accurately predict students' academic performance on a mathematics skills and concepts assessment) and mindset (growth and fixed). Therefore, this study used a correlational analysis to examine the relation among these measures.

First, this study computed teachers' judgment accuracy (operationalized by computing the intra-individual correlation between students' predicted score and their actual performance on the tests of mathematical skills and concepts). Then, a bivariate correlation was computed to examine the relation between teachers' judgment accuracy and their mindsets.

The rationale for using a correlational research design (as opposed to a generic T test, or even partial regression, which describes the relationship between two variables while controlling for the effects of one or more variables) is it provides a measure of the *relationship* between two variables—teachers' judgment accuracy and mindset (Gravetter & Wallnau, 2013). Moreover, it measures the *direction* of the relationship (either positive or negative), the *form* of the relationship (linear/straight-line form), and the *strength/consistency* of the relationship (a perfect correlation with perfect consistency, a 1 or -1, to a 0, showing no correlation at all) (Gravetter & Wallnau, 2013). This design was also chosen as a good fit because with a correlation two scores (variables) for each

individual are required. Applied to this study, each individual teacher had a mindset score—growth or fixed—and each individual teacher had a judgment accuracy score.

Furthermore, the use of a bivariate correlation was conducive to exploring the existence of a correlation by observing what goes on in the classroom more naturally and without direct interference, as compared to an experimental design that manipulates one variable to measure its effect on another variable (Fields, 2014; Gravetter & Wallnau, 2013). An important aspect of ecological validity, such a natural perspective allows for less researcher bias because the researcher is not influencing, controlling, or manipulating the variables or what is taking place in the classroom, nor biasing the measures of the variables (Fields, 2014; Gravetter & Wallnau, 2013).

Measures

To compute and analyze the bivariate correlation between a teacher's judgment accuracy and mindset, data used for Study 1 involved two measures. The categorization of the teachers into the two levels of mindsets (growth and fixed) was measured with the Mindset Survey; and, teachers' judgment accuracy was measured by the computing the intra-individual correlation (Helmke & Schrader, 1987) between students' predicted score and their actual performance on the ITML test of mathematical skills and concepts. (See Appendix A for example of ITML tests.)

Teachers' Judgment Accuracy

Judgment accuracy was operationalized as the intra-individual correlation (Helmke & Schrader, 1987) between students' predicted score and their actual performance on the tests of mathematical computational skills and mathematical conceptual knowledge—operations, patterning and sequencing, and reasoning about

quantity. These tests of mathematical computational skills and mathematical conceptual knowledge had good internal consistency (Cronbach's α = .88 and .84, respectively).

One advantage to using the intra-individual correlation design is that it provides a measure of judgment accuracy for each individual teacher, making it possible to compare accuracy across individuals or groups of teachers. It also allows for the examination of certain factors affecting judgment accuracy across teachers. For instance, the researcher is capable of investigating which mindset begets more accurate predictions (Study 1), which leads directly into an investigation of what factors might influence accuracy, such as the cues growth and fixed mindset teachers use to make their predictions (Study 2). Accordingly, each teacher had two measures of judgment accuracy—one for their predictions of student performance on the test of math computational skill, and one for their predictions of student performance on a test of math conceptual understanding. Because judgment accuracy is a correlation, scores range from -1 to +1.

A teacher's judgment accuracy was measured at the ratio level of measurement by the *relative accuracy* (Thiede, 1999; Thiede, Anderson, & Therriault, 2003) of students' test scores the teacher accurately predicted. For this study, relative accuracy refers to the extent to which a teacher's prediction of which items, relative to others, are more likely to be answered correctly, and is measured by the intra-individual correlations (Thiede, 1999; Thiede et al., 2003; Dunlosky & Rawson, 2012).

Mindset

A measure of mindset was developed for the ITML project (the full instrument can be seen in Appendix C). This instrument was developed based on the prolific work of Dweck and her colleagues (Dweck, 1975, 1986, 1991, 2006, 2008, 2013; Dweck &

Elliott, 1983; Elliott & Dweck, 1988; Dweck & Leggett, 1988; Dweck et al., 1995; Hong et al., 1999). A teacher's mindset could be *growth*, where the teacher believes that learning and one's intelligence are malleable and could therefore develop over time. On the other hand, a teacher's mindset could be *fixed*, where the teacher believes that learning and one's intelligence do not change because they are innate and constant. Some teachers may fall somewhere in the middle, but according to the research people are typically oriented toward either a growth or a fixed mindset (Dweck, 2006).

The instrument included a total of 18 items—nine that measured growth mindset and nine that measured fixed mindset. For each item, teachers indicated the degree to which they agreed with a statement using a five-point Likert scale to say they strongly agree (1), agree, neutral, disagree, or strongly disagree (5) with each one. Growth items suggest that student characteristics are malleable and can develop over time (e.g., With effort you can change your math ability quite a bit.). In contrast, fixed items suggest that student characteristics are fixed and do not develop over time (e.g., You have a certain amount of math intelligence, and you can't really do much to change it.). The scales were unidimensional and had good internal-consistency reliability (Growth Cronbach's α = .82; Fixed Cronbach's α = .89); therefore, the nine items on a scale were combined to calculate the mean score.

For ease of interpretation, the mean for the nine growth and nine fixed items was calculated ensuring it remained on the same five-point scale as individual items. Scores on the growth and fixed scale ranged from 1 (strongly agree) to 5 (strongly disagree). Therefore, it is important to note that a reverse ordering of the survey's Likert scale was necessary (a score of *strongly disagree* now became a 1, and a score of *strongly agree*

now became a 5) when comparing a person's growth mindset score with her fixed mindset score. This reverse ordering allowed for the person's score to reveal how many of the growth items she disagreed with and how many of the fixed mindset items she agreed with.

For example, a person categorized as a having a growth mindset as measured by this Mindset Survey would have a growth score of 5, which now revealed a response of *strongly agree* (no disagreement) with the growth items, and her fixed score of 1 revealed a response of *strongly disagree* (no agreement) with the fixed items. A person categorized as a having a fixed mindset as measured by this Mindset Survey may have a growth mindset score of 2.1, which now revealed a response of *disagree* with the growth items, and a fixed mindset score of 4, which now revealed a response of *agree* with the fixed items.

The 18 items were out of sequence in the survey. Items 1, 4, 7, 8, 10, 12, 13, 14, and15, reflect a growth mindset; and items 2, 3, 5, 6, 9, 11, 16, 17, and 18, reflect a fixed mindset, obviously to a varying degree in each, due to the Likert scalability of each teacher's response. The full instrument can be seen in Appendix C.

Data Collection Procedure and Time Line

As noted above, the data for this study were collected as part of the ITML project. Data collection took place in the fall semester of 2013 and the spring semester of 2014, after teachers in the ITML program made predictions of their students' performance on a test of mathematical skill and mathematical conceptual understand, and then administered the tests to students—as noted above judgment accuracy is the correlation between predicted and actual performance. The mindset survey instrument was also administered

in the fall semester of 2013. Judgment accuracy scores were from the spring semester of 2014.

Threats to Internal Validity

Although this study does not include a treatment and control group, or an intervention, certain threats to validity needed to be addressed. This study used a convenience sampling, which could pose a threat of selection due to the lack of random selection. Because there is no control group, this may not be a significant threat to internal validity. This correlational study did not try to establish a causal relationship between teachers' mindset and judgment accuracy; therefore, internal validity may not be as relevant.

Data Analysis

A bivariate correlation analysis was used to investigate the Research Question of Study 1: Is there a relationship between judgment accuracy and mindset? The statistical software of SPSS was implemented for this analysis.

Ethical Considerations

Approval to conduct this research was given by the Boise State University IRB (Approval Number: 101-SB15-037) and the schools' principals, teachers, and the school district superintendent. To protect the participants from pressure to participate as well as from privacy threats, the participants in this study were allowed to withdraw at any time, and they each signed Consent Forms, documenting their consent to participate. Moreover, all of the data were coded allowing for any and all name identifiers to be removed from the data. All data were kept confidential and stored in a password protected electronic file or in a locked office.

CHAPTER 4: STUDY 1 RESULTS AND DISCUSSION

The purpose of this study was to examine the relationship between teachers' judgment accuracy and mindset. Before reporting the results of the correlational analyses, descriptive statistics will be provided for the variables of interest.

Teachers' Judgment Accuracy

Each participating teacher predicted his or her students' performance on two tests: one on mathematical computational skill and another on conceptual mathematical knowledge. Students completed these tests after the teacher made his/her predictions. Judgment accuracy was operationalized as the intra-individual correlation between students' predicted and actual test performance. Therefore, each teacher had two measures of judgment accuracy—one for mathematical computational skill and one for mathematical conceptual knowledge. Mean judgment accuracy for skill and conceptual understanding was computed across the 90 participating teachers and are reported in Table 4.1.

Table 4.1
Mean Judgment Accuracy Computed Across Teachers

Test	Mean (S.D.)
Mathematical Skill	.50 (.25)
Mathematical Conceptual Knowledge	.40 (.25)

Judgment accuracy was significantly greater than zero for both mathematical skill [$t(89) = 18.63$, $p < .001$] and conceptual knowledge [$t(89) = 15.19$, $p < .001$], indicating

the teachers' predictions were more accurate than chance predictions. Teachers more accurately predicted skill performance than conceptual understanding, $t(89) = 4.83$, $p < .001$.

Mindset

Each participating teacher completed a mindset instrument, which measured both growth mindset and fixed mindset. For each teacher, the nine items of the scale were added and then divided by nine to put the scale score on the same scale as individual items (where 1 = strongly agree and 5 = strongly disagree). However, as described in Chapter 3, it is important to note that a reverse ordering of the survey's Likert scale was necessary (a score of *strongly agree* now became a 5, and a score of *strongly disagree* now became a 1) when comparing a person's growth mindset score with her fixed mindset score. This reverse ordering allowed for the person's score to reveal how many of the growth items she disagreed with and how many of the fixed mindset items she agreed with.

For example, a growth mindset score of 5, as measured by this Mindset Survey, now reveals a response of *strongly agree* (no disagreement) with the growth items, and a fixed mindset score of 1 reveals a response of *strongly disagree* (no agreement) with the fixed items. A fixed mindset as measured by this Mindset Survey may have a growth mindset score of 2.1, which now reveals a response of *disagree* with the growth items, and a fixed mindset score of 4, which now reveals a response of *agree* with the fixed items.

Therefore, Table 4.2 shows the mean scale score computed across the participating teachers. Teachers more strongly agreed with growth mindset items than

fixed mindset items, as measured by this Mindset Survey. The difference was statistically significant, $t(89) = 18.26$, $p < .001$. Interestingly, the means below in Table 4.2 demonstrate how a person's mindset is not a dichotomous, absolute score. Measuring one's mindset with this survey implies there is considerable variability in that a person may agree with most of the growth mindset items, while also not disagreeing completely with the fixed mindset items. Therefore, the survey used in this study cautions against definitive parameters when categorizing a person's mindset. This study recognizes this variability in one's mindset and acknowledges such caution.

Table 4.2
Mean Mindset Computed Across Teachers

Mindset Scale	Mean (S.D.)
Growth Mindset	3.99 (.47)
Fixed Mindset	2.00 (.55)

Correlational Analyses

The purpose of this study was to answer the following question: Is there a relationship between judgment accuracy and mindset? The affirmative answer to this question is presented in Table 4.3, demonstrating the correlation between judgment accuracy (math skill and conceptual understanding) and mindset (growth and fixed).

Table 4.3
Correlation between Judgment Accuracy and Mindset Computed Across Teachers

	Judgment Accuracy		Mindset	
Variable	Skill	Conceptual	Growth	Fixed
Judgment Accuracy Skill	1.00			
Judgment Accuracy Conceptual	.68*	1.00		
Growth Mindset	.33*	.36*	1.00	
Fixed Mindset	-.30*	-.34*	-.52*	1.00

Note: * indicates the correlation is significant at the .01 level.

As seen in Table 4.3, there was a significant and positive correlation between mindset and judgment accuracy for skill (r = .33) and conceptual understanding (r = .36). In contrast, there was a significant and negative correlation between mindset and judgment accuracy for skill (r = -.30) and conceptual understanding (r = -.34). As a result, these correlations clearly indicate that teachers with a growth mindset more accurately predicted their students' math skill and conceptual performance, while teachers with a fixed mindset more inaccurately predicted their students' math skill and conceptual performance. Thus, higher growth mindset scores are associated with more accurate monitoring of student learning, whereas higher fixed mindset scores are associated with less accurate monitoring.

The .33 and .36 correlations above indicate that a moderately strong, positive relationship exists between growth mindset and judgment accuracy of math skill and conceptual performance, based on r = 0.50 indicates a large correlation and effect size (Fields, 2014; Cohen, 1990, 1994, as cited by Fields, 2014). Therefore, if a teacher has a growth mindset, he is considerably more likely to accurately predict students' math skill and conceptual performance. The -.30 and -.34 above indicate that a moderately strong, but negative relationship, exists between fixed mindset and judgment accuracy; and therefore, if a teacher has a fixed mindset, he is less likely to accurately (and thereby more likely to inaccurately) predict students' math skill and conceptual performance.

It is also important to note that growth and fixed mindset scores were significantly and negatively correlated. If people scored high on both scales or low on both scales, these scales would be positively correlated. However, these scores are negatively correlated, which suggests that people who score high on one scale do not score high on

the other. That is, people are likely oriented toward either a growth mindset or a fixed mindset, which is consistent with Dweck's conceptualization of mindset (e.g., Dweck, 2006).

Therefore, the data of Study 1 begs the question behind Study 2—What are the cues that fixed and growth mindset teachers use to make their predictions of students' academic performance? Does the teacher's mindset influence the cues used? The qualitative research hypothesis for Study 2 was that fixed mindset teachers are less accurate in their predictions, basing their predictions of students' academic performance on inaccurate and/or academically irrelevant factors, such as students' gender, behavior, effort, and possibly socio-economic status. Whereas growth mindset teachers were hypothesized to be more accurate in their predictions, basing their predictions of students' academic performance on accurate and/or academically relevant factors, such as students' cumulative folders and academic records of performance, current grades, and the teacher's knowledge of student learning. Study 2 explores these hypotheses and the cues 5 fixed and 5 growth mindset teachers used to predict their students' performance.

CHAPTER 5: STUDY 2 METHOD

In Study 2, semi-structured interviews were used to gather data about the cues teachers use to judge their students' learning, and then to see how they align with fixed and growth mindsets. As the results of Study 1 linked judgment accuracy to teacher mindset, in this study interviews were conducted with teachers holding a fixed mindset and teachers holding a growth mindset. The researcher was blind to each interviewee's mindset to avoid bias and contamination. The purpose of Study 2 was to bring the correlation data of Study 1 to life through interviews examining the cues those teachers with fixed and growth mindsets use to make their predictions of students' academic performance.

Setting

The researcher interviewed 10 teachers in the privacy of their own classrooms at their school. Both schools were public elementary schools (Kindergarten – 5th grade), with a diverse population of students, and located in a suburban school district in the Mountain West region of the United States.

Participants

Based on the data from Study 1, a total of ten (10) elementary teachers were deliberately selected for a semi-structured interview of Study 2. These 10 teacher participants had participated in the ITML research study and were assigned to one of four professional development conditions described in Chapter 3, and whose data were

included in Study 1 above. This group of participants came specifically from the mathematical instruction professional development called Developing Mathematical Thinking (DMT) (Brendefur, 2008). To avoid confounding mindset and ITML conditions, teachers were selected from the same group. That is, all the participant teachers had been assigned to the same professional development group for the ITML project; thus, differences in self-reported cue use could not be attributed to being in different ITML groups receiving different professional development.

Due to the fact that all of the teacher participants had been part of the DMT-only group, it is important to note that mean judgment accuracy was greater for the DMT-only group and the DMT-Formative Assessment group than for the other groups in Year 1 of the ITML project (Thiede et al., 2015), and this pattern also held in Year 2. Therefore, the participating teachers in Study 2 had higher judgment accuracy than the FA-only and control groups, although judgment accuracy had adequate variability in this group. Judgment accuracy for math skills ranged from .16 to .95. Judgment accuracy for conceptual understanding ranged from .12 to .83. Growth and fixed mindset scores also had variability for this group.

These ten teachers participated in semi-structured interviews about the cues they used to judge student learning. Because judgment accuracy was related to growth and fixed mindset (see Study 1), these ten teachers were chosen as the highest GM and highest FM. As previously mentioned, their judgment accuracy for math skills and for conceptual understanding ranged, allowing for the analysis of how the cues usage relates to mindset and accuracy. This selection procedure created groups that were significantly different on all four measures, all ts > 3.3, ps < .001. Accordingly, teachers who differed

on both judgment accuracy and mindset were interviewed. These 10 teachers included 2 males and 8 females, and ranged in age and teaching experience (from 6 – 19 years). The group was comprised of three Kindergarten teachers, one 1st grade teacher, three 2nd grade teachers, one 3rd grade teacher, one 4th grade teacher, and one 5th grade teacher. See Table 5.1 for participants' demographics.

Table 5.1
Teachers' Demographics

Participants:

Teacher	# Years Teaching	Sex
Carter	20	M
Katrina	11	F
Hanna	10	F
Nina	19	F
Janet	6	F
Karen	16	F
Cathy	17	F
Annie	5	F
Mark	18	M
Bridgette	15	F

Research Design and Approach

Through inductive qualitative analysis of ten (10) semi-structured interviews, the purposes of Study 2 were, (1) to examine the cues teachers use to make their predictions of students' academic performance, and (2) to explore whether the teachers' mindset influences the cues used. These teachers had already been identified and categorized as having either a growth or a fixed mindset through the administration of the Mindset Survey in 2013. However, they took the Mindset Survey again before their interviews of Study 2 in the spring of 2015 to detect any changes in their mindsets.

The qualitative data collected from these semi-structured interviews were evaluated using a general inductive approach (Thomas, 2006) to investigate the cues that

teachers with fixed and growth mindsets use to make their predictions of students' academic performance. A semi-structured interview was chosen as the ideal interview format for numerous reasons. Compared to a completely structured interview with standardized questions and a protocol that has to be followed consistently with each interviewee (respondent), a semi-structured interview allows for more open-ended and depth-probing investigations of the research topic (Glesne, 2011) through the use of a framework of guiding questions. On the opposite side of the design continuum, a completely free form, unstructured interview without guiding questions exposes the risk of not eliciting the themes more closely connected to the research question under investigation (Rabionet, 2011). Because this study knowingly probed into a possibly sensitive and/or self-incriminating topic—the bases of teacher predictions—the format of a semi-structured interview was also deliberately chosen because it helps reduce the risk of socially desirable answers through its interactive and rapport-building qualities (Patton, 1990, as cited by Barriball & While, 1994). The format of a semi-structured interview compliments the general inductive approach used for its analysis.

A general inductive approach (Thomas, 2006) was chosen as the optimal method of analysis because the semi-structured interviews were driven by specific evaluation objective—in this case to investigate the cues that teachers with fixed and growth mindsets use to make their predictions of students' academic performance. By implementing this inductive approach, themes emerged from the interpretations of this raw data, and the connections between the specific research objectives—to investigate the cues that teachers with fixed and growth mindsets use to make their predictions—and the findings from the interviews became transparent and defensible. The qualitative evidence

found in the text data allowed for the theory about the underlying links between teachers' mindsets, judgment accuracy, and cues used to form their predictions.

As mentioned previously, the researcher was blind to the teachers' mindsets before and during the interviews. This design was purposefully used to mitigate any threats to validity from experimenter/researcher bias, and to allow for the deliberate search of potentially disconfirming evidence while in the classroom setting (Erickson, 1990). Especially because the semi-structured interviews and their analysis through an inductive approach were both driven by the specific research objective—uncovering what cues teachers use to make predictions of their students' performance, and seeing if this aligns with growth and fixed mindsets—it was very important to avoid looking only for evidence that supports this objective. With semi-structured interview questions, research categories exist behind each question. Therefore, both sides of the question needed to be examined for confirming and disconfirming evidence, because every good interview question has a hypothesis and/or "reasonable answer" behind it (Wolcott, 2008, p. 75).

Measures

To triangulate the mindset categorization process and the correlation between teacher's mindset and judgment accuracy, the researcher—who was blind to the mindset of each teacher—conducted semi-structured interviews to uncover the cues teachers use to make their predictions. Revealing these cues could then possibly examine the correlation between mindset and judgment accuracy.

Qualitative semi-structured interviews were chosen as the optimal way to elicit and investigate the cues that teachers with fixed and growth mindsets use to make their predictions of students' academic performance. Semi-structured interviews allow for

more open-ended and depth-probing investigations of the research topic (Glesne, 2011) through the use of a framework of guiding questions that focus on the main research question under investigation. Pilot interviews (Griffee, 2005; Glesne, 2011) took place with respondents drawn from a group of teachers to authenticate the pilot interview process. Piloting the questions on members of the actual group this study investigates—teachers—clearly informed the interview protocol used in the final interviews. These pilot interviews not only allowed for the rehearsal of the questions, but also the critical feedback and reflection on behalf of the respondents and the researcher as to the usability of the interview questions (Griffee, 2005; Glesne, 2011).

Data Collection Procedure and Time Line

Before the qualitative semi-structured interviews in the spring of 2015, one of the directors of the ITML project, who had worked with these teachers the year before, made the initial contact with the two schools' principals and the ten teachers, to explain the purpose of the research project and to verify their willingness to partake in the interviews. After IRB consent and approval from the principals and teachers, the researcher contacted each teacher directly to schedule the interviews.

Prior to the interviews, these 10 teachers completed the Mindset Survey again to compare their scores from 2013 and note any changes to their mindsets. Teachers were emailed a pdf of the survey so they could print it out themselves and complete it before the interview. The researcher then entered their responses in an Excel spreadsheet and then in SPSS after the interviews were completed. The researcher was blind to these 10 teachers' mindsets as identified both in 2013 and in 2015. The researcher did not know

the interviewee's mindsets until after the completion of the interviews and the initial data analysis.

Data collection on the bases of teacher predictions was through semi-structured interviews that took place in the teachers' classrooms during regular school hours in each teacher's classroom, and lasted about 30 minutes each. With a class roster listing each student's name and a copy of the ITML math assessment in front of them, teachers predicted how each of their students would score on this 10-item assessment of mathematics skills and concepts. After these predictions were made, teachers were asked to respond to questions pertaining to their predictions of their students' future performance, and the cues they used to make these predictions. When looking at the teacher's predictions, the researcher then probed the teachers further by asking them to explain any large discrepancies in scores and to elaborate on why they predicted one student would correctly answer 5-out-of-5 on the skills section, when they predicted another student would correctly answer 0-out-of-5, for example.

Threats to Internal Validity

With semi-structured interviews, it is important to mitigate threats to validity. Therefore, an informed and critical colleague was consulted to verify and validate the plausibility of the interview data (Griffee, 2005; Glesne, 2011; Miles, Huberman, & Saldaña, 2013). This critical colleague looked at the interview data, its coding, summary, and interpretation, to verify the path from data to interpretation; this colleague verified whether plausible conclusions were drawn from the interview data; and this colleague validated that an alternative interpretation could not be drawn based on the same

evidence (Griffee, 2005). This validation of interview data from an informed and critical colleague helped mitigate the threats to internal validity.

Data Analysis

Semi-structured interviews were used to examine the qualitative Research Questions of Study 2—What are the cues that teachers use to make their predictions of students' academic performance, and does the teacher's mindset influence these cues? Ten teachers were interviewed after making predictions of their students' expected performance on a math assessment of skills and concepts. Under investigation were the reasons they gave their students the predicted scores that they did.

Immediately following the completion of the interviews, the qualitative data collected from these semi-structured interviews were analyzed using a general inductive approach (Thomas, 2006) to investigate the cues that teachers with fixed and growth mindsets use to make their predictions of students' academic performance. A general inductive approach was chosen as the optimal method of analysis because of its "efficient and defendable procedures for analyzing qualitative data" (Thomas, 2006, p. 237). By using an inductive approach, the analysis of the semi-structured interviews was driven by the study's evaluation objective—to investigate the cues that teachers with fixed and growth mindsets use to make their predictions of students' academic performance.

Therefore, by implementing this inductive approach, the cues teachers use to make their predictions of students' academic performance could be thoroughly investigated. The connections between this specific research objective and the findings from the interviews became transparent and defensible. The qualitative evidence found in the text data allowed for the theory about the underlying links between teachers'

mindsets, judgment accuracy, and the cues they used to form their predictions, as described in more detail in Chapter 6.

Ethical Considerations

Approval to conduct this research was given by the Boise State University IRB (Approval Number: 101-SB15-037) and the schools' principals and teachers. Because only the teachers were interviewed, Study 2 did not use a vulnerable or protected population. To protect the participants from pressure to participate as well as from privacy threats, the participants in this study were allowed to withdraw at any time, and they each signed Consent Forms documenting their consent to participate. Moreover, all of the data were coded allowing for any and all name identifiers to be removed from the data. All data were kept confidential and stored in a password protected electronic file or in a locked office. Lastly, all teachers participating in Study 2 received a thank you gift card of $50.

Summary

In summary, this mixed-methods study used correlational analysis for Study 1, and qualitative semi-structured interviews for Study 2. Data used for Study 1 included the identification and categorization of teachers with either a growth or a fixed mindset, and then computed teachers' judgment accuracy (operationalized by computing the intra-individual correlation between students' predicted score and their actual performance on the tests of mathematical skills and concepts). A correlation was then run to investigate the existence of a correlation between teachers' judgment accuracy and their mindsets.

This research study utilized quantitative data collected over the fall and spring semesters of the 2013/2014 school year, and qualitative data collected through interviews

during the spring semester of 2015 in a suburban school district in the Mountain West region of the United States. Study 2's interviews utilized stratified convenience sampling, and the sample obtained was 10 Elementary (Kindergarten – 5th grade) schoolteachers of various ages, with varying years in teaching experience, and containing both females and males.

The purpose of this mixed-methods study was two-fold. The first quantitative study (Study 1) examined data to investigate if a correlation existed between teachers' mindsets (growth and fixed) and their ability to accurately predict students' academic performance. The second qualitative study (Study 2) explored the cues that teachers use to make their predictions of students' academic performance, and to see if their fixed or growth mindset influenced these cues. The researcher remained blind to these teachers' mindsets until after both the interviews and the preliminary data analysis. The next section, Chapter 6, details the results of this study.

CHAPTER 6: STUDY 2 RESULTS

Using an inductive approach to interpret the raw interview data, the cues were explored that teachers use to judge student learning and make their predictions of students' academic performance. This approach involved multiple readings of the interview transcriptions to distill the cue-usage reported by teachers. Once the cues were ascertained, a fourth and fifth reading of the data analyzed if teachers' cue-usage aligned with their fixed or growth mindset. Framed by the literature review and the more exhaustive readings of the transcribed interviews, possible connections between cue usage, mindset, and judgment accuracy were scrutinized. These data were read a final time by the researcher and one professional colleague for reliability and to check for confirming and disconfirming evidence.

Initial Coding of the Cues Teachers Reported Using

As seen in Table 6.1, there was a wide range of cues that teachers reported using to make predictions of their students' performance on the tests of mathematics skill and conceptual understanding. (See examples of the tests in Appendices A and B.) These cues emerged mostly from interview questions #5 (*How would you define prediction?*), #6 (*Describe what cues you are using to judge your students' performance. What are you basing these prediction scores on?*), and #16 (*How do you know this student won't know this content? How do you know this student will?*).

The preliminary coding process to create the initial list of cues seen in Table 6.1 involved a more general reading of the interview transcripts to preview the teachers' responses. Then, the second reading involved extracting specific cues the teachers explicitly communicated as their cues used to make predictions of their students' performance on the math test. From this second reading, the researcher drafted a list of cues. The subsequent and more scrutinizing third reading allowed the researcher to probe into any subtleties the teachers may have indirectly communicated through their responses to the interview questions. From there, Table 6.2 was created, and is described after this next section detailing what initial cues teachers reported using, supported by their verbatim explanations.

Table 6.1
Initial List of Cues Teachers Reported Using to Predict Student Performance

Students strengths and weaknesses
Students' developmental "readiness"
Students' work and performance in class
Past and recent assessments given
Students' problem-solving and questioning skills
Student's literacy skills and vocabulary
What content has been taught, studied, and practiced previously and/or extensively
Students' backgrounds and families and/or SES
Teachers' ongoing progress monitoring
Students' level of comprehension/cognitive impairment based on being on an IEP or having ADD or ADHD
Math skills needed to solve the problems on the test
Exposure/knowledge base students came in with
Students' experience/history with math?
Did they go to preschool? (*Pertaining to Kindergarten teachers*)
Students' Confidence
Students' innate intelligence and love of math vs. students who struggle with math

Students' Behavior
How solid students are with using manipulatives
If a student has an English "language barrier"

Cue-Usage Described by Each Teacher

Bridgette reported cues such as knowing students' strengths and weaknesses; students' age and how they were developmentally as students; students' performance on previous and more recent assessments given; students' work and performance in class; students' problem-solving and questioning skills; ongoing progress monitoring; how "immersed in language" student were; and particular students' level of comprehension based on being on an individualized education plan (IEP) to meet the needs of students with special needs and/or disabilities.

Bridgette's articulated some of her reasoning for why she predicted the scores she did on the math test here in her response to interview question #16. This response of hers illustrates her cues of students' problem-solving and questioning skills, ongoing progress monitoring, and students' literacy skills:

> They will get 3 out of 5, and this one will get 4 out of 5. I'm saying this because I'm seeing how they're solving other types of problems I've given them. And they have to go back, and these 3 are just not there yet. And then for a few students, a story problem is hard for them because they have to re-read it and do it over…some students, I don't have to read the story problems to them out loud. But with other ones, I do have to read everything. (Bridgette, interview transcription, p. 1, March 9, 2015)

Bridgette highlighted her cue of students' performance on past assessment and in class by saying, "I've given similar assessments and they've all answered it correctly. And then I look to see how they work in the classroom." She spoke a lot about her students'

comprehension of language when justifying the predictions she did, especially how it relates to students' age and development:

> …in math, it's hard for them with story problems, where they have to do some extra thinking or multiple steps like adding one side first before making both sides equal to (=). Some are just a bit younger. Some are just more immersed in language and some are just younger. (Bridgette, interview transcription, p. 2, March 9, 2015)

Annie reported cues of students' literacy skills, and what content she had already taught, studied, and what skills her students have practiced previously and/or extensively ("Well for this front side, we studied this format all the time… And we practice them daily"). She reported cues of English language barrier, and students' cognitive abilities. Summed up here, Annie reports using these cues summarized above when articulating what cues she used to make her predictions:

> We studied this format extensively. And I only have one student, well 2, that might miss 1 or 2. Everyone else will get 5/5 on this front side. On the backside, the story problems, um, those same two students will have difficulties. Literacy plays a factor into that. For one of them, it's more than that. It's English language barrier. The other one, I have been doing extensive interventions on counting and that student is still struggling. All the other ones will get it right, 5/5. My other one is actually having difficulty with counting; even moving objects one space to another. It's moving manipulatives one place to another and he cannot keep a number. So he's not even able to count moving objects. Just a simple act of counting from 1-100, we're still working on. (Annie, interview transcription, p. 2, March 9, 2015)

Cathy described basing her predictions on the math skills her students needed to solve the problems on the test; students' backgrounds and family; students' exposure/knowledge base students came with; students' cognitive abilities ("7 would get a zero out of five on the front of the test, because they don't know their teens and they would not be able to count backwards…"); whether or not her students had been to preschool; students' vocabulary and literacy skills; some students' level of

comprehension based on being on an IEP; and how much reading support her students would need to answer the problems on the test. Cathy's explained the cues she used in her definition of what predictions mean to her:

> Well… making a prediction is based on the information that you know, what you know about the kids and their background, and I use that to predict. Whether or not, and how much support they're going to need… I would say exposure that they appear to have had. Have they been to preschool? If their parents are working? If the parents have been to college?... those kind of things. Do the kids seem to come to school with the vocabulary or do they struggle to understand what I'm saying to them? Have they been spoken to a lot? Are they speaking in complete sentences, answering me in complete sentences?... those kinds of things. And that's what I base my predictions on. It's what they bring to the table. (Cathy, interview transcription, p. 1, March 16, 2015)

Cathy explained her scores for a few of her students who were on an IEP, based on their level of comprehension:

> Well, this one is special needs. He doesn't even recognize numbers at this point, so this test isn't even on his skill set. Same with him. They're both on full IEP's. So neither of them have the skill set to be in kindergarten at this point versus... well, I guess it's their knowledge base that they came to school with, versus someone who is getting them all right…The ones I gave 5/5 to, they came in with a lot of knowledge. (Cathy, interview transcription, p. 4, March 16, 2015)

Janet made her predictions based on cues such as what content had been taught previously and what she has exposed students to, "past data collection" such as assessments given, students' work and performance in class, math skills needed to solve the problems on the test, student's literacy skills; students' developmental "readiness," knowing the students, their innate abilities and disabilities, an auditory processing issue for one student, knowing which students would struggle on the concept questions, and some other students who would struggle because of a lack of confidence to even try it. "I know what I've taught them. I know what I've exposed them to. I also know kids that

struggle with language or maybe reading will struggle with some of the more contextual pieces on the back."

> Well this one with the zero is three grade levels behind and has developmental issues. So there you go. This one who I gave five out of five to, has always been very strong. If I give him something, he tends to deconstruct it really quickly. But that's coming from a lot of assessments and previous knowledge that I've already given him. (Janet, interview transcription, p. 2, March 16, 2015)

Hanna spoke of cues involving what content had been taught, studied, and practiced previously and/or extensively, "impulse control" and whether or not students are paying attention and not trying to hurry (which she also linked to students caring or not caring), cognitive impairment (referring to her "IEP kid"), math skills needed to solve the problems on the test, knowledge of students' problem-solving and questioning skills, and students' work and performance in class. Hanna reported making her prediction on the math skills section of the test based on how "…we've done all of this many, many, times. We've been doing this for a long time. All these kids would- oh except this one. She's my little IEP kid. She wouldn't be able to do this."

> I think they would do fine on the story problems, and they would add it right. But they would just put the total instead of the = sign. But if I said to them, "I need you to go back and look again," most of them would fix it. (Hanna, interview transcription, p. 2, March 10, 2015)

Mark spoke of cues such as knowing students' strengths and weaknesses; knowing which students struggle; past and recent assessments given and the groupings he does in small group work, based on students' abilities; students' work and performance in class; student's literacy skills; students' math journals; small group work; and students' developmental "readiness." He detailed his cue usage by stating:

> A lot of it is based on.... ***reading***, especially for the second page. There's a lot of reading that's involved. So for somebody that I've given a one or zero to, they're

> brand-new students who are really struggling with reading. But not necessarily mathematical concepts. Some of them just aren't developmentally ready, and that's just the way it goes… Especially in the small group math, I can understand and see if they're getting it or not. (Mark, interview transcription, p. 1, March 9, 2015)

Karen concisely summed up her cue usage of math reasoning skills needed to solve the problems on the test. She told the researcher exactly how she made her predictions and what cues she used to do so, when she said:

> I looked at, first of all, skills that I've specifically taught. Some skills that I know most kids can do because I've specifically taught it. Then some were more reasoning skills, and so I thought how well were the students reasoning with problems that they hadn't seen before. And the types of problems, that's why I wrote down the skills needed for each of those reasoning problems while I made my predictions, to figure out how I thought they'd do. (Karen, interview transcription, p. 1, March 10, 2015)

When comparing students' predicted scores, the researcher asked Karen to talk more about why she gave two different students very different scores. Karen referred to students' cognitive abilities or impairments, describing one of her student's innate intelligence as compared to another student's cognitive impairment.

> She just has wonderful math reasoning, even with things that I haven't taught her. She can even explain things and always starts sentences with "I know that such and such, so that's such and such." And this boy is actually cognitively impaired. He's good at memorizing things, but has no reasoning. He just can't... he can actually do algorithms pretty well, but that's about all. (Karen, interview transcription, p. 2, March 10, 2015)

Katrina, a full-day Kindergarten teacher, talked a great deal about her cues that consisted of whether or not students were developmentally ready and their age; if they been to preschool; her students' "understanding of math" and her knowledge of their learning; their home life and the support at home to better prepare them for their

academics; the exposure to and experience with math; students' behavior in class; and students' work and performance in class.

> Right now I would say 80% of my students would get five out of five on the front of the test. At this point in the year, in March, they will get 5/5. If I look at this at the beginning of the year their scores would be totally different. I know this because every year the group that comes in is different and this year the group that came in was young. The kids were younger with fewer skills... in general they were young in age and developmentally just not ready. The other thing is life at home makes a huge impact on what they've been going through. We do have some that have a hard… not hard, but a shaky life. And that kind of stops them from performing. I think they're all very smart kids... But it's the home life that really matters sometimes. Their home life impacts their learning. Who's at home when they go home? Who's there to help them with homework? Was there someone to talk to them? I'm seeing a group that has less language skills and less ability to solve problems. All that is translating into their academics. (Katrina, interview transcription, p. 1, March 9, 2015)

Katrina shed an interesting light on how the Kindergarten schedule is set up, causing her to have the specific cue, students' exposure to math, when she said:

> I think it has to do with their experience of math and how much exposure they are getting. I would say a few of my students that may not get five out of five, is because they have missed some math activity because they have to be at the computer to recognize letters, or they get pulled out and have to leave the room during math. For reading intervention, math seems to be a convenient time, unfortunately, to pull students out. (Katrina, interview transcription, p. 2, March 9, 2015)

Katrina spoke a great deal about her students' "understanding of math" and how she, as the teacher, assesses their learning of math. When describing the cues she used to make her predictions, she said she scored based on:

> Their understanding of math. I'm always looking for little things like, you know, I'll do number flashing with the 10 frame and I'll see kids do this. But then look around and do this. Those are the kids I'm watching out for because I'm thinking, "are you looking at your neighbors' answer, or are you doing your own work"? So those are the students, when they turn in their work, I have them sit with me and I ask them to talk to me about their answers and explain their work. Because that's how I can find out what is going wrong. The problem with math is that we've never figured out what the kids were thinking. We are always worried

> about what is the right answer…We need to look more at the process, how did the mistakes happen. That's the one thing I changed a lot and I'm basing my predictions on that. (Katrina, interview transcription, p. 3, March 9, 2015)

Nina reported cues such as what content had already been taught, studied, and practiced previously. Her cues also included students' intelligence levels, where one student she referred to as being a "late bloomer" who has ADD, and one who is "bright." Nina said, "So on this backside I'm going to say, looking at my roster and looking at this backside of the test, well, I definitely have some bright students who will get five out of five on problems like this one." She went on to connect some of her cues with having:

> …some late bloomers that need more help…. And more practice, mathematically they're going to be confused because it'll be foreign to them. We've done a lot of story problems and I think they would understand those because they understand them visually. But these other problems they would be very confused by… It's ADD. And my other guy is very smart but needs a lot of repetition and practice. These are my late bloomers. (Nina, interview transcription, p. 1, March 7, 2015)

Nina also referred to basing her predictions on students' work and performance in class, students' confidence, and students' ability to be an independent worker. Nina also explicitly stated using the cue of how "solid students are with using manipulatives" to drive her prediction scores. She was the only teacher who targeted that skill as a cue behind her predictions.

Carter described his cues as "knowing the child and how they think," as well as knowing what his students were capable of. He alluded to basing his predictions on knowing what his students history has been in math, and his students' work and performance in class; how they approached testing and handled challenges of math. Carter cited students' motivation level and confidence as cues, as well as his students'

literacy skills when reading the story problems on the back of the test. His cues were revealed when he defined what *prediction* meant to him:

> Predictions…. They're in part knowing the child and knowing what they're capable of. It's knowing what their history has been in math and knowing how they approach testing and challenges of math. Some of them are very capable, but some kids are just not very motivated. So it's more of an art. But just by knowing these kids for the last six months, you kind of get an idea. But they will surprise you sometimes. Sometimes the ones that struggle, sometimes things just click. It's not an exact science, but just knowing them and how they think, and what their motivation level is, and things like that. (Carter, interview transcription, p. 3, March 7, 2015)

Carter reported using the cues of what content has been taught previously—what he referred to as "the timing thing." He referred directly to cues about students' involvement with math and their (innate) love for math as compared to a student who does not like math and struggles with it. He described more of the overall climate in his classroom and how he perceived students' learning and understanding:

> Some of them are very capable, but some kids are just not very motivated… the ones that I would predict a five out of five are very much involved in the hour of math every morning. Hands are up. They're always ready with the answer, or at least what they think the answer is. Their homework is complete and done correctly. They actually have a love for math. There is something inside of them that allows them to see the world a little more mathematically versus a student who gets 2 out of five and who sees the world less mathematically and who just struggles. It is not that they can't or won't learn; it's just that the process is slower for them. So in the classroom, you know through the weeks of going over math and concepts, you know who kind of hangs out, hangs back and you know who's pretty excited about whatever lesson we are learning. (Carter, interview transcription, p. 1, March 7, 2015)

Other cues he spoke of were students' mathematical development, student's family life, and socio-economic status (SES) as compared to another student's innate intelligence. "This boy struggles in math, but he also, as far as I can tell, is kind of raising himself… She is a very, very intelligent child who's in the Challenge program." His cue

of students' behavior was directly connected with a student's ADHD and ADD, and how this affected his academic performance and ability to be engaged in the instruction. Table 6.2 gives a detailed summary of each teacher's cues.

Table 6.2
Cues Reported by Each Teacher During the Interviews

Teacher Participants	Cues Teachers Reported as Using to Predict Student Performance	
Bridgette	• knowing students strengths and weaknesses • students' developmental "readiness" • age • past and recent assessments given • students' work and performance in class	• students' problem-solving and questioning skills • ongoing progress monitoring • student's literacy skills ("immersed in the language") • level of comprehension based on being on an IEP
Annie	• student's literacy skills • what content has been taught, studied, and practiced previously and/or extensively	• English "language barrier" • students' cognitive abilities (possibly students' problem-solving and questioning skills)
Cathy	• math skills needed to solve the problems on the test • students' backgrounds • family • exposure/knowledge base students came with • level of comprehension based on being on an IEP	• students' cognitive abilities (possibly students' problem-solving and questioning skills) • have they been to preschool? • vocabulary and literacy skills • how much reading support students will need to answer problem
Janet	• what content has been taught previously and what she has exposed students to • past and recent assessments given • students' work and performance in class • math skills needed to solve the problems on the test	• student's literacy skills • students' developmental "readiness" • knowing the students • auditory processing issues • confidence
Hanna	• what content has been taught, studied, and practiced previously and/or extensively • "impulse control" - whether or not students are paying attention and not trying to hurry (also linked to students caring or not caring)	• cognitive impairment ("IEP kid") • math skills needed to solve the problems on the test • knowledge of students' problem-solving and questioning skills • students' work and performance in class
Mark	• knowing students strengths and weaknesses • knowing which ones struggle • based on past and recent assessments given and groupings	• students' work and performance in class • Student's literacy skills • math journals • small group work • students' developmental "readiness"
Karen	• math reasoning skills needed to solve the problems on the test	• students' cognitive abilities or impairments (innate intelligence vs. cognitively impaired)
Katrina	• students' developmental "readiness" • age • have they been to preschool? • understanding of math	• home life and support (students' background and family) • exposure to and experience with math • class behavior • students' work and performance in class
Nina	• what content has been taught, studied, and practiced previously • being a "late bloomer" who is A.D.D., or "bright" (indirectly students'	• students' work and performance in class • how solid students are with using manipulatives • students' confidence

	developmental "readiness")	• being independent worker
Carter	• knowing the child and how they think (possibly students' problem-solving and questioning skills) as well as • knowing what they're capable of • what their history has been in math (students' work and performance in class) • how they approach testing and challenges of math • students' motivation level and / or confidence	• student's literacy skills • what content has been taught previously ("the timing thing") • students' involvement with math • students' (innate) love for math vs. a student who doesn't and struggles with it • students' mathematical development • student's family life, SES compared with student's innate intelligence • students' behavior – especially ADHD and ADD

Further Analysis of the Cues Teachers Reported Using

After the third analysis of the interview transcripts detailed above, it was apparent that several of the cues coded for overlapped and could therefore be condensed. The cue codes of past and recent assessments given, and students' work and performance in class, were collapsed into one cue code: students' work and performance in class and on past assessments. Since the same teachers reported using both of these cues, it was a realistic and appropriate collapse of codes to make. Students' exposure/knowledge base they came in with, and students' experience/history with math were also collapsed to be in one cue code: students' exposure/knowledge base they came in with. Condensed under the cue code of math skills needed to solve the problem on the test were the reported codes of "students' understanding of math," "students' involvement with math," and "students' mathematical development." These cues aligned with a students' overall grasp of math and how they would attack each problem on the test; therefore, it seemed reasonable to the researcher to subsume them under one cue: math skills needed to solve the problem on the test. Additionally, the same teachers who reported the collapsed codes also reported the final code, justifying the subsumption.

Two cues reported during the interviews were not included in the final codes because they were considered to be broad terms that the researcher felt were better exemplified by more explicit codes. The cue of knowing the students, as reported by Janet and Carter, was subsumed under other cue codes such as students' performance, knowing students' developmental "readiness," and literacy skills. The more ethereal cue of knowing the students was better articulated through the more explicit cue codes it collapsed into, as was the reported cue of students' cognitive abilities. This was represented by many of the final codes on a more descriptive level. The same teachers who reported these subsumed codes also reported the final code, justifying the subsumption.

Potentially perceived as a broad and general cue, the code of ongoing progress monitoring was deliberatively included in the final codes because the researcher felt it was a conscious pedagogical cue worthy of keeping. Overall this left 17 cues that emerged from the interviews' raw data after five intensive readings.

Apparent in Table 6.2, many of the cues were reported by several of the ten teachers (7 teachers spoke of using the cue of student work and performance in class and on past assessments), while other cues were reported singularly by one teacher (how solid students are with using manipulatives). Some cues were grade-specific, such as two of the three Kindergarten teachers shared the cue of making their predictions on whether or not the student attended preschool or not.

Table 6.3
Final List of Cues Teachers Reported Using to Predict Student Performance

Cue Code	# of times reported	By which teacher
Students' work and performance in class and on past assessments	**7**	**Janet, Bridgette, Hanna, Mark,** Katrina, Nina, Carter
Students' problem-solving and questioning skills	**7**	**Bridgette, Hanna, Janet, Mark, Annie,** Cathy, Carter
Math skills needed to solve the problems on the test	**6**	**Cathy**, **Janet, Hanna**, Karen, Carter, Katrina,
Student's literacy skills and vocabulary	**6**	**Annie, Bridgette, Cathy, Janet**, **Mark**, Carter
Students' level of comprehension/cognitive impairment based on being on an IEP or having ADD or ADHD	**6**	**Bridgette, Hanna**, **Cathy,** Nina, Karen, Carter,
Students' developmental "readiness"	**5**	**Bridgette, Janet, Mark**, Katrina, Nina
What content has been taught, studied, and practiced previously and/or extensively	**5**	**Annie, Janet, Hanna**, Nina, Carter
Students' innate intelligence and love of math vs. students who struggle with math	**4**	Nina, Karen, Carter, **Janet**
Students' backgrounds and families and/or SES	**3**	**Cathy**, Katrina, Carter,
Students' Behavior	**3**	**Hanna**, Katrina, Carter
Exposure/knowledge base students came in with	**3**	Katrina, **Cathy, Janet**
Did they go to preschool?	**2**	Katrina, **Cathy**
Students strengths and weaknesses	**2**	**Bridgette, Mark**
Students' Confidence	**2**	**Janet**, Nina (*Hanna, Carter, and Cathy refer to confidence, but not as a cue*)
If a student is an English language learner	**2**	**Bridgette, Annie**
Teachers' ongoing progress monitoring	**1**	**Bridgette**
How solid students are with using manipulatives	**1**	Nina

Data Analysis

Seventy percent of the teachers interviewed (7 out of 10 teachers) reported using two cues: students' work and performance in class and on past assessments, and students' problem-solving and questioning skills. Sixty percent (6 out of 10 teachers) reported using three cues: math skills needed to solve the problems on the test; students' literacy skills and vocabulary; and students' level of comprehension/cognitive impairment based on being on an IEP or having ADD or ADHD. Fifty percent indicated the cues of students' developmental readiness, and what content or skill had been taught, studied, and practiced previously and/or extensively. Forty percent spoke of two cues: students' innate intelligence and/or love of math, as compared to students that struggle with math. Thirty percent of the teachers referred to three cues: students' background, families, and/or SES; students' behavior; and exposure/knowledge base students came in with. Twenty percent of the teachers reported using four cues: whether or not the students went to preschool, students' strengths and weaknesses, students' confidence, and if a student is an English language learner. Ten percent (1 teacher) referred to teachers' ongoing progress monitoring, and how solid students were with using manipulatives.

Cues Influenced by Mindset

Predominantly framed by Dweck's implicit theories (1991) and their cognition, affect, and behavior model (Dweck & Leggett, 1988), the influence of teachers' mindset on their cue-usage could be further analyzed to verify a connection between the specific research objectives (shown again in Figure 10) and the findings from the interviews. This analysis also allowed the researcher to assess whether the cues and/or mindset influenced judgment accuracy.

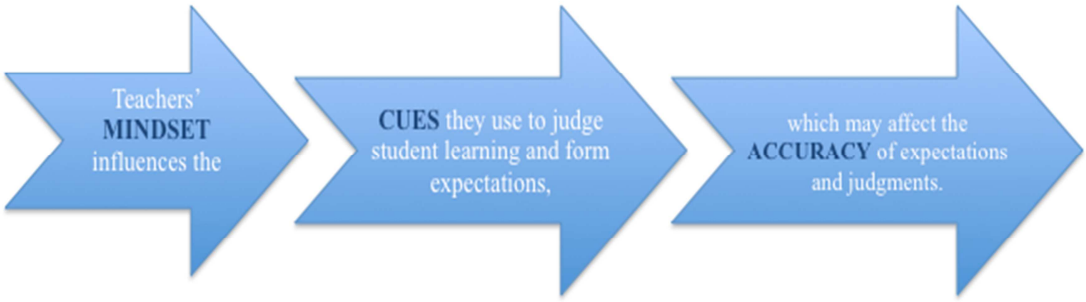

Figure 10. Graphic representation of study's purpose.

With the interviews more thoroughly coded for cue-usage as described in this chapter, the next step was to analyze if a teacher's growth mindset (GM) or fixed mindset (FM) influenced their cue-usage, and thereby potentially influenced the accuracy of teachers' judgment and monitoring of student learning.

Looking back at Table 6.3, the teachers' names in bold are those with a growth mindset, as measured by the Mindset survey implemented by this study. The researcher used the teachers' mindset score from March 2015 to analyze mindset's potential influence on cue-usage.

Table 6.4
Teachers' Mindsets

Participants: Teacher	(Blind) Anticipated Mindset	2013 Mindset	2015 Mindset
Carter	F	F	F
Katrina	F	F	F
Hanna	F	F	G
Nina	F	F	F
Janet	F	G	G
Karen	G	F	F
Cathy	G	G	G
Annie	G	G	G
Mark	G/F	G	G
Bridgette	G	G	G

Growth Mindset

Out of the seven teachers reporting the cue of students' work and performance in class and on past assessments, four were GM teachers. Six out of the seven teachers reporting the cue of students' problem-solving and questioning skills were GM teachers. Five out of the six teachers reporting the cue of student's literacy skills and vocabulary were GM teachers. The two teachers were GM who reported the cue of whether or not a student is an English language learner. The only teacher who explicitly said her ongoing progress monitoring was something she based her predictions off of had a growth mindset.

Teachers with a growth mindset spoke of forming their judgment cues on elements that predominantly reflected their students as individual learners and members of their classroom. They spoke realistically and optimistically about their students (Dweck, 2008). They spoke of making their judgment of student performance based on cues reflective of the students' learning and understanding of the content. These cues reflected the students' thinking and the teacher's knowledge of student learning and understanding (Carpenter et al., 1988). The students shaped these cues. GM teachers did not judge, but neutrally *perceived* students to have lower ability (Rattan et al., 2012). Overall, GM teachers did not label students as often as the FM teachers did. That said three out of four teachers were FM who used the cue of students' innate intelligence and love of math vs. students who struggle with math, potentially implying an influence of the teachers' growth mindset on their cues.

Fixed Mindset

Three out of the six teachers reporting the cue of math skills needed to solve the problems on the test were FM teachers. Three out of the six teachers reporting the cue of students' level of comprehension/cognitive impairment based on being on an IEP or having ADD or ADHD, were FM teachers. More FM teachers than GM reported the cues of students' innate intelligence and love of math vs. students who struggle with math; students' backgrounds and families and/or SES; and students' behavior. Fixed mindsets believe in fixed traits, and as a result believe they can accurately judge those traits (Dweck, 2006). Students' learning (and intelligence) is their responsibility, and if they don't have what it takes, so be it. Predominantly, the academic relevance of FM teachers' cues were established within very confining parameters, such as being "late bloomers," "not developmentally ready," or simply "not caring." The teachers shaped these cues by labeling students and/or defining them by their situations like poverty and "low" academic standing (Dweck, 2010a; Rist, 1970).

FM teachers' cues seemed almost as if they were based on how the students made the teachers feel, and the cue was the teachers' reactions to students without centralizing student learning or understanding of the content. FM teachers spoke of making their judgment of student performance and learning based on several diagnostic sources. Several based their judgment on static cues like innately low intelligence (Dweck, 2006), claiming a student is a "late bloomer who struggles mathematically…because of ADD." Similarly, several teachers based their judgments on students' lack of attention and poor behavior (Dusek & Joseph, 1983), and even excused them because of being medicated. Other FM teachers used the cue of whether or not a student showed any effort (Jussim &

Eccles, 1992). One FM teacher in particular focused almost entirely on family troubles and impoverishment (Rist, 1970) claiming “this boy struggles in math, but as far as I can tell he’s raising himself,” creating an overwhelmingly depressing and pessimistic future for students (Dweck, 2006, 2008, 2010a; Rattan et al., 2012), as well as communicating and promoting a helpless response pattern that students will notice (Dweck & Leggett, 1988).

A Tale of Two Teachers

As a point of interest, it would be wise to analyze mindset’s influence on cue-usage by following two teachers—one GM and one FM—to take a closer look at the cues they reported using and to look at them with their mindsets as the backdrop. Bridgette measured highly growth mindset on the mindset survey (4.6/1.2), and she reported these cues: knowing students strengths and weaknesses, students’ developmental “readiness” and age, past and recent assessments given, students’ work and performance in class, students’ problem-solving and questioning skills, ongoing progress monitoring, student’s literacy skills, and level of comprehension based on being on an IEP.

Katrina measured highly fixed mindset on the mindset survey (3.2/2.7), and she reported these cues: students’ developmental “readiness”; age; if they been to preschool; students’ understanding of math; home life and support; exposure to and experience with math; class behavior; and students’ work and performance in class.

Interestingly, Katrina and Bridgette’s cue-usage only overlapped twice—with students’ work and performance in class and on past assessments, and students’ developmental “readiness.” Otherwise, these teachers have different cues they reported using to predict their students’ performance (Table 6.4).

Judgment Accuracy Influenced by Mindset

These ten teachers were chosen as the highest GM and highest FM, and their judgment accuracy for math skills and for conceptual understanding ranged. The researcher felt this variability in judgment accuracy might allow for the analysis of how cue usage relates to mindset and accuracy in the absence of a pattern between mindset and accuracy within this sample.

Table 6.5
Teachers' 2015 Mindsets and Judgment Accuracy on Math Skills

Participants: Teacher	2015 Mindset	Judgment Accuracy: Skill
Annie	G	1
Nina	F	1
Cathy	G	.97
Hanna	G	.73
Karen	F	.68
Katrina	F	.63
Carter	F	.45
Janet	G	.33
Mark	G	.33
Bridgette	G	missing

Table 6.6
Teachers' 2015 Mindsets and Judgment Accuracy of Math Concepts

Participants: Teacher	2015 Mindset	Judgment Accuracy: Concept
Bridgette	G	.67
Mark	G	.6
Carter	F	. 5
Annie	G	.5
Hanna	G	.46
Karen	F	.46
Cathy	G	.45
Katrina	F	.27
Janet	G	.06
Nina	F	-.72

Looking at the above ranking of judgment accuracy scores in Table 6.5 and 6.6, it is clear that 3 of the 4 highest judgment accuracy teachers (top 2 from each table) are GM teachers. However, out of the two lowest judgment accuracy scores on both tables, 3 of the 4 are GM teachers.

Many of the cues reported were academically relevant and significant because they were based on academic proof of student learning, misconceptions, skills, and/or behaviors reflecting their academic profile as a student. Academic relevance serves as a determinant factor because of its value in cue-usage and its accuracy. Therefore, because so many of these cues were academically relevant, a distinct pattern between mindset and cue usage was hard to find. Teachers spoke of basing their predictions on current and previous grades, previous standardized test scores, and students' self-concept of math ability—cues based on academically relevant evidence that beget accurate judgments of student learning and monitoring (Dusek & Joseph, 1983; Jussim & Eccles, 1992).

Similarly, many of the reported cues were situated within the teacher's instructional practice and interactions with students to show how a teacher comes to know her students, and definitive patterns did not emerge between mindset and accuracy.

Summary

In summary, what emerged from extensive analysis of the interviews were 17 cues teachers use to make predictions of student performance. These cues included a variety of components, from academics and formative assessment to behavior and cognitive impairments. When these cues were examined against the backdrop of teachers' mindsets, a plausible connection could be seen. This connection alluded to the influence

of mindset on cue-usage. However, this connection was not as definitive as hoped for, and warrants further investigation.

CHAPTER 7: DISCUSSION AND CONCLUSION

The discussion will consist of several components: (1) an interpretation of Study 1, Study 2, and then both studies together, (2) the implications of the study, (3) limitations of the study, (4) recommendations for future research, and (5) the conclusion. Before diving into these components, below is a model describing the study's main tenets as supported by the teacher expectation and mindset literature.

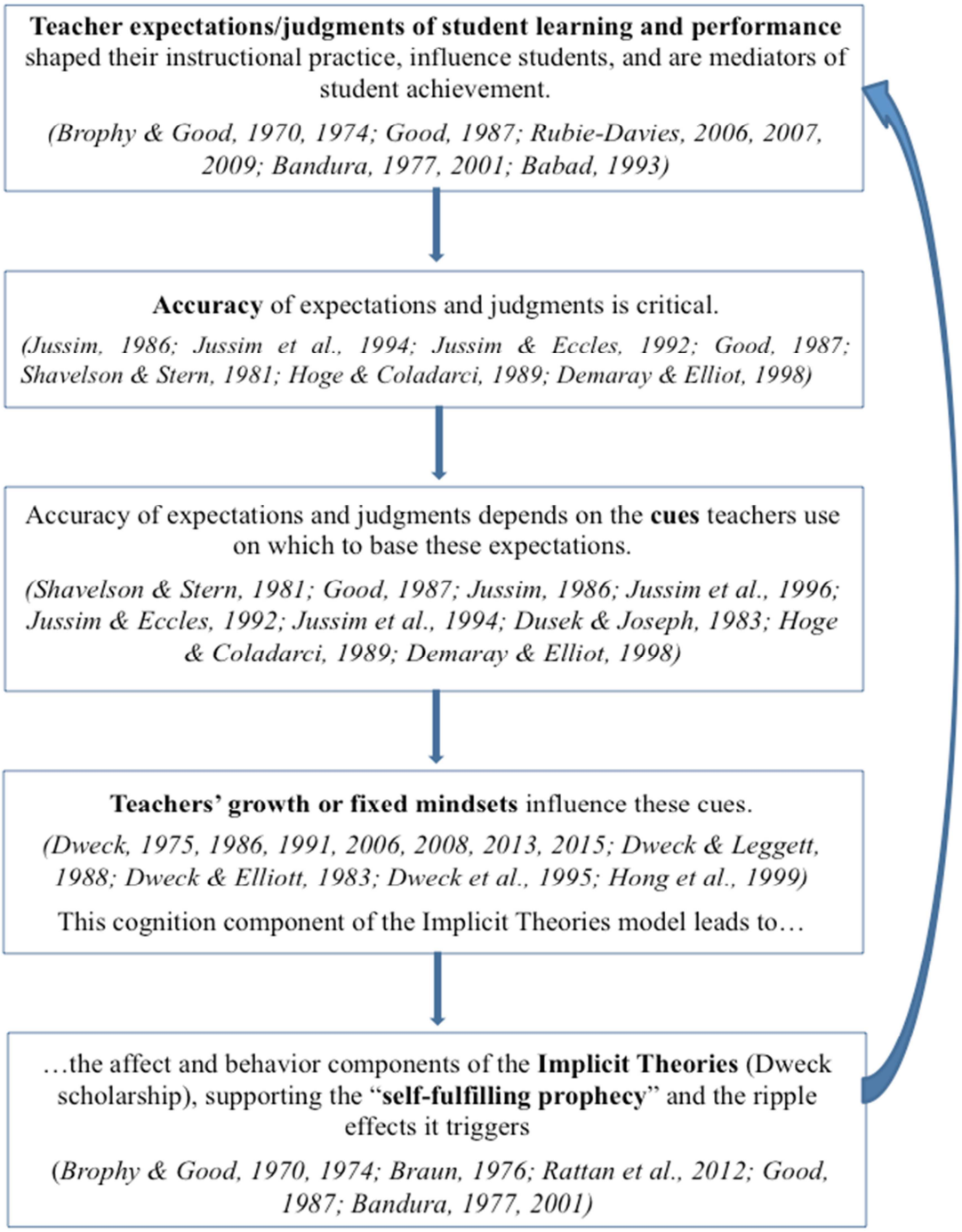

Figure 11. Graphic describing what the main tenets of this study are from the literature.

Interpretations of the Studies' Findings

Study 1

The purpose of Study 1 was to answer the following question: Is there a relationship between judgment accuracy and mindset? Study 1 found that there was a significant and positive correlation between growth mindset and judgment accuracy for skill ($r = .33$) and conceptual understanding ($r = .36$). In contrast, there was a significant and negative correlation between fixed mindset and judgment accuracy for skill ($r = -.30$) and conceptual understanding ($r = -.34$).

This means that if a teacher has a growth mindset, the teacher could be more likely to accurately predict students' math skill and conceptual performance. On the flipside, there was a moderately strong, but negative relationship between fixed mindset and judgment accuracy, meaning that if a teacher has a fixed mindset, the teacher could be less likely to accurately (and thereby more likely to inaccurately) predict students' math skill and conceptual performance. That said, data from Study 1 showed correlations, not causations. This study does not make the claim that if a teacher has a growth mindset, then he is guaranteed to be more accurate at predicting student performance. Just like this study is not claiming that if a teacher has a fixed mindset, then he is guaranteed to be more inaccurate.

The findings from Study 1 implied that mindset influences teachers' judgment accuracy. However, the question still remained after Study 1 as to why. The reasons behind the mindset/judgment correlations needed clarification.

Study 2

Accordingly, the findings from Study 1 laid the groundwork for the questions

behind Study 2—What are the cues that teachers use to make their predictions of students' academic performance? Does the teacher's mindset influence the cues used? Study 2 uncovered some of the cues teachers with a growth and fixed mindset use, giving rise to the affirmation of mindset's influence over such cues. However, this influence warrants further investigation. Of course mindset is not the sole influence, but the consistencies between the growth and fixed mindset teachers allows for a claim to be made.

Study 1 and 2 Combined

The layering of these two studies brings the notion of accuracy to the forefront. The findings of Study 2 brought to light some possible explanations behind the mindset/judgment correlations found in Study 1. Because a fixed mindset perceives intelligence as static and relatively immutable regardless of effort (Dweck, 1991, 2006, 2008, 2013; Dweck & Elliott, 1983; Dweck & Leggett, 1988), this might cause fixed mindset teachers to base their judgment cues on more teacher-centric and two-dimensional factors, such as the ones described above and in Chapter 6.

Basing their judgment of students' academic performance on inaccurate and/or academically irrelevant factors such as behavior, impulse control, the timing of their instruction regardless of students' comprehension of it, and socio-economic status (Rist, 1970; Good, 1987; Dusek & Joseph, 1983; Jussim, 1986; Jussim et al., 1996; Jussim & Eccles, 1992; Jussim et al., 1994), could plausibly cause fixed mindset teachers to make less accurate predictions.

Whereas growth mindset teachers might be more accurate in their judgment because they based their predictions of students' academic performance on accurate

and/or academically relevant factors, such as students' cumulative folders and academic records of performance, current grades, and the teacher's knowledge of student learning (Dusek & Joseph, 1983; Jussim, 1986; Jussim et al., 1996). It seems logical that a teacher who centers her instruction on her students will more accurately assess and monitor students' learning and performance because, most likely, that teacher uses accurate cues with which to do this.

That said FM and GM teachers overlapped in many of their cues (such as previous assessments and classwork, problem-solving skills, and math skills), confounding the influence of mindset on cue-usage. Additionally, the mindset/judgment accuracy correlation for this sample was premature optimism for this particular group. As an averaged judgment accuracy score, the group of ten teachers showed fairly accurate judgment. But the group did not show as strong of a correlation as the overall data of Study 1 did. Fortunately, however, the ten teachers did improve their judgment accuracy from the school years 2013 to 2015.

Though Dweck (2006) claims peoples' mindsets can vary in the degree to which they strictly align with either a growth or a fixed mindset, categorically speaking Dweck claims people are typically one or the other with slight variability in between. However, this study would like to acknowledge the fact that a growth or fixed mindset is not set in stone, or a black and white categorization, and quite possibly not precisely measured by the Mindset Survey in this study. Instead of being conceived as dichotomous categories in this study, these mindsets can be thought of having the possibility of blending. It is the belief of this researcher that the Mindset Survey used in this study lent itself to such a blending.

Could it be that since a fixed mindset's main concern is being judged (Dweck & Leggett, 1988; Dweck & Elliott, 1983; Dweck, 2006), some of these teachers answered the Mindset Survey with what they thought would be the "right" answers to make them appear more growth minded? This is a common problem and limitation of self-reporting on surveys. Explained another way, the completion of the Mindset Survey by several teachers could be based on how the consensus would probably answer these questions (Rokeach, 1960). Estimating and wondering about how many other teachers hold such basic beliefs (Rokeach, 1960) could have driven these teachers' responses.

Because in fact, some of the teachers' responses to the in-person interview questions may have revealed their core beliefs (showing a fixed mindset) that are related to one's self-concept (just like Dweck's implicit theories explained in Chapter 2) and conceptions of others (Rokeach, 1960; Dweck, 2006) while their survey answers revealed their peripheral beliefs (Rokeach, 1960) that emerge from more formal, learned content of one's beliefs about something like intelligence and creativity, and what would be the *appropriate* answer.

For example, Hanna's 2013 Mindset Survey score showed a significantly fixed mindset (3.2 GM/2.7 FM), while her 2015 Mindset Survey score showed a significantly growth mindset (4.3 GM/1.8 FM) as seen Tables 7.1. Because these teachers were involved with a year-long professional development that focused on improving teachers' monitoring of student learning, one could argue that changes in mindsets as measured by the Mindset Survey were reasonable in teachers participating in this professional development, such as Hanna. This shift in mindset demonstrates how mindsets could

change with the deliberate goal of such change (Blackwell et al., 2007; Hong et al., 1999; Dweck, 2006, 2008, 2012, 2013, 2015).

However, there is more to this story. It must be noted that these studies cited above involved extensive and deliberate "belief intervention" (Dweck, 2008, p. 391) for teachers and students. These interventions aimed at changing one's core beliefs (Dweck, 2008; Rokeach, 1960) that lead to personality changes when shifting from a fixed to a growth mindset at the core. Therefore, the professional development the teachers in this study participated in was not the "belief intervention" that Dweck (2008) describes as necessary to bring about the change that such "consistent patterns of experience and action that are central to the case that personality can be changed" (Dweck, 2008, p. 392).

This calls into question for this particular teacher, Hanna, the issue of only peripheral beliefs (Rokeach, 1960) changing as measured by the survey. Her peripheral beliefs about intelligence and creativity are based on more formal, learned content of one's beliefs, and would involve giving more of the *appropriate* answer than what her core beliefs rest on (Rokeach, 1960). Her change from fixed to growth as measured by the survey could explain the anomaly described above, where her interview revealed a more fixed mindset person (her core beliefs), while the change in her survey score measured the peripheral beliefs that underwent a change from 2013. A personality change, as Dweck's scholarship describes, at the core level of beliefs has not occurred, as evidenced in her responses to many of the interview questions, just like Janet's situation. Therefore, both Hanna and Janet demonstrate how a teacher's mindset as measured by this survey might not explicitly predict their cue usage with which to judge student

learning, nor their instruction and feedback. Their core beliefs may not have changed, only their peripheral beliefs

In summary of this closer examination of interviews, it became very apparent that there was a discernable alignment with teachers' mindset and their cue-usage. Yet the few teachers where this alignment was not as discernable were the ones whose mindset—as measured by the survey—and responses to many of the interview questions showed a contrasting relationship. The interviews provided more of a window into a teacher's core beliefs rather than the Mindset Survey that seemed to show peripheral beliefs. Also relevant is the fact that these two teachers'—Hanna and Janet—judgment accuracies declined from 2013 to 2015, as seen in Table 7.1. This suggests that the cue-utilization for monitoring student learning could be influences by one's mindset, thereby suggesting that one's mindset could influence one's accuracy of monitoring and judging student learning and performance. Clearly stated, cue usage affects judgment accuracy, and judgment accuracy relates to mindset, and therefore, it seems reasonable to postulate that mindset affects the cues teachers use to judge student learning, which were the combined purpose of Study 2.

Implications

The current study has social change implications. For instance, the study contributed to the research base concerning the impact mindset has on teacher judgment and thereby expectations—specifically that a growth mindset (even a growth *oriented* mindset) is more conducive to cues that empower students. Furthermore, the results of this study imply a connection of mindset and cue-usage, and how this could parallel the cognition-affect-behavior model of Dweck (2006) and colleagues' implicit theories.

Therefore, an additional social change implication is that a growth mindset (even growth oriented mindset) may have the potential to help address important achievement gaps between those students for whom a teacher maintains low expectations and high expectations. The following section discusses these implications for social change in more depth.

To begin, reflective cues appear to be more empowering and motivating for students *because* the students and their learning shape them. Because GM teachers more prevalently used RFC's to monitor their students' learning and make their predictions, generally speaking this is more likely to set off a positive chain of events leading to mastery-oriented behavior in pursuit of learning goals (Dweck & Leggett, 1988). A connection between using RFC's and the teacher's use of strategic feedback (CKF) seem to be more encouraging of future learning (Rattan et al., 2012).

On the contrary, reactive cues (RAC's) appeared more demotivating because the *teacher* shapes them rather than the students. Because FM teachers more prevalently used RAC's to make their predictions and monitor their students' learning, generally speaking this is more likely to set off a negative chain of events, leading to a helpless behavior response in pursuit of performance goals (Dweck & Leggett, 1988). A connection between using RAC's and the teacher's use of unidirectional, correct answer feedback seems to be more pessimistic and disabling of future learning. This is similar to Rattan and colleagues' (2012) study where they called it *comforting feedback* that aimed more at than promoting more effort in students, and what Cooper (1979) referred to as *affectively valanced feedback* communicated to low-expectations students that include more

criticism than praise, resulting in students exerting less effort and thereby sustaining weaker academic performance.

It seems logical that a teacher who centers her instruction on her students will more accurately assess and monitor students' learning and performance because, most likely, that teacher uses accurate cues with which to do this. However, that is not to say all reactive cues are inaccurate or misleading. Certainly there is validity to the teachers' use of reactive cues such as a student's literacy problems or development issues, because these situations could lead to academic stumbling blocks if left unattended. But rather than label them diagnostically within the confines of entity theory, teachers can be more effective when they see these as opportunities for growth. Yet when teachers' base their perceptions and evaluations of student learning solely on *reactive cues* that are mainly shaped and driven by the teachers' reactions to their students, teachers detrimentally label and categorize students, expecting them to stay in those categories.

Mindsets are contagious! Students perceive them, and their performance can reflect them (Dweck, 2010a; Rattan et al., 2012). Most of the FM teachers seemed more pessimistic, defensive, and depressing. GM teachers seemed more optimistic. They saw the child more holistically, whereas FM teachers could not distinguish between students as individuals and students as defined by their families of origins or by their innate abilities (or lack thereof). Some teachers in this study seemed to perpetuate the self-fulfilling prophecy and low expectations by giving no credit to their students for the intelligence and (coping) skills they do have. They block these attributes from even coming to the surface with of their chronic helpless, maladaptive behavioral response that demotivates students.

The implications behind this study (or any part of this study) are not intended to vilify or debase fixed mindset teachers. Making less accurate predictions does not automatically make for poor instruction, and it is not to say that all teachers with a fixed mindset make more inaccurate judgment of student learning. Nor is it to say that a fixed mindset teacher is therefore a bad teacher. In fact, fixed mindset teachers can be effective instructors. This study implies that perhaps with a shift to a growth mindset, these fixed mindset teachers could be even more effective.

Potentially inherent in these social change implications is the possible link between low expectations and fixed mindset, and high (realistic) expectations and growth mindset. As discussed in great detail in Chapter 2, expectancy effects research demonstrated how the process of teaching led to a change in the product of student achievement, thereby demonstrating expectancy effects. Teacher expectations were defined in the expectation literature as teacher perceptions about students' performance and aptitude (Brophy & Good, 1970; Weinstein, 2002; Rubie-Davies, 2014). This current study expands upon that definition by turning the element of perception into the practice of making predictions to then be analyzed for its ***accuracy***, thereby getting at the heart of the matter and the driving force behind expectations. Are low expectations teachers more aligned with a fixed mindset? Are higher expectations teachers more aligned with growth mindset?

The answers to these questions may help contribute to closing the achievement gap between those students who are *accurately* and those who are *inaccurately* perceived, predicted, and then destined to perform academically a certain way. After all, a self-

fulfilling prophecy is "a *false* definition of the situation evoking a new behavior, which makes the original false conception come *true*" (Merton, 1948, p. 195, italics in original).

With its heavy reliance on and obsession with performance goals (assessments), has America's education system as a whole fostered, perpetuated, and encouraged a fixed mindset? Is the alphabet soup of standardized testing (ISAT, IRI, ACT, etc.) creating a fixed mindset culture? Since the main concern of a fixed mindset is being judged, while that of a growth mindset is improving (Dweck, 2008), shouldn't we be headed in a growth-oriented direction? This era of accountability certainly has it merits and teachers need to be accountable. Yet rather than being held accountable as measured by a *performance goal* score on a test (fixed mindset), why not be held accountable as measured by a *learning goal* demonstrating students' improvement of intelligence and competence?

Limitations and Assumptions of the Study

This study recognizes its small sample size for Study 2 (n = 10 teachers) as a possible limitation. Using this stratified, convenience sampling process could pose a limitation and thereby restrict the generalizability of the results to other school districts and to other populations of teachers and students. This sample containing teachers with a loose correlation of mindset and judgment accuracy could also be a limitation. The sample did not represent the data from Study 1. This was chosen as a way to check for patterns, but it served as a limitation in the end.

Additionally, the sample was a homogenous group of teachers from one school district who had all participated in professional development in monitoring student learning, which may have influenced the results. It will be important to interview and

observe other teachers with a more diverse sample to assess the scaling and applicability of the primary and secondary codes. This is planned for a future study.

The assumption for Study 1 is that the teacher participants completed their predictions of student performance to the best of their abilities. The assumption for Study 2 is that teachers answered each interview question honestly and with thoughtful reflection. The other assumption for Study 2 is that teachers completed the Mindset Survey in a way that authentically reflects their mindset, free of any popular bias of how one "should answer."

Recommendations for Future Research

This current study focused on teachers' mindset impacting the cues they use to judge student learning and performance, and the accuracy of these cues. Because this study only involved teachers predicting their students' scores on the mathematical skill and concept test, a logical future study would involve interviewing the same teachers after their judgment accuracy was calculated and the teachers would examine their predictions compared with students' actual scores. More specifically, teachers would have the opportunity to evaluate and reflect on their own predictions and their accuracy *with* students' actual scores in front of them. This valuable second interview would allow for conversations about teachers' understandings of individual students, the cues behind their accurate or inaccurate predictions, and this overall experience.

This entire research plan for a future study should also be conducted at the beginning of the school year, when teachers have only had minimal time with their students. This could allow for a more gut-reaction type of cues teachers reveal, adding to the research on cue usage and teacher expectations.

Another recommendation for future research includes developing interview protocol questions targeting certain cues that emerged in this current study. By creating separate and specific questions aimed at uncovering the codes, the interview could succinctly and efficiently yield more relevant information.

Another recommendation for future research involves classroom observations of the teachers following their interviews. Teacher observations could verify if and how what they described in the interviews aligns with their instructional practices and interactions in the classroom. This research could then unearth if and how a teacher's mindset manifests itself and/or is revealed through their pedagogy, feedback, and interactions with students. This study would also include doing a members check with the teachers to review the researcher's field notes from the observations together.

Conclusion

The accuracy of a teacher's judgment of student learning and performance fundamentally trumps all. Therefore, the veracity and academic relevance of *what* teachers base their academic expectations on—regardless of whether high or low—is the antecedent to the accuracy of expectations and judgments of student learning and performance. The purposes of this study were to explore the cues (the reasons, the bases) teachers use to form their judgments and to analyze whether these cues influenced teachers' judgment accuracy. Additionally, this study explored whether or not a teacher's mindset further influenced cue-usage. Evidence from this study uncovered how teachers with a growth or fixed mindset used both similar and different cues on which they base their judgments and expectations of student learning. This is not to offer a gesture of generalization, as two teachers in particular displayed very divergent mindset/cue usage,

and some teachers from both growth and fixed mindsets reported hybrid elements. Yet overall, evidence from this study makes a unique contribution to the research, in which a teacher's mindset is an influential factor on cue usage for judging student performance and learning, and growth (oriented) mindsets evidenced more appropriate, academically relevant, and student-centric cues.

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APPENDIX A

ITML Test of Mathematical Skills and Concepts: Grade 2

Directions for Part 1: *Please answer each question. (Teachers may read items to students if necessary).*

1. What number comes next? **86, 87, 88, 89, ____**	
2. What number is missing? **78, 79, ____, 81, 82**	
3. What number comes next? **63, 62, 61, 60, ____**	
4. Solve: **11 + 12**	
5. Solve: **12 - 3**	

6. What number belongs in the missing space so both sides add up to the same amount? **9 + ___ = 1 + 9**	
7. What number belongs in the missing space so both sides add up to the same amount? **14 + 2 = ___ + 3**	
8. What number belongs in the missing space so both sides add up to the same amount? **7 + ___ = 8 + 2**	
9. Tammie has 24 toys. Her friend gives her 7 more toys. How many toys does Tammie have now?	
10. There are 26 cookies on a plate. If you eat 9 cookies, how many cookies would still be on the plate?	

APPENDIX B

ITML Test of Mathematical Skills and Concepts: Grade 4-5

Directions for Part 1: *Please answer each question.*

1. Solve: **12.6 + 7.8**	A. 19.4 B. 20.4 C. 25.1 D. 19.14 E. Other	
2. What is the value of the digit 4 in the following number? **241**	A. 4 B. 10 C. 40 D. 41 E. Other	
3. Solve: $3\frac{4}{8} - 1\frac{5}{8}$	A. $\frac{7}{8}$ B. $2\frac{1}{8}$ C. $1\frac{7}{8}$	D. $4\frac{9}{8}$ E. Other
4. Which number belongs in the missing space so this is true? **14 + 5 = ___+ 6**	A. 19 B. 25 C. 15 D. 13 E. Other	
5. Kyle ran 3.4 miles. Janice ran 3.38 miles. Who ran the farthest?	A. Kyle B. Janice	

Directions for Part 2: *Read each question and each part to determine whether the statements are true or false.*

6. Here is Tanner's method to solve $\frac{4}{8} + \frac{3}{4}$. Which comment is true: A. $\frac{4}{8} + \frac{3}{4} = \frac{7}{12}$ so his answer is correct. B. His answer is less than it should be. C. His method will always work. $\frac{4+3}{8+4} = \frac{7}{12}$	A. B. C.
7. Which statement is correct about the number 179.6? Select ***only one*** statement you think is correct. A. There are 17 tens in 179.6 B. 179.6 is closer to 179 than 180. C. 179.4 is greater than 160 + 19.4 D. The digit 7 has a value of ten.	A. B. C. D.
8. To the right is Madison's method to solve 232 – 136. Could Madison's method be used to solve 245 – 135? 200 − 100 = 100; 30 − 30 = 0; 2 − 6 = −4; 100 + 0 − 4 = 96	A. Yes B. No
9. Allie shows this to explain how she knows that 56 + 48 = 55 + 49. Is Allie correct? 56 + 48 = 55 + 49 (−1, +1)	A. Yes B. No
10. Which method shows the correct way to solve: $\frac{3}{4}$ **x 2** A. $\frac{3}{4} x \frac{2}{2} = \frac{6}{8}$ B. $\frac{3}{4} + \frac{3}{4} = \frac{6}{4}$ C. $\frac{3}{4} + \frac{3}{4} = \frac{6}{8}$	A. B. C.

APPENDIX C

Mindset Survey

Mindset

Please indicate your level of agreement with the statements below.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Your level of intelligence is highly related to the amount of effort you put into learning information.					
You have a certain amount of math intelligence, and you can't really do much to change it.					
You have a certain amount of physical ability, and you can't really do much to change it.					
You can change the amount of talent you have in various areas with effort.					
You have a certain amount of talent, and you can't really do much to change it.					
Not everyone can be smart at math.					
No matter who you are you can significantly change your intelligence level.					
With effort you can change your math ability quite a bit.					
You have a certain amount of creativity, and you can't really do much to change it.					
Your level of creativity is highly related to the amount of effort you put into cultivating it.					
You can learn new math skills, but you can't really change your math intelligence.					
Intelligence is a process and can be increased over time.					
Your level of intelligence can change with effort.					
Your level of creativity can change with effort.					
The brain is like a muscle, when it is stretched/challenged, it grows					
Your math ability is something about you that you can't change very much.					
You can learn new things, but you can't really change your basic intelligence.					
You can learn new things, but you can't really change your basic creativity.					

Statements or scenarios 1, 5, 6, 11, 12, 15, 16, 17, and 18 reflected a growth mindset, and statements or scenarios 2, 3, 4, 7, 8, 9, 10, 13, and 14 reflected a fixed mindset, obviously to a varying degree in each, due to the Likert scalability of each teacher's response.

APPENDIX D

Interview Protocol

Interview Protocol for Teacher Judgment/Mindset Correlation Dissertation

Step 1:

Teachers will have already taken the Mindset Survey **before** I interview them.

Step 2:

Teachers will have a class roster with all of their current students' names listed on it. They will also have a copy of the ITML math assessment to look over. After doing so, each teacher will predict how each of his/her students will perform on the ITML math assessment. Each teacher will write down the number of correct answers that she/he predicts each student will score. Each teacher's score will reflect this judgment of students' total correct answers.

Step 3:

Depending on the mood/teacher/vibe, I will either have the teachers make their predictions without me posing any questions until they are finished with their predictions, or I will gradually begin to ask them interview questions while they are making their predictions.

Step 4: Interview Questions

1. Please state your name and today's date.
2. Please tell me where you work and which grade you teach.
3. How many years have you been working as a teacher?
4. What does it mean to you to be a teacher?
5. How would you define *prediction*?
6. Describe what cues you are using to judge your students' performance. What are you basing these prediction scores on?
7. To what extent do your math lesson planning and instructional practices center around **your** explanation of the concepts/content?

8. To what extent does your math lesson planning and instructional practice center around your understanding of **students'** thinking*? (For 7 and 8, I'm getting at whether the instructional focus is on the <u>product</u>—the transmission of knowledge to students, like through repeated practice, or on the <u>process</u>—the construction of knowledge by students.)*
9. How do a student's background, culture, and/or family determine his or her intelligence?
10. As your students learn new concepts and content, do you think they change their intelligence?
11. In what situations does *effort* matter to you in school or teaching?
12. During your lessons and discussions, to what extent do you carefully explain the correct process or procedure to avoid students making mistakes? (*I'm trying to get a sense of a teacher's sense of and need for **control***.)
13. During your lessons and discussions, to what extent do you want to bring about student misconceptions (*as learning opportunities for a student and whole-class or small group discussions-- get a sense of a teacher's sense of and need for **control***)?
14. In what situations are you comfortable with students choosing and talking about the methods they use to solve problems?
15. In what situations are you more comfortable with students working individually on the assignment you assign?

Step 5:

After each teacher is finished making his/her predictions, I want to review the predicted scores with him/her. Looking at their scores, I will point to a student who is predicted to do really well (ex. 4 out of 5, or 5/5 score) and one who is predicted to do really poorly (ex. 0/5 or 1/5) and ask the teacher to describe the difference between the students.

16. How do you know this student won't know this content? How do you know this student will? *(For this question, see if the teacher uses different cues to make predictions in Concepts and Skills sections of ITML test.)*

17. For this student you just gave a 0, 1, or a 2 to, how would you respond to them when they answer a question like this one incorrectly in class? (Then I would point to a question from the ITML test that the teacher just made predictions on.) *(I'm looking for product feedback —teacher gives right answer to student, or process feedback—teacher explains or reviews the cognitive or behavioral processes that student should go through to come to correct answer. The product feedback also connects to fixed mindset person whose main concern is being judged, and the process feedback connects to growth mindset person whose main concern is improving.)*

APPENDIX E

Interview Transcriptions

Transcribed interview with BRIDGETTE

BW: Please state your name and today's date.
BRIDGETTE: Bridgette, and today is March 9, 2015.

BW: Please tell me where you work and which grade you teach.
BRIDGETTE: I work at Piper Elementary, and I teach first grade.

BW: How many years have you been working as a teacher?
BRIDGETTE: I've been teaching about 15 years

BW: What does it mean to you to be a teacher?
BRIDGETTE: I feel like I've been given the privilege to be a part of something very special in the children's learning to help them understand how the world works, how to learn why were at school, what we can do with what we're learning; how important education is and to help them use their imagination and have fun with learning. And also to dig deeper in their learning, so that they can challenge themselves. It's a gift. I love coming to work with these kids every day. It really is fun. Some days more than other; but it's a reward.

(*Then while she's making her predictions*)…
BRIDGETTE: Out of the front five questions, only one student would not get five out of five. They all should be able to get that 5/5.

BW: What about that one student who wouldn't get a five out of five?
BRIDGETTE: You know, it's like she's at a kindergarten level and her parents forced her into the first grade. So a lot of times, this type of problem solving... she's not there yet. So I'm just guessing that she could probably get it wrong and she would probably get a 3/5 or 4/5. Counting backwards is hard for her, so this problem she might miss (*pointing to a particular problem on ITML test*). Everybody else should be able to get that. Unless they just make a silly error, like instead of saying 11 they said 12. But other than that, they should all get it.

BW: And what are you basing those predictions off of?
BRIDGETTE: Well, first of all, I think that's fairly easy (on the front of the test). I don't want to use that word, *easy*, but they're at a level where they should be able to get a five out of five. I've given similar assessments and they've all answered it correctly. And then I look to see how they work in the classroom. But I think it's fairly simple work for them to do. Maybe at the beginning of the year, I would think differently. But at this point in the year, I'd say most all of them will get it. Now there are still some that do a reversal of numbers. They might put 14 instead of 41. I'm seeing a lot of that lately, especially with that one little doll! And I have progress monitoring for this because she does this a lot. And I've spoken with her parents about it and I think I've talked them into having her do first grade over again… She can barely even use scissors.
So now let's switch to the back. I know these four students would make errors on this side. Three of these four are in progress monitoring, and one I've had just move over

from a different classroom. I'm learning how he's doing in math. I know he's capable, but I'll have to wait and see because he makes mistakes because he's not being careful. Same with these three—they will get 3 to 5, and this one will get 4 to 5. I'm saying this because I'm seeing how they're solving other types of problems I've given them. And they have to go back, and these three are just not there yet. And then for a few students, a story problem is hard for them because they have to re-read it and do it over. They say that they only know the answer, but then they say, "ohhhh", and they have to do it again. Some students, I don't have to read the story problems to them out loud. But with other ones, I do have to read everything. These two in particular- so that's what I would guess.

BW: So let's compare these students—this one here you gave 5/5, and this one you say would get 3/5. Tell me why these scores?
BRIDGETTE: Some are more immersed in the language, so if we did an assessment of language at the beginning of the year, they'd be able to repeat what you said and absorb that and be able to have that comprehension of language where they know what you said and how to answer it. But for some, it just goes right of their head. So in math, it's hard for them with story problems, where they have to do some extra thinking or multiple steps like adding one side first before making both sides are equal to (=). Some are just a bit younger. Some are just more immersed in language and some are just younger. And especially, I don't mean to pick on boys, but a lot of times the boys are younger. Sometimes that can have something to do with it. I have three boys that are very young- that doesn't mean they necessarily have a problem with math. In fact, one's very strong in math; he just has a problem with writing and giving me an equation with this math problem. He wouldn't be able to give me an equation with appropriate signs, but he'd be able to tell me the answer nine times out of 10 and talk about it… you know, what's going on versus I have another student who is just not there when it comes to the language component and understanding what you're saying.

BW: Is that related to native languages and ELL's?
BRIDGETTE: No. I have one on an IEP and one that is getting put on an IEP. I also have two girls and I just have to repeat the problem and then they understand it. If I questioned them on it and pull back and say, "let's read this", then they get it. They don't need manipulatives as much as they need to think it through.

BW: How do you define *prediction*?
BRIDGETTE: Well, I always feel guilty when I predict because I should be able to think each student will get 100% because high expectations are really important. There is reality and that's the way I look at it-- it's the reality based on what I've seen them do. I have to be realistic even though it says "sky's the limit"! In fact, we're doing a lot of the missing addend story problems, but they're not able to do other things like equality or even knowing your numbers. So prediction is being able to accurately assess how they would perform with skills (and in this case math). When they show me the performance sometimes, they may not be able to show me with writing, but they could tell me and that's as equally important because I know in their head that that was going on.

BW: Thinking about your lesson planning and instructional practices, how much do they

center around your explanation of the content and how much do they center on the students' understanding?
BRIDGETTE: Well, my explaining I try to do at the beginning of the lesson, like when I'm stating the objective. I might give them a sample and then show them the sample and show how a student last year did it, and maybe have it be a little bit off or wrong and see if they catch that to make them think. And sometimes I'll call students up and have them work on a similar problem. I've had to do math centers this year because I have too many students that race through their work. I level in math but because I've got those students that race through it, those are the ones that I need to challenge. But I need to pull them aside and have em in small groups to be able to do that. I get to keep the others busy and let them guide their learning, like maybe they need to step up like if we're doing units of four and they're building 40, and they show me that that's four, 10 times and how do you put that in an equation? So that's four times 10. And I have some students that do that and they're guiding that.

BW: And for the ones you just described as finishing really quickly, is their work correct?
BRIDGETTE: Yes! I have about five that are like that, and it's growing more and more every day. I have the ones I told you about that are struggling and need extra help. And so I have my high ones help these ones. But they either get it or they don't get it. It's that black-and-white.

BW: What do you think that's about- that they get it or they don't?
BRIDGETTE: Well, it depends on the lesson. Like some of them understand things like decomposing. But some of them get lost in the abstract. I believe our textbook can be a bit abstract. And so just because they've moved on to a new problem, they understand it more than they think, but it takes me or someone to help them just so they can get it. And then to show them the sample to go along with the objectives, and then they get it. But sometimes it takes a lot more one-on-one with those particular students.

Transcribed interview with Annie

BW: Please state your name and today's date.
ANNIE: I am Annie, and today is March 9th, 2015.

BW: Please tell me where you work, which grade you teach, and how many years have you been working as a teacher?
ANNIE: I am at McDonald elementary and I am a second grade teacher. I have been teaching for five years.

BW: What does it mean to you to be a teacher?
ANNIE: I think for me, because I had a whole life before I was a teacher, part of the fact I became a teacher was because I have my own daughter and I wanted to be able to be there for her more often. But the other part is that I've always enjoyed teaching people, and so when my daughter was born, I went back to school to get my elementary education degree. The most important thing for me is to feel like I'm making a difference in their education.

BW: How do you know this student won't know this content? How do you know this student will? (Annie's looking at the predictions she made.)
ANNIE: We studied this format extensively. And I only have one student, well 2 that might miss 1 or 2. Everyone else will get 5/5 on this front side. On the backside, the story problems, um, those same two students will have difficulties. Literacy plays a factor into that. For one of them, it's more than that. It's English language barrier. The other one, I have been doing extensive interventions on counting and that student is still struggling. All the other ones will get it right, 5/5.

BW: By that you mean five out of five?
ANNIE: Yes.

BW: For those two that will not get five out of five front and back, is it just the language piece, or is anything else factoring into that?
ANNIE: The one is the language barrier and he's also, well because of the language, he's also struggling in other areas including math. So he wouldn't even be able to read the questions. Because we practice that format all the time, he might be able to figure it out. But he gets easily confused even by the symbols that are used to represent math in English. I don't even know if the symbols are the same in Spanish. My other one is actually having difficulty with counting; even moving objects one space to another. It's moving manipulatives one place to another and he cannot keep a number. So he's not even able to count moving objects. Just a simple act of counting from 1-100, we're still working on.

BW: And with this process of looking at your students and predicting how they are going to perform on the math test, how would you define prediction?

ANNIE: Well, prediction, which we talk about all the time, is an educated guess of what you think is going to happen. I always tell my students there's no right or wrong in making a prediction. It is just your best guess as to what you think might happen.

BW: Can you hone in specifically on what cues did you use and do you use as a teacher to make such predictions of students' performance?
ANNIE: You mean how do I know they will do well on this? Well for this front side we studied this format all the time. I have the technology and the clickers and flip chart with these exact formats that I created this summer. And we practice them daily. I send it to them on their quicker, they respond back to me, and I can see who is getting it correct and who is not correct. So almost in a way, it's not really a prediction because I know who's understanding and who's not.

BW: If I was to point to one student on your roster, what are the first things that come to mind on which you based your predictions?
ANNIE: Well that one student that you just pointed to is a GT (gifted & talented) student. So I am constantly thinking of how I can challenge him. That's all I ever think about with him – how am I going to push him as far as I can. When I'm giving the other students something like this test, I would put an extra number on the front of this number and I'll make it three digits on each side of the equation. I am always making it harder for him. So that's what I think about when I see him. He needs to be challenged so I want to push him as far as I can.

BW: Okay let's think of a test or even just a quick assessment that maybe is harder and less familiar content. And let's pick a student that maybe you would give a three out of five or even a two out of five. What are some of the factors that play into your 2/5 predictions?
ANNIE: Um, I would think that if this particular student got only a two out of five, it was because they didn't read the question carefully. I feel very confident that my kids can solve the problems if they understand what it's asking. I think that's when a lot of misconceptions occur during testing. It's because the wording is never the same, the format is never the same. So for this student, I would think that would be the only reason why.

BW: To what extent does your math instruction center around **your** explanation of the math of new math content or strategy?
ANNIE: I'm always doing direct instruction for math. I do small group direct instruction also, and I do direct instruction for math. While I'm doing that, I'm walking around adding things to the kids that need it, trying to help the kids that the math is a little bit more difficult for. So I guess I am always thinking about all those things at the same time, and I'm always trying to challenge the kids that need to be challenged and also help the kids that are struggling, which has become more difficult this year with the class of 30. So it's gotten really hard this year for me. But I do a lot of… well, it's forced me to do more direct instruction this year than I have previously. I like doing the smaller groups because I can give them more one-on-one attention, but it's just not possible this year with such a big group.

BW: If you're doing more direct instruction and you're noticing maybe half the class is isn't quite where you wanted them to be as far as understanding the lesson, how do you handle that?
ANNIE: Well for example say we're adding two digit numbers and I see half the class has got it and the other half does not, that's when I traditionally will break up and have my kids that have a really solid understanding and have them, of course, do more independent practice to make sure they understand it. But then I would also want to push them on to do something more challenging like adding three, two- digit numbers or 3-digit together. But I don't know if that creates more work for me in the long run, because then does that divide get bigger? It kind of depends. Sometimes kids just need a little bit of extra help to help them catch up to the other ones. Yep that's pretty much what I do. I try to pull those other kids as much as I can to do the extra work with them. I don't ever let the kids sit idol and do nothing. They're always being challenged.

BW: With that being said how does effort play a part in your teaching, in your interaction with students?
ANNIE: I think there is one thing about math that has always irritated me and I try to convey this as a teacher and that is there a lot of teachers have a negative attitude towards math. And I think if you have a negative attitude towards math, it's going to relate to what the kids think about math. So I am always so excited about teaching math. I mean I love teaching math. It's one of my favorite subjects. so I think my enthusiasm rubbed off on them and they put forth more effort. Do I still have the students who don't like math? Yeah, I do. I still have a couple of kids that are just not thrilled about math. But I pay more attention to them and they probably like that! But I pay more attention to them to try to get them excited about math too. In the long run if a kiddo decides that he doesn't want to put forth the effort into learning math, it can be a factor. So yeah, they have to try but I think it's my job to make sure that they are excited about it.

BW: Do you see effort as connected to intelligence?
ANNIE: No, I don't think that is true. The reason being is because I know kids that don't want to put in the effort to do it, but they are very intelligent. It's kind of about what you have to engage them. It comes back on me. You have to get them excited about it and you have to find that point that's going to make them want to participate and give any effort. That comes back on the teacher. I would almost consider myself that student when I was in school. I consider myself to be very intelligent and I never tried in school. I tried to skate by as much as I could because it's like why do I want to try? Why do I have to do that? And my daughter unfortunately is the same way. Do I know she's intelligent? Yes, but it's about finding out what is going to engage them and make them interested and care about their own learning.

BW: On the flipside of that, if you have a student who does not understand the concept or who is just struggling in general, do you think that with effort they can grow their intelligence?
ANNIE: I guess it depends on how you define intelligence. Do you say intelligence is something… I mean I just think anybody can learn anything. I really do. Are there cases

where people who are cognitively unable to learn something. Yes. But overall I think if you want to learn something and you have the determination and drive to learn it, you can learn to do anything you wanted to do. So in the end, it comes back on me, the teacher. I always think that if they are trying to learn something and they don't get it, it's because I did not present the information to them the right way that reaches them. So it's about me adjusting my teaching to reach them. To make it engaging to them so they can understand what I'm teaching. I know there are days when I am not speaking the same language that they're speaking. So then it's time to change it up a little bit! But yes, I think they can grow. They just have to want to do it.

BW: Thinking about student backgrounds and cultures and families, how do those factors play into intelligence?
ANNIE: Unfortunately it's a huge factor. I think if you have two students that are intellectual at the same place, and you get one who goes home every night that has food in their belly, a place to sleep, extra resources, and the family is able to provide extra tutoring or work with them on their homework at night, reading to them at night, tucking them in, showing love and affection. Comparing that to the student who goes home hungry or there are language barriers at home. I've got student whose parents don't even speak English. So are they doing the homework with them? No, they aren't. Is it affecting their child? Yes unfortunately it is because that student doesn't have the same resources. These are huge factors and they will continue to struggle. As far as poverty goes, people from poverty have different sets of values on what's important, and education is not one of them. Like for example if you read Ruby Payne's framework for understanding poverty, it's pretty clear that they have different things that they prioritize that are more important in their lives. Education is at the very bottom.

BW: Does these issues ever come into play, when you make predictions and even hold expectations for students? Do those factors like poverty come into play?
ANNIE: Hummm, let me think about that. I'm thinking of who my students are. Does that come into play? Not one of the first things that popped into my head. I don't know that I really ever think about that, but instead of the long-term effects like with my one student for example who has difficulty with English. I mean, yes, that's the first thing that comes to mind because he won't be able to read the assignment or the test. So yes, that's something I would consider. I have other students in here that have difficult home lives, but I don't think I consider it right away. Yes it's a factor but it does not pop into my head right away. I'm thinking of them all more academically. Because there are students that have a really horrific home live, but who are very intelligent and continue to grow and I continue to push them in class. That's a good question I haven't thought of that before so it makes me really think.

BW: During your lessons and during your instruction, how much is it the correct procedure versus exploration?
I would say that the majority of my lessons are more exploration. I'm not able to plan out an entire week of math instruction. The reason being is because I go off of where my kids are in their learning. There are days when we can skip through things really quickly because all of them have it and they all have an understanding and we move on. But then

there are days when we do more of what you said, where I've got half the class that understands and half that doesn't. So I need to make adjustments. I go off of what they are doing. One of the biggest ways that I teach math is I make them explain their answers and we talk about that so it becomes more of a discussion. How many different ways can we come up with the answer? Instead of "yes, that's the right answer. You got it correct. Move on". I have a big thing that I do with them and it spells APE. They have to **a**nswer the question draw the **p**icture and **e**xplain their thinking. They have to make "I know" statements like "I know that this plus this equals that, so when I do that, this happens so we try to use it all the time.

BW: What types of assignments or activities are you more comfortable with having your student do independently versus whole groups?
ANNIE: All of my independent work is follow-up activities to things we've already done together as a group. So I always introduce the new content, and then we do independent practice on our own. And then we'll do it even in math center rotations a few days after that.

BW: When a student answers one of these questions incorrectly (pointing to an ITML math item), how do you handle that?
ANNIE: Well again I ask them to explain their thinking and then that can take care of itself even. Even if it's wrong, I use that as a teaching moment. If it's incorrect, that's almost more perfect for me because then I can have the class talk about it and we can explain it and then when the student explained their work, they catch themselves and then it means more to them and they have a deeper understanding. It's a good thing!

Transcribed interview with JANET

BW: Please state your name and today's date.
JANET: I'm Janet. Today is March 16, 2015.

BW: Please tell me where you work and which grade you teach.
JANET: I teach at Piper elementary, grade 3- I've taught for six years.

BW: How many years have you been working as a teacher?
JANET: 6 years- I taught three years in second grade and three years in third grade.

BW: How would you define *prediction*? …Especially after doing this activity making these predictions--
JANET: Well, it's an educated guess. I know what I've taught them. I know what I've exposed them to. I also know kids that struggle with language or maybe reading will struggle with some of the more contextual pieces on the back. But I also think that predictions... I don't know how valuable they are. I think it's kind of a... Well, for your purposes it may be valuable. But for a teacher I don't think making predictions is valuable. I just assess them and I don't guess.

BW: So tell me more about that. Why doing this prediction activity that we just did, why do you think it is not valuable to you as a teacher?
JANET: To just guess where I think they're going to be? Because I think it's kind of arbitrary. As far as I'm concerned I can find out where they are and move on from that. I wouldn't just label them and say, "Here, you're a 4 out of 5... I think." I'd rather know and then we'll go from that baseline to the next step and we'll keep building. But you're assessing my awareness so it's valuable for a researcher but not for a teacher.

BW: Then what do you base your predictions off of? What cues? You gave this student zero out of five and this student 5 out of 5. What cues did you use to make those predictions?
JANET: Well this one with the zero is three grade levels behind and has developmental issues. So there you go. This one who I gave five out of five to, has always been very strong. If I give him something, he tends to deconstruct it really quickly. But that's coming from a lot of assessments and previous knowledge that I've already given him. But I really can honestly say it might not pan out that way. What I perceive isn't always what happens.

BW: So in general then, what do you base predictions off of? Say, if you were planning a test and you were wondering what the students' scores would look like during your preplanning and pretest stage, what cues are you using to predict?
JANET: Well I build assessments based off of the curriculum. And then I give them the baseline data and then they go from there. Then I change my teaching strategies. As far as predictions go, I don't know that I do a ton of it.

BW: So looking at this prediction sheet that you just filled out for me, what cues exactly did you use to make those scores?

JANET: The past—past data collection, tests, assignments... everything. And some of it is knowing the kid. I have some auditory processing issues so I know some of the kids would struggle on the back and some other kids would struggle because of confidence to even try it. So it's knowing the whole kid. I'm not saying it's accurate. I won't know that until they take the test and I can compare.

BW: Since you've come back from three months leave of absence, you told me you got two new students. What did you make their predictions off of?
JANET: Hearsay. I've had a week to get to know them. I just know that I was told one particular one came struggling. I have not had time to get to know her, and the other one ... he's got little ticks and has a little different way of thinking. So I guessed. I had to. It's like making predictions in September when I first meet all of my students.

BW: Looking at your math planning and instruction, how much does your lesson center around *your* instruction and how much does it center on student thinking and where they are in the lesson?
JANET: Since I've had two years of MTI training, I'm very hands-on. We do a lot of things with our hands. We do not do a lot of worksheets. So I make sure they have the physical models. I don't have a general curriculum for day-to-day. It's very organic for me. That's why it's very hard for me to plan for someone else. It's very much where we are day to day. And the next day we might be at the same place so it's very hard for me to plan.
It's been an eye-opener having come back after three months. The kids are different. We work out wherever they are, so as a whole I might target my instruction to that average and then complete those tasks together. And then try to extend and then scoop up some of the low. Now it's interesting because it's almost an entire trimester. So I'm trying to figure out, "did they learn what they needed to learn?" And so we're going back to some of the modules that Jonathan and Sam gave me, like fractions. That's important, and then we'll move onto trimester three. For me it's very organic what happens day to day. What do I feel for them? Are they struggling emotionally with it, or do they have mental blocks, or is it something bigger? And then I try to shape it for the next day. My lesson plans are not full of "we are going to do this, and then we're going to do that". We do a lot of filming, paper slide videos, listening to each other explain through answers and that kind of stuff. That way I can understand where they are.

BW: That said, as your students learn new concepts and content, do you think their intelligence changes?
JANET: No. Intelligence is an interesting thing. I think they're all intelligent so it's up to me to teach so that... I wouldn't say I think their intelligence changes but I think their understanding grows. I can't scientifically tell you that nor am I willing to say their intelligence changes.

BW: In what situations does effort matter?

JANET: Effort matters all the time. Effort is probably the number one reason and marker for success.

BW: What does effort look like then in your class?
JANET: That we're all following directions. We have a safe place to learn. We learn from each other and that we do the best we can.

BW: Does effort look differently when you see effort coming from different students? Say this student (*and I point to a student that she's given a two out of five*), do you value effort differently coming from this student compared to this student (*and I point to one that she's predicted a 5/5*)?
JANET: No. Test scores aren't effort to me.

BW: No I'm saying just to compare the students-when you see effort coming from different students, does it look differently?
JANET: No I don't compare students. Effort is individual. But they have parameters they need to fulfill.

BW: So what does effort look like coming from this student?
JANET: It's funny that you picked that one. Um... Stay on task, being able to stay focused and actually attend to something for more than 10 minutes. For her it would be attention. "Will you pay attention; will you not shut down"… those kinds of things.

BW: Then what about for this student?
JANET: Well he is always on task. In fact, he's one who wants to learn. There's some intrinsic need in him that he wants to succeed. So for him, he's easy. He's a dream kid. I very rarely have to redirect him. He came preloaded. So for him, effort is, "how do I extend him? How do I motivate him to want to do more?" And I have not found anything that he won't do.

BW: You mentioned this girl…
JANET: She's new so I don't know what effort looks like for her. Last week was crazy-the first week back. It'll take me a while before I get to know her. I know she's very sweet, but I don't know anything academically. She seems like she wants to follow the rules, but I don't know... she could be one of those sleepers so I have to watch her.

BW: How do a student's background, culture, and/or family determine his or her intelligence?
JANET: Well I can tell you that I came from a lot of trauma when I was little very little. So I don't think... I think once you have emotional needs met, you can learn. But I couldn't learn for about four to five years because I really struggled and I wasn't whole. I was the one that went to the resource room. Mostly because emotionally, I wasn't whole. I think this docks performance. But I'm very smart, so it's not my intelligence. You know what I mean? So I think it plays huge in performance when kids emotional needs are met. But that doesn't play into intelligence, unless there's some kind of brain trauma or something like that.

BW: Do you think culture plays a part in intelligence?
JANET: No! How rude of a question. I'm sorry, but no. I don't think that, but you'd be surprised, even in this building. It's crazy, but there are certain cultural parameters to make kids work harder and I have seen that. But culture has nothing to do with intelligence. It's the priority of education in cultures that matters.

BW: During your lessons and discussions, to what extent do you carefully explain the correct process or procedure to avoid students making mistakes?
JANET: We celebrate them! We have a lot of misconceptions and we celebrate them and learn from them. We all celebrate them.

BW: How does it look during whole group or small group, if you called on a particular student and they have the incorrect answer?
JANET: We do a lot of work under the document camera and they can volunteer to share their work. And if they get it wrong, I say, "thank you for the wrong answer because now we can learn from it". And so we just do it that way, and then once you develop that, there are still some that are uncomfortable. But you kind of have to do it that way because that kid is not the only one that feels uncomfortable. Maybe I created it. I don't know.

BW: Is it harder for those students that are uncomfortable to show effort?
JANET: Not in my room. Not in this environment. Maybe in another environment that would shut students down, but not in my classroom with so much diversity in my classroom. So we celebrate it just the way it is. We follow the rules and we are all different.

BW: In what situations are you more comfortable with students working individually on the assignment you assign?
JANET: We do a lot of independent work. But throughout a lesson, we might work out a couple things together and then I send them. But they can always feed off their neighbor. They can always whisper with the neighbor, unless it's an assessment. Then that's independent because I want to know what they know. But I don't usually take their community away unless they're being naughty. When they're naughty, they will be sitting by themselves in the room doing quiet work because if they're taking advantage of the good-natured of the buddy work, then they don't get the buddy.

BW: We talked about the cues, but I want to dig deeper into a few more students. What makes you give this particular score of 3/5? How do you know she's a three out of five and not 5/5?
JANET: History. Past struggles and developmental problems for her. But I really don't know. I can honestly tell you I'm never been a fan of this process of MTI. And when we did this last year, I never understood why we did it or found it valuable. It's just not what I do. I don't sit and predict students at all. So when you ask me, it's really based off of conjecture. But I don't know! It's based on what I've seen them produce and these are very straightforward questions, and I know with this one, she's struggling developmentally. But she could also surprise me. I don't know. I can't really tell you.

BW: Did you use different cues when making predictions on the front and back of the test?
JANET: Yes it's so much more contextual on the back, so I actually knocked them all down one point! Like I said, it's really arbitrary. Not really the front- so I was pretty easy. It's second-grade skills, so I was more generous. I hope that they have that mastered. But on the backside, it's a lot more contextual. But I think it will be a struggle for some of the kids, but I really don't know. I really don't. I struggled with these predictions because I can sit there as long as you stare at that name, nothing's coming up. I really don't know until I see it.

BW: What do you mean by that?
JANET: Well, I could sit here and stare at that student's name and I can say she will, maybe, get it. But it's a human. She's human. So I'd rather get the data and then figure out what to do with it. So I can pretend to know because I know the child, but I don't know how they're going to perform on certain things because certain things throw them for a loop that I would never have dreamt of.

BW: Do you think it comes down to really knowing the students?
JANET: Yes, yes! It's knowing them but also knowing the skill. I know each student very well, but I don't know what makes their academics tick 100%. Only assessments do that. It's an interesting concept, and I'm wondering what's the reason for even doing your study? Is it, the more educated I am, then the better I predict? The more I get into MTI, do I predict better? I don't know....

Transcribed interview with HANNA

BW: Please state your name and today's date.
HANNA: Hanna, March 10th, 2015.

BW: Please tell me where you work and which grade you teach.
HANNA: Piper Elementary, second grade.

BW: How many years have you been working as a teacher?
HANNA: 10th year teaching, with 7 years of subbing before that.

BW: Let's do the predictions first. Look at your class roster and then make predictions on how many you think your students will answer correctly – how many out of five on the front, and how many out of five the back.
HANNA: This time of the year, I can totally tell you. But at the beginning of the year, no!
Ok on this front side, I will have 22 of my 23 students score a five out of five.

BW: And what are you basing that prediction off of?
HANNA: Because we've done all of this many, many, times. We've been doing this, yeah, for a long time. All these kids would- oh except this one. She's my little IEP kid. She wouldn't be able to do this.

BW: Why not?
HANNA: Well, this one student might be able to do it orally; but she would not be able to read it. So I have to read it for her. Ah ha on the backside this gets trickier. I would say 16 to 18 out of 23 would get five out of five. If they're paying attention and not just trying to hurry, I would have 16 to 18 get 5 out of 5 correct. I've really made huge progress this year. I have a couple that if they just glanced at it because they want to be the first one done, then they'd make silly mistakes. But if I say, "go back and look at that again", they would totally know how to do it, and they would get it right.

BW: So then what about those six or seven kids who would not get the five out of five? What would be their score out of that five and why would you give them that prediction score?
HANNA: I think they would do fine on the story problems, and they would add it right. But they would just put the total instead of the = sign. But if I said to them, "I need you to go back and look again", most of them would fix it. It's just that instant concept of, if it's a blank, then it's just got to be the answer. I've got some of them, well seven of them that are still working on that and I got these seven *low* students in my math group. They are still working on that, and I know that they can all do it and are very capable. But without me saying to them "look again", a lot of them will just put the answer there. I just did it two days ago, 10+ blank equals 64. And they all got it right. But the other one was a subtraction problem on one side of the equal sign and addition on the other side. And a lot of them did the subtraction problem and put the answer in the blank on the other side because are just used to that. They did all the hard work of the subtraction problem. It

was like 74-10, and so they had to do a lot of work. So when they were done, they just assumed that they wrote the 64 on the other side not thinking about what would... Yeah. And it was a test so I didn't say anything and couldn't say, "Look at it again". If I had, they would've figured it out. We got a lot of work to do on that…
And I did not include --- in that. She's my little IEP kid and she cannot do that at all and she doesn't count. I just say I have 22, not 23 in my class when it comes to math. It's just easier that way. I usually give her a first grade worksheet from Steppingstones when the rest of my class is doing our second grade math. She doesn't know her tens and ones. She can tell you what numbers are in 74, but she has no concept of two-digit addition. If she draws the picture carefully, she can do it. But you always have to say, "draw the picture and count each". It's not ingrained in her. She can't find the missing addend to save her soul. She doesn't even understand the concept. You ask her what's 3+5 and she thinks it's 80.

BW: How would you define prediction?
HANNA: It's an educated guess and for this time in the school year, it's a pretty firm educated guess versus at the beginning of the year.

BW: Let's go back and look at the prediction scores you gave your students. What cues did you use to make these predictions?
HANNA: Impulse control has a little bit to do with it. The kids are always trying to be the first one done, and then they make silly mistakes. I point that out, we point that out as a whole class. I would say most of the kids that make mistakes on this kind of stuff would be simply because they are hurrying. And the others work so hard to figure something out… since these are pretty easy on the front of the test, that I'm not sure this would apply… but they work so hard to figure something out, that they simply forget there is another set. That's the most common mistake I see. They do the first partial set, but then they don't realize they have to continue to go on. It took so long to get there; they forget they have to complete it. It's like reading -sometimes it takes them so long to sound out the word, that when they get finished reading, they're not even sure what they just read. That happens sometimes in math- if there are two or three parts, then the ones that I have that struggle, it takes them a long time to just get through one part and they forgot to go back and check their work. They forget to check if there are other parts.

We build that into the lesson - where we do a lot of share, because especially this year I've got a group of really, really high math kids. And because of that, I try to flip it around on them so they have to come up and explain what using the struggling kids' work. That's really hard for them because they don't draw pictures or trade answers on how they think. It's hard for my advanced kids because they have to solve it in a different way than what they are used to.
I've got kids who are still at the concrete stage - all they see are the numbers and it's hard for them to break the number apart. I've got about five that are pretty concrete. I think you get more comfortable going between concrete and abstract and I think they can develop that. Because I've got some that are now partially abstract and partially concrete, and they're learning to do this. I have three little ones that could not do anything without blocks. Now at least they can draw pictures of the problem. And then I've got two that

started out totally, completely concrete who are now able to do everything on a number line, which is completely abstract. So I think the more familiar and comfortable they get, they totally change. Totally. Now I don't think this is necessarily true that you can do this in reverse. I don't think you could take my high kids and tell them they could not solve it without numbers. That would be tough. That's why it's hard for my high ones to explain the ways that my struggling students solved a problem. In an abstract state, it's hard for them to work in reverse. But that would be my guess. It's just my guess!

BW: To what extent do your math lesson planning and instructional practices center around your explanation of the concepts/content, and to what extent around your understanding of students' thinking?
HANNA: I always go into a lesson, every lesson I do, with, "this is what I am hoping they come out with, and this is what I am probably going to see in my room". Because they're not always the same thing. Every lesson gets us closer and closer to what I want them to get by the end of the school year, and sometimes what they are doing contradicts that ... Well, I shouldn't say contradicts it, but it lets me know if I can go on to a new lesson or if we need to stay at the same lesson. So those two days a week that I meet with those math groups, sometimes two of those groups are doing completely different things than the other group. So sometimes it's three distinct lessons. But usually it's 2 lessons- one adaptive lesson and then one totally different lesson for those kids who are still at that completely concrete stage because I need to support the concrete stage and get them working towards the abstract in a way that they understand. Since they're at the abstract stage, I'm enhancing their learning. Three days a week, it's a general lesson and it's a whole group lesson. We might share and work in buddies, but mostly it's a whole group lesson and Thursdays and Fridays we will either continue in the small group so I can work with the concrete guys to make sure they're on track, or it's completely a totally different way with them. It depends. If it's something where I can see that they are getting it, and they just need support, then we do the same thing in a smaller group. We maybe only get two problems done in the whole half hour of working together and talking about the strategies. In that small group - it's three groups of eight. Most the time it's completely different from what we've been doing in class. So especially now we're gonna be doing geometry- I'm not gonna quit doing number lines. Especially with my group that struggles - because they are just getting those skills and they need to keep being confident with them and to build that confidence. So the two days a week that I meet with them, they will probably still be doing number lines and not necessarily anything to do with the unit that we are working on in class. It'll be reemphasizing and allowing more time to explore the concepts; then I can move them up eventually.

BW: How does a student's background, culture, and/or family determine his or her intelligence?
HANNA: Intelligence versus IQ?... Well, first of all I believe that *they* have to think it's important that they learn. They have to come from a family who believes this. Coming from a family who believes school isn't important and you don't have to do your homework, then they don't think they have to work hard or persevere. I try really hard to stop that. I mean, then you also have the families that put too much pressure on them, and I have to backtrack and say "hey, it's okay to fail", because everything we get wrong, we

can fix and we learned. So I see both. Sure it would be great if every kid came in willing and able to absorb what we have to give them. But that's not always the case. But I've seen both - the ones who expect too much and the kids get frustrated because "mom's going to be mad", and I say "no, this is practice. This is not a test"; and then you get the kids who want you to hand feed them and give them the answer because it's hard. I say, "no, sorry"; and then you have the kids who just wrote the answers and think it's right because they wrote it! And I say "I don't know if it's right because you have to show me your work so I understand how you did it!" So at the beginning of school, that's rough. But now at this point in the year, nobody just walks up with an answer on their paper. So more than anything, I don't think it's culture - although we do have a non-diverse group - but family and culture, and their relationship to school is important. I think it can affect how they go about attacking problems. And that's the other thing to think about - do they have problems to solve or do mom and dad solve their problems?

BW: In what situations does *effort* matter to you in school or teaching?
HANNA: ***All***… even behaviors. If you've got a kid with real impulse control problems, and he's always in trouble but he's trying and it is getting better. He gets in trouble only one day a week - he's trying and you have to acknowledge that he's trying. So effort counts more than the right answer. I even tell them, the right answer is not what I'm looking for always. Sometimes it's how you solve the problems. If you made a tiny math mistake, but I know that you have the right attack, and you know the right way of doing it, then I'm going to give you kudos for at least trying. So you forgot that 8 - 3 is five; but you knew what the numbers were and you did the number line perfectly, you knew it was a subtraction problem and you know how to attack it. That's more important than finding the right answer.

BW: Do you encourage student misconceptions in your lessons?
HANNA: Encourage? Well, I walk around the room and I call on kids. And when I see a wrong answer, well… if they started out with the right problem, then I'll have them come up and show the class. I'll put it under the document camera and grab the pointer and say, "show us what you did to solve your problem", and halfway through, they usually realize their mistake. But if I told him, "that's wrong", and they just change their answer, then they would not learn anything. Same as when they're in buddy groups. If I hear a buddy saying, "that's wrong", I say, "Who says you're wrong or right? Work together to find the right answer." So for a group lesson, especially if it's a challenging questions, they need to compare with their group, they need to look at each other's answers and talk with each other and work it out, figure it out together; see if you've come to the same conclusion I never want to hear, "everyone's wrong. I'm right". I encourage them to talk it out.

BW: So looking back at the predictions and the cues that you used to make these scores, let's look at two very different students - here you scored a zero and here a five out of five. What's the difference between these two students?
HANNA: There are three in the group that would struggle to get five out of the five on the back of the test for sure. And it would probably be impulse control and simply not caring. Like my one guy who took six minutes to take the MAP test. Did he care? No.

Did he try? No. I can't control that. I can make him go back to his desk and say, "you need to look at those again". He'll fix them usually. At least now he knows I'm not gonna let him get away with that. Before he handed his work to me and didn't even expect me to look at it. So he'd go off and do something different. That's effort. He didn't care. There's a couple where that's a learned behavior and we're working on that. With more effort, he'd get 5 out of 5. It is not a lack of skill. I've thought that at times. But he's proven me wrong because I've seen him fly through things while the others around him are clueless. He is more than capable. He's been my shining star in my afterschool program, so I realized he's not as low as I thought but it's just because in class he's not paying attention and he has no effort. He totally gets it, but on his own paper and in the class with 23 others, I don't see that. And he's the kid that finished the MAP test in six minutes... impulse control.

BW: How do you handle it when a student like this (pointing to #17 who she predicted would get 0/5) answers incorrectly? How do you respond to that?
HANNA: Well whole class, I say, "I want you to look at this one carefully and see if there's a problem".

BW: What if it's up at the board?
HANNA: If they came up to the board, usually I say to the class, "thumbs up, thumbs down. How many do you think this is right?" They look and if they want to look at it again, I say, "look at it again". And if they don't understand what's wrong, I'll say, "who can explain it to so-and-so? And what can you do differently?" Usually this time of year, they can fix it themselves.

BW: In what situations are you more comfortable with students working individually?
HANNA: On tests – they work individually or even during a check for understanding- not even graded, but if I'm checking for understanding, I want them with their own work. Most of the other times, I'm a big believer that they can learn from each other. Unless it's a check for understanding or an actual graded test - which I hardly ever do - then I expect there to be some sharing. Not giving answer, but sharing information. At the beginning of the year, they just want to share and give the answer. So I have to be careful who I buddy up together; but by this time of year, they're pretty good knowing that the answer doesn't help somebody learn. It just gets it done quicker. If you're trying to learn, then just getting the answer doesn't help.

Transcribed interview with Katrina

BW: Please state your name and today's date.
KATRINA: My name is Katrina. Today is March 9th, 2015.

BW: Please tell me where you work and which grade you teach.
KATRINA: I work at McDonald Elementary school. I teach full day kindergarten which is the class that stays from first thing in the morning through the whole school day.

BW: How many years have you been working as a teacher?
KATRINA: This is my 11th year of teaching.

(While looking at her class roster and the ITM L math test, she reflects-)
KATRINA: Right now I would say 80% of my students would get five out of five on the front of the test. At this point in the year, in March, they will get 5/5. If I look at this at the beginning of the year their scores would be totally different. I know this because every year the group that comes in is different and this year the group that came in was young. The kids were younger with less skills. A lot of them and a lot of students who would not have been able to do this at the beginning of the year, did go to preschool. But in general they were young in age and developmentally just not ready. The other thing is life at home makes a huge impact on what they've been going through. We do have some that have a hard… not hard, but a shaky life. And that kind of stops them from performing. I think they're all very smart kids. I think each one of them has potential. They can all learn and perform. But it's the home life that really matters sometimes. Their home life impacts their learning. Who's at home when they go home? Who's there to help them with homework? Was there someone to talk to them? I'm seeing a group that has less language skills and less ability to solve problems. All that is translating into their academics.

BW: Now let's look at the reasoning side, the backside of the math test.
KATRINA: Reasoning at the beginning of the year… probably would've been 20% of the class. 80% could not. But right now, I would say between 60 and 70% of my class would get five out of five.

BW: Describe what cues you're using to judge your students' performance. What are you basing these predictions on?
KATRINA: I am not going to take full credit for that! It's that the smartest things these kids are doing, is being sent to ***all day*** kindergarten where they have twice as much exposure to academics than others. Some kind of schedule and regular activities instead of going home or their regular daycare. Whether they like it or not, they're being forced to do things. At this age, they are likes sponges. They are ready to do things. They are ready to learn if somebody is showing them what to do. They are so eager to learn. Then also I realized after doing the ITML class, about letting them play with math. It is important to let them explore. It is important. We never used to include games and you know, now we take math cubes and we never used to do that. But now we have changed. In the morning when they're fresh, I let them do a math activity that's not structured. I

just give them cubes, let them measure who is short, who is tall, measure the distance, make a pattern. Those kinds of things and then exploring the numbers - counting it, finding out where I'm wrong, where I'm right. You don't have to tell them "you are wrong". You can correct them and then walk away and let them figure out the process. They play with 10 and five frames. It's been a long process but it's been a good learning experience for me as well. It solidifies every year.

BW: Let's talk about the 30 to 40% that might not get the five out of five. Let's talk about a student on your roster that would get a zero out of five that you pointed to.
KATRINA: I don't think it has to do with intelligence. I think it has to do with their experience of math and how much exposure they are getting. I would say a few of my students that may not get five out of five, is because they have missed some math activity because they have to be at the computer to recognize letters, or they get pulled out and have to leave the room during math. For reading intervention, math seems to be a convenient time, unfortunately, to pull students out. At this stage, knowing your ABC's is very important, but they literally miss the math lessons. The emphasis is on "do you know your numbers and do you know how to count from 1 to 10"? So I'm asking the more sophisticated skills, and if they've missed the preceding lessons, I have to except that they make it a little later - maybe in a month. But that is probably the reason and I also feel that at home, there are some parents who are talking math to their kids and that shows up in class. But there are others who don't have the time to do it or just don't know how to do it. I feel like in schools we should have lessons for parents to show them how they could interact with their kids. Because parents are at a loss and do not know what to do.

BW: During your lessons and discussions, to what extent do you carefully explain the correct process or procedure to avoid students making mistakes?
KATRINA: I tell my kids "your answer is not wrong if you can explain it to me. How did you get your answer? I explain to my kids that this will help me know how you're thinking. It's not about getting the right answer and moving on. We have to learn the process. Math is a process. It's the process that matters.

BW: If you have a student who you've predicted here would get a zero out of five, how do you handle the incorrect answer when he or she gives it in class? How do you handle that moment?
KATRINA: With the student I'm thinking of right now, I would not correct her right away because the poor little thing, every time she comes up, "this is not correct" is all she hears all the time from me and from other teachers. So she's asked to leave the class sometimes to fix things and to learn how to fix things. But definitely I sit with her one-on-one specially during rest time for half hour each day. I pull her from rest time and sit with her and ask her to show me her process and her thinking. When she showed me the wrong answer, I then say, "oh show me" and then "oh how would this look if you did it this way?" It's a long road for her. She's young and home factors- everything. But when you put it together, it's a very cute package. She's a darling, but she has her issues.

BW: What is your reaction when a student presents the wrong answer whole class?

KATRINA: My first reaction to them is, I like the way you made an effort to try this out", or I would tell them, "tell me what you're thinking". And then we will look at if it's right or wrong. What I have done is make a very conscious effort to call on kids with the right answer so that they don't think that it's only the wrong answers that get a reply. Somehow they always associate the teacher asking you something, so it must be wrong. So I will always tell them, "so why are you thinking like this?" I have told them I do this because I want to make sure you're not looking at your neighbors answer and giving me their answer. I want to know what you were thinking about the answer. I repeat, "nothing is wrong and nothing is right, as long as you can explain it to me. I've heard it myself, "you're wrong, that's not right". So I don't want my students to feel that. They should not hear, "you're not right".

BW: Tell me how would you define prediction??
KATRINA: Well with my class list, I'm looking at each student and I'm saying, "oh this student would get this definitely". But then this happened just yesterday. I did this kind of prediction of their performance, and I said, "oh this student is going to get this right". And he proved me wrong! So prediction to me depends on their class behavior, on how much help they have at home, how much I know their parents, and their performance in class.

BW: Let's explore the cues that you use to make predictions of their performance. What are some of the cues that you use to make predictions?
KATRINA: Their understanding of math. I'm always looking for little things like, you know, I'll do number flashing with the 10 frame and I'll see kids do this. But then look around and do this. Those are the kids I'm watching out for cause I'm thinking, "are you looking at your neighbors' answer, or are you doing your own work"? So those are the students, when they turn in their work, I have them sit with me and I ask them to talk to me about their answers and explain their work. Because that's how I can find out what is going wrong. The problem with math is that we've never figured out what the kids were thinking. We are always worried about what is the right answer. That was my problem, too, with my own kids who are in high school. We need to look more at the process, how did the mistakes happen. That's the one thing I changed a lot and I'm basing my predictions on that.

BW: When you plan and teach a lesson are you focusing more on how you're going to teach it or are you thinking more about how the students will be thinking?
KATRINA: Honestly neither. I'm thinking about the curriculum first and then I'm thinking what lesson will suit the curriculum? And then thinking and looking at my class. Are they going to be able to grasp it? Is it too much for them? Do I need to scale it down? And then I think about my teaching. My teaching depends on how much they are or who is listening and what level am I catering to? If I feel like 80% of my kids get it, I go on with the lesson. But if not 80% I'll save the lesson. Might be too early so I put it in my lesson plan book and do it in a couple of months or so. There are some lessons that I have felt like they were just too early.

BW: What are the cues that you read from the students that made you stop the lesson?

KT: …just their reaction to the problems- if the kid looks at his neighbor like "I don't know this". And when I see that even in worksheets- their answers when they come to me, and then when I asked them "how did you get this"? Their explanations help me know what they're ready for. This year I've had so much success with word problems just because I think I took a step back. I scaled it and I did it step by step. I did not just read the problem to them. I said listen to the first sentence. Let's make a picture. I make them do that. I know they have to move on. But this is the first time I've shown them the correlation between having a picture and a math sentence so they know the both things come together. It's not one or the other. So I think slowing down was important.
If 80% of the class gets it, then you can take care of the others because you know their capabilities and abilities.

BW: How much do you think effort plays a role in students' intelligence?
KATRINA: Effort is huge. Intelligence…there are some things that take a while to click. But I don't doubt anybody's intelligence. A little more or a little less is a different issue all together. But how much effort they're putting into the lesson, how much attention they pay to the lesson at the time, that is so huge.

BW: When a student shows you more effort, do you act differently towards the student? I mean, how does effort look in your eyes?
KATRINA: First of all, that student who's putting in more effort or the student who has understood the concept, he gets the same and will get the same praise as a student who has none because he's putting in his effort. Who knows if that other student is capable of getting the concepts at that time? He may get it at a later time. But I will tell the student who got it to help his peers. So for me, that's my way of telling him that you got the concept. This is another way for me to understand or to see that the concept is really understood by the student. You should see this one student – he's so gung ho about helping his peers. I think sometimes other students also enjoy listening from their peers rather than from the teacher who is always saying "you're wrong, you're wrong". It is so amazing to see him explain like he feels responsible that he's a teacher. The explaining part is where I feel like he's going to get deeper into it and can help his peers understand. I won't and I don't think I do more praise for effort. But I'll have them help me in other ways though he knows I appreciate his effort.

BW: What's your reaction to a student who's not showing any effort?
KATRINA: That's so hard. My first reaction is, "oh you can do this. Let's try together." That is important to me. Maybe they need a little extra motivation or attention time. Maybe just not having a good day. So I just say "let's do it together". It's not only to him that I would say let's work together, but I would also say that to a student whose understanding 50%. I don't want students to feel like "because I don't get it, then I'm sitting with the teacher".

BW: How does a student's background, culture, and/or family determine his or her intelligence? You've alluded to this before, so let's look at this deeper.
KATRINA: You know, we have preconceived notions of certain cultures, and that's not good. I'm guilty of that, too. But we do have those preconceived notion. Yet we do see

effort from homes and where families- the kinds of families they come from- it does factor in how they perform in school. It matters in school, and all that kids deal with does upset the balance a little bit. They can have a good day at home and they can have a great day at school. And then do you have parents that have preconceived notion about how intelligent their kid is, but the class performance doesn't show that. So it's hard to break the news to the parents. But we have seen that family life does matter. Family expectations matter and they make a huge difference in how students perform at school. If you have a good understanding of what parent expectations are, then I think we can make it work for a lot of kids. I think I've been labeled as a strict teacher because I've been told that by some of my friends. Some of the parents in my class said, "we heard you were a strict teacher". And that's because I'm a nonwhite person, and I place too much emphasis on academics. And I do I feel that if you're paying for full day kindergarten, I'm not going to let your kids just play. that's not what I'm here for. But there's also those parents who told me, "no, no! We love it. You're not strict!" So it is what it is.
I think I've been labeled *strict* because my expectations for these kids are high, and I always tell these children, "if you walk out of my classroom knowing one new thing every day, then I'm doing my job. If you come here and play and don't learn anything and go home, then I'm getting paid for nothing. I'm an example of a what cultural expectations and labeling are.

BW: As your students learn new concepts and content, do you think they change their intelligence?
KATRINA: I don't know about that, but I know they're definitely opening their minds to new things. I feel some kids are stronger in some areas, and other kids are stronger in other areas. Some kids are masters. It definitely opens their mind to new things and helps them be prepared for new and other things. It's what builds up on each other, so at least they can think, "I learned *this*, and this is based on *this"*… so maybe that part of their brain is meant for that content and concept. Maybe addition is not their strength, or geometry isn't, but I think everybody is equipped to be intelligent. I don't think there is not an intelligent person out there. For some people, not having to be put in effort in that happens. But some people feel like it's never going to happen for them, and that's what we need to get rid of –that thought that math cannot happen. It can happen, just maybe a little bit. But it will still happen.

BW: Please state your name and today's date.
CARTER: Carter. Today's date is March 9th, 2015.

BW: Please tell me where you work and which grade you teach?
CARTER: I teach at Piper Elementary fourth-grade.

BW: How many years have you been working as a teacher?
CARTER: I've been teaching for 20 years.

(While looking over the ITML test, Carter chats to himself about making his predictions.)
CARTER: These are more things we have done more recently… Well, no… We've done that in the beginning of the year… going to mix-and-match fractions we've done more recently this is a mostly fraction….

BW: What does it mean to you to be a teacher?

CARTER: Well, I have to carry the torch to get the next-generation ready for the working world and just to be good human beings. There's a lot, lot to it, and some of it's pretty subtle. And you're not always Mr. popular. But you still have a job to do. It seems to be getting a little tougher every year. I think there are a lot of factors involved – a lot has to do with just the family dynamics -there are a lot of struggle families out there, and their priorities are different than say 20, 30, 40 years ago. It's getting a little tougher but you know, you just keep going. You just keep going.

BW: In regards to predictions, thinking about making them in real time in your classroom as well as making them today for me, how do you define *prediction*?

CARTER: Predictions…. They're in part knowing the child and knowing what they're capable of. It's knowing what their history has been in math and knowing how they approach testing and challenges of math. Some of them are very capable, but some kids are just not very motivated so it's more of an art. But just by knowing these kids for last six months you kind of get an idea. But they will surprise you sometimes. Sometimes the ones that struggle, sometimes things just click. It's not an exact science, but just knowing them and how they think, and what their motivation level is, and things like that.

BW: Let's talk more specifically about what it is exactly, let's hone in on what you used to make these predictions. You talked about how much you know them, but what is it about them that you know that's allowing you to make these predictions? What makes you give the students a two out of five and say, this one a five out of five? How do you know this student won't know this content? How do you know this student will?

CARTER: Well the ones that I would predict a five out of five are very much involved in the hour of math every morning. Hands are up; they're always ready with the answer or at least what they think the answer is. Their homework is complete and done correctly. They actually have a love for math. There is something inside of them that allows them to

see the world a little more mathematically versus a student who gets 2 out of five and who sees the world less mathematically and who just struggles. It is not that they can't or won't learn; it's just that the process is slower for them. So in the classroom, you know through the weeks of going over math and concepts, you know who kind of hangs out, hangs back and you know who's pretty excited about whatever lesson we are learning.

BW: And what do you think makes them struggle? What are the causes of their struggles in math?
CARTER: Well, math is *so* sequential, and there are holes in their learning. It could be, there's so much to know even before you get into fourth grade. But if they're not solid in some of these concepts, then the job gets harder and harder. It's going back and trying to fill in some of those holes while also keeping up with current instruction and that's quite a struggle. We really do need some help getting kids that are struggling in math to fill up those holes. It's a question that they need to go back and look and understand that they know how to do it, and they just need to get the basics and the foundation better. For instance, there are kids still at this point who don't even know their math facts. Even after emailing and calling parents and getting them extra help, they are still struggling. And fourth grade is multiplication and division and they are at such a loss when they don't know 5 x 4 is 20 that quickly.

BW: Let's look specifically at particular students…you pick two and I want to look at comparing your predictions.
CARTER: So let's look at this boy here and this girl right above him on my list. These two right by each other. This boy struggles in math, but he also, as far as I can tell, is kind of raising himself. Parents leave early in the morning - six, 7 o'clock and he's required to do his breakfast and all the health things by himself. And homework, planners signed, and this is just not working out for a nine-year-old. So he struggles and he's got other fish to fry besides learning math. She is a very, very intelligent child who's in the Challenge program. She's the kind of girl that goes beyond just the answers. She wants to know why is that the answer. So there's a dramatic difference between the two kids and they're exactly, or almost the same age.

BW: So I'm hearing you say the family background and life outside of school is a huge factor.
CARTER: Yes, because it's also confidence building. If students feel they can do math and they get that confidence growing. And the ones that never have the answer, or don't know the answer, or don't even know where to start, they just struggle and don't have that confidence. And then you put them in a group of 32 kids and it's not going to be one on one anymore.

BW: Would it ever work that she could help him out?
CARTER: Well I'm lucky that way - the kid next to him actually helps him out. But that doesn't always work that way. Some kids don't lend themselves to being helped. And others have social issues and nobody really wants to help them. So I got lucky that this person helps him and he wants help.

BW: How does effort play a role in student learning and what does seeing a student exert more effort do for you as a teacher? Do you think their effort helps their learning and basically their intelligence?
CARTER: Well as a teacher it's nice to see. It's kind of an ego booster, really, when you see that they are trying hard and you assume that you are connecting with them. And then you assume that it's all about your teaching. But I'm not so sure it's all just about teaching. They like the subject, and they like being successful and like making the connections mathematically and it just clicks for them. On the other hand, you have kids that it does not click, and they get behind even at this level, and they're just not very forthright in raising their hand at all.

BW: How would effort play into his situation?
CARTER: Well he does not have the backing at home. So whatever grade he gets on his report card or test is just a squiggly line to him and his parents. At this point the kids know that they go on to the next grade and there's no fear of staying back. In his case the parents are more concerned with putting food on the table and they don't care if his math score is a 50 or 75 on a test. They have other things to do in life besides worry about math.

BW: Do you see that play out in his participation in math and showing of effort?
CARTER: Yes! He's not going to raise his hand and there's no effort. He just does not have that confidence at all.

BW: Do you think effort can be developed?
CARTER: Well I'm hoping so. There's an after-school program that I signed him up for and he's been going. So we are trying to get him some help. But like I say, without the parental background and priority list, it's a really tough hill to climb. There are just more and more of those kid coming down the road.

BW: Do you think that the students' background, their culture, and/or family have a part in determining his or her intelligence?
CARTER: Oh I do. I think there are cultures that really, really prioritize education as the number one spot in the child's life, and others, you know, where it is more of babysitting. I hate to say that, but school is just a place for them to get dropped off and the parents won't deal with them for a while; and there are cultures and then families within cultures that *really* value education and see the big picture that it opens doors and opportunities. And then there are cultures and families that really don't subscribe to that at all. They are living in the moment. It's cross-culture too. Every culture, if the parents realize how important education is, they're' going to make sure that the child is taking it seriously. It really doesn't matter what their background is, they *just* take it seriously. You can tell.

BW: Thinking about your math lesson planning and the actual instructional practice, to what extent do your lessons and practice center on students' thinking? And to what extent on your explanation of the concept and then the lesson and content?
CARTER: Well at this level, I do have to present the concepts and teach the concept because we're working with two major software programs. One is Orgo - which is what I

use for the first 10 minutes- and then I use Engage New York with that and there's a worksheet with it. So I put those together with the same concept, and *hopefully* the kids are learning strategies of reading the problems, drawing the models, and showing that you know what's going on, and then arriving at the correct answer. At this level if I didn't help them, they would all sit there with your hand up. So it's really a lot of kid gloves right now, just walking through it. And then you have the kids that take off and keep going. But then you have the kids where I help them with all the problems because that's where they are. That includes reading all the word problems with them and to them because they've gone from third grade where they've had simple little algorithms, you know, and now we're doing some major story problems. And they have to put it altogether and weed out the information that you don't need and put in the information that you do need. You have to choose what kind of sign and operation to use, so there's a lot to it. It's constant. And not everybody is okay with going off on their own in the first 5 minutes. So there's a lot of handholding at this age.

BW: As your students learn new concepts and content, do you think they change their intelligence?
CARTER: Yeah, it's kind of forced on them. Like I say it's not just answer A-B-C-D anymore. It's you need to show that you have the answer and show how you arrived at the answer *and* show your thinking and that metacognition. A lot of kids are not used to that way. So everything gets slowed down, everything gets talked about. The questions come up and we go through the questions, and you really have to slow things down. The way things are going, you have to go slow, especially with SBAC and the way testing is going to really thinking beyond just guessing an answer. And that is tough for kids, especially when they don't have that level of thought that's higher level like that.

BW: That said, do you spend more time and put more emphasis on getting the right answer or on the process of getting to an answer?
CARTER: Getting the right answer is important, but it's the process that sticks with you through your lifetime. It's how you approach things, so it's really mostly the process of the modeling and the drawing and the thinking. But it's nice that they know at the end of it they have the right answer. But I think the process is more important and more emphasized at this level.

BW: When a student, and let's take the two we talked about earlier for example, if the boy answered a question incorrectly, how do you handle that?
CARTER: Incorrectly? I just ask him to think a little bit harder, think a little bit about what else he could do? I just give him some more time. Sometimes they'll approach it in different ways and come at it in different ways and solutions. But other times they're truly just stuck, so I just ask him to call on a friend to maybe help him out and keep going with that. You try not to make it too glaring, but not everybody has all the answers all the time. It's not an embarrassing thing. But the mistakes and errors are all part of the learning process and that gets explained right away.
(Student comes in and he waves her off saying "You need to go. Go! Go! Go!".)

BW: In your lesson planning and instruction, are you focused more on the correct answer or are you focused on bringing about misconceptions to allow for those learning opportunities?
CARTER: Well the planning starts off with, you know, pretty much a skeleton sort of outline. But as a teacher, I am learning that with the Common Core, you can't help *but* to make time for the mistakes and all the misunderstandings. And because it's such a new curriculum, the student can actually see *me* make mistakes and then I show them what I do. And I go back in to rethink what I'm doing. They see that we all make mistakes and there's more than one way to figure out math problems. They see that because I model that. Days of quick little answers and algorithms are over. It is a philosophical shift in mathematical thinking. It lends itself to a very different way of doing math and taking risks and more about the rigor now than just throwing down an answer. You really have to wrestle with it and it's not an easy answer right away in 10 seconds. So *hopefully* they understand that.

BW: Let's look back one more time at your predictions and let's compare the front and the back of the test. Do you use different cues to make your predictions as far as the skills compared to the math reasoning? Do you have different things you're basing your predictions off of?
CARTER: Well one thing that hit me right away was at what point was the information taught? And things that are taught recently, in the last few weeks, I think they would have a better chance of getting the modeling and the answers correct, then if we had done it in September. So the timing thing, but like I say, you kinda get to know these kids and you realize that they're not all at the same level mathematically. There are *diverse* levels *especially* in math and reading, and so if they're having troubles reading, then this new way of dealing with the math story problems, this just gives them another layer of difficulty for the kids that struggle in more ways than one. So I take that into consideration.

BW: Thinking more globally about you're teaching and even outside of this specific math test, do you ever make predictions based on things that are not academic? I mean do you ever find yourself thinking, "Oh, I had his brother last year, or he's having a hard time behaviorally"… (And then Carter immediately interrupted me saying…)

CARTER: *The Behavior, definitely*! The sibling thing, no. Siblings can be very different. But definitely with some medical issues that I'm seeing- the children that are being cared for with ADD ADHD in here, with these conditions, they have a much tougher time sitting in a classroom. Paying attention for any length of time, it's hard for them. I know, and it's not their fault. Some are medicated, some of them are not. But I take that into consideration. You have to be very patient with those kids that really have the attention span of a gnat; I mean it's really only a second. So that goes into the mental formula too.

BW: Well that's my last question. Do you have anything you want to add or ask as far as the prediction process?
CARTER: Well I know that these predictions are simply that - they are just predictions. If you actually did a scientific study where you take this test we're looking at here, and

the kids take the test and my predictions numbers could be drastically different and surprisingly so. That would be interesting to see if these numbers that I wrote down are even remotely close to what the actual student scores are. Because at any given day or at any given hour, test taking is different for kids. Did they have enough breakfast today? Sleep well? And have a fight with her siblings and parents? Are they in one of those depressive moods where they don't care about anything? It's very hard to predict the final outcome. That's why the testing and the whole testing process are controversial. It's one little snapshot of the kid who could've had the worst day of his life. Who knows? So I can predict as an adult and as a teacher by getting to know them, but my numbers can be so off base it's laughable.

Transcribed interview with KAREN

BW: So what was it before the common core that made you think they wouldn't be able to get it?
KAREN: Um. I guess I was still in the mindset that some kids are *mathy* and some aren't. But now with the common core stuff, it's a lot harder, and most of the kids have been able to rise to the occasion. Some kids that you thought weren't *mathy* and are maybe better writers, they end up maybe not the best in the class, but they have a pretty decent understanding of what we're doing.

BW: Please state your name and today's date.
KAREN: Karen, March 10th, 2015.

BW: Please tell me where you work and which grade you teach.
KAREN: I work at McDonald Elementary, fifth-grade.

BW: How many years have you been working as a teacher?
KAREN: This is my 16th year as a teacher.

BW: What does it mean to you to be a teacher?
KAREN: The bottom line is to help prepare kids be successful Americans.

BW: How would you define *prediction*?
KAREN: Prediction is using what you already know and applying that to what you think will happen in the future.

BW: Looking at the numbers next to each student's name, what kind of cues are you using to make these predictions?
KAREN: I looked at, first of all, skills that I've specifically taught. Some skills that I know most kids can do because I've specifically taught it. Then some were more reasoning skills, and so I thought how well were the students reasoning with problems that they hadn't seen before. And the types of problems, that's why I wrote down the skills needed for each of those reasoning problems while I made my predictions, to figure out how I thought they'd do.

BW: To what extent does your math lesson planning and instructional practices center around your understanding of students' thinking?
KAREN: Students' thinking - like 90%! When I first started teaching, I used to, it used to be all about me writing the perfect lessons and staying on track. But now honestly my lessons are pretty loose because every day it changes, or they know something, or you can go off in a different direction. It's pretty student-driven I'd say.

BW: To what extent do your math lesson planning and instructional practices center around **your** explanation of the concepts/content?

KAREN: I do use our 3 district tests, 3 unit tests that are *supposed* to be based on the Common Core, that I use to *guide* our direction. But the students kind of tell me which streets to go on to get there!

BW: How does a student's background, culture, and/or family determine his or her intelligence?
KAREN: Intelligence? Um, I don't think their life experiences factor into their intelligence. I do think that certain families might have higher expectations and different expectations of education, so that may factor into motivation. I used to be very much thinking that intelligence was genetic and that a high IQ is what intelligent was. But high expectations are what help kids perform better in school. I don't know if that intelligence though...

BW: You said before that you used to think that intelligence was more genetic. And now looking at how you conceive of it today, what kind of a role do you think that culture, family, background play into that?
KAREN: I don't think culture has anything to do with intelligence. Background and family? Maybe as far as motivating kids. And parents with high expectations. But in the classroom- and this may sound rosy, but I think it's true- if you develop a relationship with the kid and you have high expectations, then you can get em there. Just give em a little sugar and they'll eat out of your hand! Most of the time anyways!

BW: What extent do you carefully plan out the correct answer and foster the correct answer rather than address misconceptions?
KAREN: I like to have them try something before I've even given the instructions. But I don't want to give too much attention to that because if they're in the wrong direction, I don't want them to get stuck in the wrong direction. If they're starting to go down the wrong path, I redirect pretty quickly. And I try to have other kids point that out sometimes. But for the sake of time, I just gather everybody together and go back over it and show them what to do.

BW: Okay now let's take a look at your prediction scores and look at the student that you assigned 0/5 to, and this student that you gave five out of five to. What are the differences between these two students and why did you give these prediction scores?
KAREN: She just has wonderful math reasoning, even with things that I haven't taught her. She can even explain things and always starts sentences with "I know that such and such, so that's such and such". And this boy is actually cognitively impaired. He's good at memorizing things, but has no reasoning. He just can't... he can actually do algorithms pretty well, but that's about all. His parents are frustrated because they say he's doing fine in math, but he's not. They show him the algorithm at home and he can do it, so they think he's doing fine. They say, "We think he's just playing with you and trying to get attention".

BW: Let's talk about her then - she's got one out of five.
KAREN: Oh um...Her reasoning... She's still stuck on place value. You could model things for her and she will sort of get it and then she'll forget it shortly after that. She

just… she just… for some reason it just doesn't stick. She's already been retained one year and her mom homeschooled her. She struggles with math, and I don't know why.

BW: For you as a teacher, what is this prediction process like? How does it influence your thinking about your students?
KAREN: Well, I was surprised at how many 5's I wrote down next to students. Doing this I didn't realize much confidence I have in them. (*laughs*) Um I also feel like, and I think this might have to do with the Common Core too, that I'm better at predicting than I would've been, like four years ago. I understand their thinking more than just what score they got.

BW: If a student answered one of the reasoning questions on the back- if they answered it incorrectly during a whole class discussion, how do you handle that mistake making process? What kind of feedback do you give them?
KAREN: My first question is how did you get that? Why did you do it that way? And a lot of times the students realize a mistake and say "oh". Other times I will have ... And I think I've made a pretty safe environment for this... I ask the students to point out what's wrong. With that safe environment, hopefully my students and I feel comfortable having our mistakes pointed out to us. Hopefully it helps having other kids doing it too. Sometimes they don't point it out as clearly as I do. So after they've pointed it out, I'll go back and re-explain it just to make sure they understand it.

Transcribed interview with CATHY

BW: Please state your name and today's date.
CATHY: Cathy, today is March 16, 2015.

BW: Please tell me where you work and which grade you teach.
CATHY: I teach kindergarten at Piper Elementary.

BW: How many years have you been working as a teacher?
CATHY: I've been teaching for 17 years.

BW: What does it mean to you to be a teacher?
CATHY: To be a teacher means I am getting them ready for their education. Kindergarten is all about making sure they have a positive experience and that they enjoy school so they want to be here every day.

(*Then while making her predictions, she says*…)
CATHY: Eight students would get three out of 5. 7 would get a zero out of five on the front of the test, because they don't know their teens and they would not be able to count backwards…

BW: Based on what we just did, how would you define *prediction?*
CATHY: Well… making a prediction is based on the information that you know, what you know about the kids and their background, and I use that to predict. Whether or not, and how much support they're going to need… I would say exposure that they appear to have had. Have they been to preschool? If their parents are working? if the parents have been to college?... those kind of things. Do the kids seem to come to school with the vocabulary or do they struggle to understand what I'm saying to them? Have they been spoken to a lot? Are they speaking in complete sentences, answering me in complete sentences?... those kinds of things. And that's what I base my predictions on. It's what they bring to the table.

BW: When you made these predictions, what were the cues that you used to judge your students performance and to come up with the scores?
CATHY: Like if it was counting up or counting down? That's a different skill set if you say 4+3, if you don't tell them what plus means. They might not know what plus means if they're expecting to read that on their own. Some kids can add, but can't subtract. And same with the back and the story problems - the less you're telling them what those keywords mean, they'll most likely add both of these. They won't take things away. They don't always know without an explanation, that an equal sign means you need to make them equal on both sides. They may look at this and put a one there but they may not know what to do with the five here. Here they'll put a one here because the numbers look the same. So here, they'll get one, but not the other unless they truly understand. This one's pretty easy because they'll figure out you just need to put some more on there.

BW: How does a student's background, culture, and/or family determine his or her intelligence?
CATHY: I don't think it tells you how smart or intelligent someone is, but it tells you what a person has been exposed to. Their background, their ethnicity, it'll tell you what they've been exposed to. But it won't necessarily tell you how smart someone is, or how quickly they can pick up on something. If someone comes to school with absolutely no experience and if they are very bright, they can catch up with everyone else very quickly. So these things don't tell you if someone's smart or not smart- if that's what you're calling intelligence.

BW: Then how would you define intelligence?
CATHY: To me, intelligence is how smart you are, or how quickly you can adapt. There are a lot of things that are *intelligence*. How well do you adapt? How well do you catch on? How well you can learn? But also you could be smart in the streets and have street smarts, but not necessarily be book smart. There are a lot of different niches in intelligence.

BW: To what extent does your planning and instruction of math lessons center around your exclamation of the content?
CATHY: A lot in kindergarten. I mean everything we do in kindergarten, we always have to assume that the students don't know. So we have to give a good lesson. Especially when we're doing addition. I don't think we can assume that anyone knows how to add in Kindergarten. I think as we get in the higher grades, we can assume the kids know more. But in kindergarten, you're always teaching. I teach them something they have to do it in a group or altogether, and then they have to do it by themselves almost always.

BW: Then what kind of assignments and activities are you more comfortable having them do independently?
CATHY: After I've taught something and we practiced something. I would never ask them to do something independently that I haven't taught first. We even do the same assignment a couple of times together before I expect them to do it by themselves.

BW: Then how do you know when they're ready, and what are some of the cues that you use to say, "oh it looks like they are ready for the independent work"?
CATHY: Well we do independent work every day they get a lesson. But that doesn't mean they're graded on it. I give them a lesson and if no one's raising their hand, then obviously everybody didn't understand it. So I need to teach again. It didn't work out so well. Or if they're done in two seconds and bring me their paper, then we got it! But when we do it again tomorrow, you can see if the whole table all has the same wrong answers, well, that table didn't get it and they all copied the same person! So it's those kinds of things that let me know if we can go on or if we need to repeat. And even the story problems- we do story problems for a long time and changing them up, adding the fact families to them, or adding a number… you can tweak it ever so slightly, but they're still on the same topic. And I always read my word problems to my students. I think 80% of my students can read, but too many of them assume that it's addition in the word

problem because that's what we're doing at the time or subtraction. But I still want to read it to them.

BW: In what ways does or doesn't your instruction of the lesson include student thinking? CATHY: I definitely ask them to answer the problem and I ask them how they got it. I expect them... and sometimes I have to tell them that they're right because they're afraid I'm calling on them because I think they're wrong. And I have to say to them, "I'm not asking you because I think you're wrong. I know you got the right answer. I'm asking because I want you to share how you solved the answer". And that usually helps, especially in kindergarten because students are always looking to the teacher for approval. You try not to do that, but they won't share unless I do. And then they'll say, "oh, I just knew it", and then I say, "no, I want you to tell me *how* you solved it." And I have to say, "did you use counting on? What did you do to get to that answer?" And I have to prompt them just to say how they solve the problems. But for some students it's very difficult to talk math. If they don't even know what I want them to do, they don't even know where to start.

BW: Have you noticed a change or improvement as the years going on?
CATHY: Yes, I have. I think I'm asking more questions than I used to, like show your own way of taking to the class. I'm asking them these kinds of questions more, but it's hard to say I would assume that they would be doing better just because the math is changing. I have seen my students' confidence grow in their ability to solve the problems, rather than worry about coming up with the right answer. I don't know … the ones who are always confident, are always confident; and the ones who are not confident, are not confident. They haven't worked that out yet.

BW: As your students learn new concepts and content, do you think they change their intelligence?
CATHY: (*Long pause*) Well, I guess their exposure and their knowledgebase is getting bigger… so what they can draw upon is getting bigger so they can use that as a reference to solve another problem or another situation. So yes, I agree.

BW: In what situations does effort matter to you in school or teaching?
CATHY: Effort won't get you a grade. But if you actually are trying, that gives me... well... I want to give them more of my time to teach them. Even if you're totally wrong, but you're working really hard, that means you were trying and you're trying to figure out the information. If for some reason, I'm just not communicating with them in the way that they can understand it. But if they're going to throw up your hands and not care, then I'm not gonna sit there and try to work with those who don't want to put any effort into it. And they know that, and I use those words with them, "if you're not going to try, then I have things to do. Trust me. I do". So they have to put in the effort, if they expect something from me. Even if they totally don't know anything, they have to try in order for me to sit next to them and try to help.

BW: Let's look at the predictions again and pick a student that you gave a 0 to 5, and compare with the student that you gave a 5 out of 5 to. Look at both the front and the

back. What makes you give this student a zero and this student the five? (*Pointing to two students' names on her roster.)*
CATHY: Well, this one is special needs. He doesn't even recognize numbers at this point, so this test isn't even on his skill set. Same with him. They're both on full IEP's. So neither of them have the skill set to be in kindergarten at this point versus... well, I guess it's their knowledge base that they came to school with, versus someone who is getting them all right. And even just the conversations I have with them, they're able to pick up on things a lot quicker. And they just are clearly exposed to more. The ones I gave 5/5 to, they came in with a lot of knowledge. They're just starting at a different point. So when I say, "we can take our doubles and add one", they're able to take it to the next place. The ones I gave a zero or two out of five, they don't even know what a double is, and I need to go back and teach them what the double is. But someone who came in knowing what a double was, they just have to say, "oh, it's this plus that". So this kid's base was already well above this kid's base.

BW: The ones that have come in with the lower base, have you seen them grow?
CATHY: Yes, absolutely.

BW: So when you give them a two or zero, besides what they are coming in with, what cues did you use to make the predictions?

CATHY: Well the support they would need to complete the assignment. Like the fives, they could probably do this with very little guidance… maybe very little reading because their reading base is also very high. So they can understand what the definitions are and what the words mean. They see "how many more toys" and know what *more* means - I'm adding to the number. It gets bigger. I've taught them that, but they also understood the vocabulary. Some of my lower students don't even understand that *more* means getting bigger, so it's double whammy. So they say, "what do you mean more?". Ok so if more means bigger, then my pile is getting bigger, and you need to add. So they're going to need more support to accomplish the same things that the kids who are reading and have a better vocabulary already.

BW: If one of the students that you gave a zero or two was solving a problem (this one) whole class, what feedback would you give them and how do you handle it if they gave the incorrect answer?
CATHY: Usually if they get it wrong, someone will always tell them! And I say, "well, is there another way we can look at it? Why don't we look at our drawings again", or "let's look at what you drew on the board and make sure that if we say *equal,* what does equal mean?" So we have to go back to the vocabulary. "Does that mean both sides have to be the same? So if you say 4+3, is that the same as 5+ 1? Find what is 4+3? Then find 5+ 1. What's that answer? Are these equal? No. So how are you going to make them equal? What do you need to do?" And they have to work through it. And they still have to solve it. I still make them work it through. And sometimes if they're starting to look stressed, I tell them they can ask a friend for help. Would you like to ask a friend for help? And they can ask a friend. But they don't get to just get off the hook because they got the wrong answer.

Transcribed interview with MARK

BW: Please state your name and today's date.
MARK: Mark, today is March 9th, 2015.

BW: Please tell me where you work and which grade you teach.
MARK: I teach at McDonald Elementary, second grade.

BW: How many years have you been working as a teacher?
MARK: I've been teaching for 18 years - eight here, 10 in California, both second and third grades.

BW: What does it mean to you to be a teacher?
MARK: Well, it means to be a person who tries to get the best out of a person as much as possible on an individual level, and find out where a child is; and then, of course, try to get them to move forward from there. It's definitely harder this year as my room has grown to 35 students, and trying to meet their needs.

BW: How would you define *prediction*? Especially in this context of the activity you just did?
MARK: It's essentially teacher assessment on how well I know my students.

BW: Then what does it mean to know your students?
MARK: Well, knowing where my students' strengths are; where their weaknesses are; which ones struggle, and ideally I should be able to tell you where any student is, in any subject based on assessments and groupings. So for example in math, we have individual math groups—small groups—based on ability, so I can challenge everyone wherever they are. In reading groups, we even have the spelling groups based on different common assessments that we have. That's how they were originally formed, so kids are challenged no matter what.

BW: Based on what you just said about your definition of prediction, what are you basing these particular predictions off of?
MARK: A lot of it is based on.... ***reading***, especially for the second page. There's a lot of reading that's involved. So for somebody that I've given a one or zero to, they're brand-new students who are really struggling with reading. But not necessarily mathematical concepts. So I can see right away when I ask 11+12, that they can come up with different strategies to solve that. But as you start to include, not necessarily higher level vocabulary in this test, but at least with the reading, that's gonna throw some of them off. So as far as predictions, there's a lot more contextual problems of course… it's a different thinking where some can do one plus one, no problem. But I just know some of them are going to be struggling with those problems and they're gonna have more difficulty with this side- the second side.

BW: So adding your predictions for the conceptual part, what is about that one student who you think will struggle, versus a student who will not struggle conceptually?

MARK: Reading aside? Just with having worked with them in math journals and small groups with parent groups, for example. There's a small group of students that tend to struggle as opposed to just answering level one type of questioning ... and blooms Taxonomy type of questions so... and that's kind of across-the-board. Reading too. Are they going to understand the higher-level thinking? Some of them just aren't developmentally ready, and that's just the way it goes.

BW: To what extent do your math lesson planning and instructional practices center around **your** explanation of the concepts/content?
MARK: Well, ideally we want the kids to come up with their own strategies. So when we had our math group time, I can have more small group interaction with them. Just because I have 29 students as of Wednesday, there's not much I can do whole group anymore. When I do, I like to have them use their clicker so they can send in their answers. So when we get a wrong answer, ideally I like to get them to say, "why did somebody do this? What's going on? Why would they come up with that answer?" Because that's just important as getting the right answer. So as much as possible, I want the kids to explain as opposed to me. "What were the explanations? What are the different ways to get that answer?" And sometimes I will even give them the answer and then they had to figure out how did somebody get that answer? Like, what's 11+12, and then they discuss the different ways of coming up with the answer that I gave him. We have a lunch count every morning, for example, and they send in their answers with the clickers and this gives me a graph of how they answered.
I don't focus on the right answer. I focus on how they got it. I can pick on somebody and say, "Charlie did it this way. Let's use his method, but then I'll change the problem and then call on someone to solve this new one using Charlie's way. So they're forced to not use the way they're most comfortable with to solve the answer, because they're forced to use someone else's method.

BW: How does a student's background, culture, and/or family determine his or her intelligence?
MARK: Well, intelligence versus performance would be different. Intelligence… well, let me change it as far as performance. Families are huge- we get kids whose family doesn't necessarily value education. I just heard a stat last week that only 36% of parents even look at the report cards as a whole district. When I asked one parent who I *know* didn't look at her child's report card online, I asked why she didn't and she said that she just doesn't have time. I don't know about you, but growing up and how I did at school was really important to my family. So when education is not valued like that at home, kids at age 7 or 8, they are not necessarily so self-motivated. So if they don't see education as a goal, is that a factor? Yes. Does that affect intelligence? No! Course all kids can learn and there are some factors that we can control… and they are frustrating, like homework being turned in, parents who complain about Common Core etc. etc.! I would tell my parents at our back to school night that we need kids to be able to come up

with the problem and if you don't conceptualize the problem, you lose it. So the computer can give us the answer, but students need to come up with it themselves.

BW: In what situations are you comfortable with students choosing and talking about the methods they use to solve problems?
MARK: 0h, always! If possible, I'll start with the answer like I said, and I want students to come up with as many ways to solve that problem.

BW: In what situations are you more comfortable with students working individually?
MARK: Well, for example, when you came in today, the small group was working on a leveled reader, and then they can take the test online. That's all independent. Assessment is a good little snapshot to see how their reading is coming along. But it's a good assessment, and unfortunately they need to get used to taking tests online. So that's one example of when they would work independently. So at least they can get used to the online testing format.

BW: Now let's look back at the predictions you made for each of your students. *(He shows me which students are the new ones in his class.)* Since they're new, what are you basing your predictions off of for them?
MARK: Well, it's just how I've gotten to know them. Especially in the small group math, I can understand and see if they're getting it or not. I know some of them, actually all of them, are struggling. One of them in particular has moved eight times. So that total inconsistency doesn't help. But again, family life for a lot of these students… it's just a matter of… well, one of these is a very poor reader, so I know they struggle and then putting him as a three on the front side. But on the backside, you throw any words in there, and he's just going to be totally lost.

BW: So then let's compare that to the student you gave a five out of five to. What cues are you using to make that score?
MARK: Five out of five here because I know this one student will not have a problem. This one's a five on the back, and I know that because he'll be one student who, when problems like this come up in class, he'll be fine on it. When we do this kind of work, he does well. If he misses one, it's because he probably didn't spend more than five minutes on it.

BW: How do you handle it when a student (like this one you gave 2/5 to, in particular) answers the question whole class incorrectly?
MARK: Well, one thing I did even today, and this was with contractions- having nothing to do with math- but I did a quick poll, and the kids sent in their answer through the clickers. And that was three minutes before recess. Everyone that got it, I said could lineup. The others, I just kept really quickly, and said, "okay, let's review. What is does the apostrophe mean? What letter disappears?" And then I put another quick word for review. So this technology is huge for really ... You think you know a kid- you think you know where they are - I think it does a much better job than white boards being held up. The data can be displayed anonymously, and then I can go in really quickly to see who

doesn’t understand it. I know it took only maybe 3 to 4 minutes to review, so it’s a real attempt to at least be accountable.

Transcribed interview with NINA

BW: Please state your name and today's date.
NINA: Nina, March 10th, 2015.

BW: Please tell me where you work and which grade you teach.
NH: McDonald Elementary, am and pm kindergarten.

BW: How many years have you been working as a teacher?
NINA: I've been working as a teacher for 19 years.

(While she's making her predictions, she's talking out loud and I asked her some general questions about her prediction process…)
NINA: How would I determine how they would do? Well just from our classwork. We've done a lot of this and a lot of these. Like today we were doing one like this with Dr. Seuss characters. We've had lots of practice with the wreck and wreck and the number line. Um, I will say not as many kids like using the unifix cubes now that they've been introduced to the wreck and wreck and the number line. Before unisex cubes were everything. Especially my early teaching in kindergarten. So how do I think my 19 students in my a.m. kindergartners will do while looking at the roster? I would say that every student of mine will get five out of five on this front side of the test. I'm very confident of that. But now on the backside of this test, I'm not so confident! Let's see. How do we get problems like this? We need worksheets that have these to practice with them… I read these questions to my students and I talk to them about when they hear a number in the word problem, they have to down write that number. I don't let them draw pictures, just a number. So on this backside I'm going to say, looking at my roster and looking at this backside of the test, well, I definitely have some bright students who will get five out of five on problems like this one. I really only have a handful that I'm gonna say are going to get five out of five…I'm gonna say 10 out of 19 will get five out of five. Wait, am I going to give this to them orally? Oh wait, they have a choice to answer with. So now I'm going to say 15 students out of 19 will get five out of five. Especially since they can choose from these possible answers, I would say 15 out of 19.

BW: So what about the other four who will not get five out of five?
NINA: So, I have some late bloomers that need more help. But if I can give them support… I could say just by looking at this question they'd be confused. You know, just because we haven't done these types of problems. And then for some other kiddos, even though we haven't done these problems, they'll have a problem but then see these answer choices and they'll be able to solve it by using the options of the answers. But for my late bloomers who need more practice, mathematically they're going to be confused because it'll be foreign to them. We've done a lot of story problems and I think they would understand those because they understand them visually. But these other problems they would be very confused by.

BW: Let's dive deeper into exactly what are you basing your predictions on? You said you predict based on what you've already taught in class, but let's go deeper into what cues are you using?
NINA: So you're asking how do I base my predictions on how I think my students will do when I give them work? I think I base my predictions on how solid the students are with using manipulatives to help them solve problems. Which ones are really adept at switching from wreck and wreck over to the number line? Because some of my kids are good at using the number line in making the jumps from number to number. For my tactile kids, I've got a froggy number line so they can jump the numbers, like what's 3 + 3, they can jump to the numbers to add. But for my higher kids, I've taught them "now once you get your froggy in place where you know you need to start, you don't have to move him. You can just use your finger to get to the answer. Because it's more time-consuming doing the leaps. But with the manipulation, some need it. I tell my students we're all trying to learn faster way to count. I ask them, "Is it faster to start at the number one, or the number you're counting on from?" I'm always trying to prepare them mentally for a faster way to count.

BW: How would you define *prediction*?
NINA: A good guess. I tell my kids we are always trying to make a good guess.

BW: To what extent do your math lesson planning and instructional practices center around your explanation of the concepts and content?
NINA: Well I would say sometimes we do math whole group and so I spend more time doing direct instruction where I'm teaching something for the first time. Since we're doing it altogether. But then after I've introduced it, we start to practice and I do things more in small groups and I have 4 work centers and the kids have free choice, which they rotate every two days. I have two math activities and then a English language arts and social studies work centers, at least something like that, but always two math centers. And I'm reviewing and don't spend as much time doing direct instruction because we're reviewing.

BW: How much do you factor in **student** thinking and the students' understanding of the concepts into your instruction?
NINA: *Their* thinking? Well... (*long pause*) I always ask if they have questions. During practice and review days, we do a practice problem or two. We do that whole group and I invite students to come up and do it on the big board and then on the second day, I just ask, "does anybody need to practice"? And a few may need to come up and review. Of course I always have a couple students who just sit there, especially when something new is being introduced. Those are my challenging ones. I tell them "sitting is not a choice and if you help, you need to come and talk to the teacher".

BW: Do they come get help?
NINA: They do… well, one more than the other. But there's other issues going on with one of those guys. It's ADD. And my other guy is very smart but needs a lot of repetition and practice. These are my late bloomers.

BW: How does a student's background, culture, and/or family determine his or her intelligence?
NINA: So I'm going to switch gears from my morning kindergarten to my afternoon class, just because I have a sibling in my afternoon class and I had the other brother last year. It's a Hispanic family, mom does not speak English, dad does a little bit, but there's an older brother I think in seventh grade and he speaks fluent English. I had middle brother and then I got the younger brother now, and I will say that both of them are so bright, so smart. And my feeling is… what resources do those parents use to help their students learn? And I know culture matters, but rather I think the parents have the resource and use the resource of the oldest brother to help the younger ones learn. It comes down to what resources are available, and in this case is there an adult at home at night who could help? And I tell the parents "homework is not for your child, it's for you, so you know how your child is doing". When they get their work home from the kindergarten class done right and correctly because everybody has a chance to do it successfully in class. When they don't get help and it's not right, then I make sure my students come and see me or the parent volunteer so we get it done right. So I want my parents working with their children so they understand where their child is. It's homework for the parents to see how their kiddo's doing. How parents utilize their resources and if they're available make a big difference to students' academic learning.

BW: As your students learn new content and concepts, do you think the students' intelligence is changing?
NINA: Sure, absolutely, because you're filling that brain with more information.

BW: In what situations does effort matter to you in school or teaching?
NINA: You know in kindergarten, you don't have to give the huge effort just because everything we do is in short, small chunks. I think everybody's effort is good unless they don't understand the concept. So then that's my job to go back and reteach the concepts, because then I think their effort can be successful.

BW: What about the kiddo that you were talking about, actually the two that you were talking about earlier, that you have to almost probe them to be more engaged with the lesson- how would effort look with them?
BW: Well effort for my one guy, I think it's more of a confidence thing. When he comes and sits with an adult, he can get it. But left alone, he's insecure. But now for the other little guy, it's focus. His is really about focus and I've even talked to his mom about that and we're thinking about making a little office, trifold thing for his desk to help him focus. He's hugely distracted, but capable. His own physical surroundings and his own inner personal ability to stay focused affects his effort.

BW: Would you wait to see signs of effort from a student who you knew needed help, or do you go ahead and help them?
NINA: I initially always let my students start out independent. I do sort of a global scanning to see which students are having trouble. I also have a running record in my mind and then I just visually look and if I see a child who looks like they're stuck, I asked

"do you need some help with that?" Then I say come over to the teacher table so I can work with them. I'm trying to keep everybody's needs met and sometimes that's tricky.

BW: Let's look specifically at some of the predictions you made. How do you know that this one student you're predicting will get a five out of five? How do you know that this student knows the content and get that five out of five? And then let's compare that to the student you think will get a zero out of five. Let's talk about how you compare those two students and the cues you used to make your predictions.
NINA: I think confidence has to do with it. Being an independent worker plays a role. Some students can get everything, but they are dependent and they need guidance. They have not gotten that secure or even mature, and I always tell the kiddos in my classroom "somebody who was born six months before you has six months more information". I tell my kids not to compare themselves to each other. We're all at different places and growing at different levels. Then distractions and thinking about staying focused on what's in front of them, then worrying about how other students are doing and staying focused on what's in front of them is tricky. Those areas are what affect their ability to do and complete assignments.

BW: Are you driven more by students getting the right answer or how they got to their answer? During your lessons and discussions, to what extent do you carefully explain the correct process or procedure to avoid students making mistakes?
NINA: Well, I want to see what they're using. I want to see if my kids are drawing pictures and if that works better for you, go for it! Everybody's learning their tool to be successful and I tell my students this. I say "I'd like for you to learn lots of ways to use tools, but use whatever works best for you". Because I think if they need to touch it, or draw it, or feel it to have it make sense, then that understanding is what you want them to have. You think of a five-year-old mind, it's huge. So whatever the concrete object is that they use to get that understanding, I don't care. That's why I try to encourage multiple tools. That's why I give them the tools and then they make the choice because that's what's important and helps them the most to make sense. If there using a tool, and they're not getting the right answer, that's okay. But then I want to do a pullout and I want to sit with them and have them show me. I want to review more one-to-one correspondence. The manipulation is huge.

BW: How do you handle it when a student—say the one that you predicted would score one out of five—how do you handle it when he answers incorrectly in class?
NINA: A lot of times when we do these types of problems (pointing to a problem on the backside of the ITML test), I do this whole class a lot of times and it's during the practice time when the whole class is on the carpet and each student has her own white board and marker. Students have a whiteboard so when I get an incorrect answer, I say, "let's go back and see if you got your numbers right." I just say, "let's make sure that you got your objects matching your numbers". So that's what I would do. We do the problem together and I have my whiteboard to model it. And I have my students turn their whiteboards over when they have their answer. And then I'll look at it and then have them put it down because I don't want students to be copying each other. "Don't look at your neighbors and copy them because you don't know if they got it right". Then for the students who

are wrong, I say. “let’s go back and start from the beginning and make sure you have the number corresponding to the number of objects, and make sure they have that one to one correspondence”.

(While taking the Mindset Survey, NINA shared some thoughts out loud…)
NINA: Can you change your intelligence level? I mean I’m thinking of sitting in on an IEP meeting, and I don’t think you can change your intelligence but rather your skills.

You can learn new math skills but does that change your math intelligence? I g*ggguuess* it could! Is it intelligence that grows or exposure to things that make it grow? I definitely think you’re either creative or not. I don’t know how to cultivate my creativity! Boy, this is really making me think.