# Academic Agency: The Impact of Underlying Dispositions that Affect Teachers' Sense of Responsibility to Educate all Children in a Middle Grades Mathematics Classroom

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Based on the novel framework of Academic Agency, this study explored how a teacher's sense of efficacy, commitment and knowledge influenced their overall sense of responsibility in instructing all children in the science of mathematics. This study employed a two-phase data collection process in which surveys, classroom interviews, and observations were used to examine practicing teacher's beliefs regarding efficacy, commitment, content knowledge and responsibility. Pearson Correlation and Multiple Linear Regression were employed as analyses tools to identify the direction and strength of the relationships existing between variables. Findings suggest that there is a positive correlation between a teacher's sense of efficacy and their overall sense of responsibility and also a teacher's sense of efficacy and of mathematics teaching efficacy. The second phase of the study, participant interviews and observations, provided a more detailed look at how four purposefully selected educators enacted their articulated beliefs. Hour-long semi-structured interviews were conducted along with a classroom observation. The qualitative data collected from the four individuals was analyzed using NVivo software. Based upon recorded coding structures, individuals were placed into four predetermined categories ranging from *Custodial Emphasis* to *Focused Academic Agent.* Findings suggest that sense of responsibility may be a factor in educational decisions.

Attempting to identify constructs that impact instructional choices made in mathematics classrooms, this paper seeks to articulate underlying dispositions of teachers' sense of responsibility to educate children in a middle-grades setting. The novel framework of Academic Agency, the framework for this study, amalgamates constructs previously identified through a myriad of educational studies and situates them within the notion of teacher's sense of responsibility. Teachers' responsibility, the impetus of the Academic Agency theoretical framework, views responsibility through the lens of efficacy, commitment, knowledge, and action. The framework of Academic Agency allows the strengths and weaknesses of an individual educator to be defined in regard to his or her personal and professional sense of responsibility in educating all children in mathematics. The Academic Agency framework posits that the responsibility of action becomes the changing factor that moves personal responsibility into professional accountability. Figure 1 depicts the interactions and movement toward Academic Agency. At the point where efficacy, commitment, and knowledge intersect with action, Academic Agency exists. Along with the identified constructs, four teacher dispositions can be described: Custodial Emphasis, Commitment Emphasis, Knowledge Emphasis and Academic Agent. These four descriptions will be discussed in detail in subsequent sections.

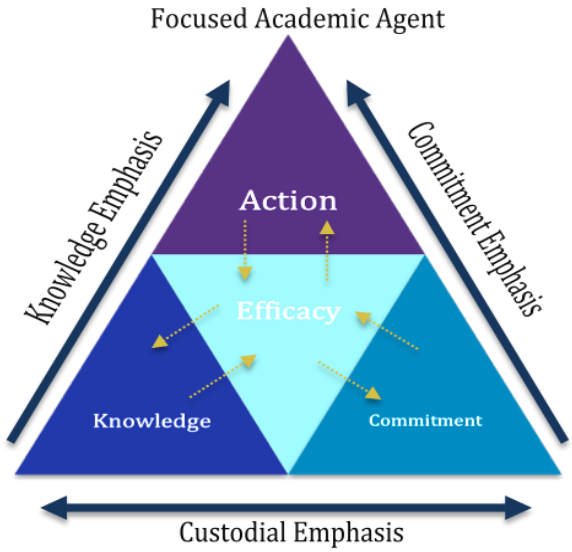


*Figure 1.* Academic Agency Diagram

## *Efficacy*

Efficacy's influence on personal commitment, personal knowledge, and action, and how an individual defines their personal and professional responsibility, is irreplaceable in an educational setting. Ashton and Webb (1986) found that teacher expectations and commitment to responsibility were altered by student characteristics such as socioeconomic class, race, or classroom behaviour. Specifically, teachers that demonstrated a low sense of efficacy failed to accept any responsibility for student achievement. Teachers with high efficacious feelings cited more positive relationships with students and took a greater responsibility in reaching all children.

What a teacher believes about the nature of mathematics directly impacts their belief system and what it means to actively engage in doing mathematics (Mewborn & Cross, 2007). Results of a study by Stipek, Givvin, Salmon, and MacGyvers (2001) revealed that teachers who were identified with having more traditional beliefs taught in a direct manner, with an emphasis on performance, speed of problem solving, and minimal student autonomy in their mathematics classroom. Restrictive practices in mathematics education have been well documented in the research literature. Frank (1988) identified four significant dispositions commonly associated with traditional mathematics instruction: 1) mathematics is computation, 2) mathematics problems should be solved quickly, 3) the goal of mathematics is to achieve one correct answer, and 4) in the mathematics classroom the teacher is actively contributing and the student is passively receiving the information.

Research indicates that the beliefs held by mathematics teachers begin to transform into more positive practices once the teacher realizes that their instructional techniques may be problematic (Swafford et al., 1999; Sowder et al., 1998; Cobb et al., 1990) Cobb et al. (1990) go on to state that "beliefs and practice are dialectically related. Beliefs are expressed in practice, and problems or surprises encountered in practice give rise to opportunities to reorganize beliefs" (p. 145).

## *Sense of Responsibility*

The construct of responsibility is ambiguous in mathematics education. To begin the discussion regarding responsibility as framed by this study, two paradigms related to

responsibility identified through Silverman's (2009) dissertation work must be addressed. Silverman's research suggested that responsibility may be categorized as virtue-responsibility (VR) or accountable-responsibility (AR). Silverman (2009) posits that a responsible and virtuous person will engage in areas that are driven by morality and the choices that they make regulate their behaviour. An accountable and responsible person on the other hand is driven by rules, outcomes, and punishment. (see Table 1)

Table 1

*Virtue Responsibility (VR) versus Accountable Responsibility (AR) (Silverman, 2009)*

| | Responsibility | |
|---|---|---|
| | Virtue | Accountability |
| Form of Judgement | Conscience | Law |
| Answerable To | Self | Others |
| Defined By | Discovery | Decision |
| Codified By | Morals | Ethics |
| Agency | Individual | State |
| Judged According To | Intention | Outcome |
| Consequence of Error | Guilt | Punishment |

The micro-political context in which a teacher operates must be acknowledged. Teachers' sense of students' ability (Roscigno & Ainsworth-Darnell, 1999) and teachers' sense of responsibility for students' learning both individually and collectively (Lee & Smith, 2001; Lee & Loeb, 2000; Diamond et al., 2004) define the micro-political context. In addressing individual's sense of responsibility for student learning, Diamond, Randolph and Spillane (2004), posit the organizational habitus guides teacher expectations and sense of responsibility for student learning through the interactions, evaluations, and practices that exist within a school environment and provides direction for an individual stream of beliefs.

Lee and Smith (2001) identified three components to measure a sense of collective responsibility: 1) teachers' innate sense of responsibility for student learning, 2) a teachers' willingness to modify teaching strategies to address students' needs, and 3) a teachers' sense of efficacy in their teaching practices. Collective responsibility, therefore, exists on a continuum, on one end are environments where teachers acknowledge their success and failures in the classroom and accept responsibility for student success and at the other extreme, teachers who take little responsibility for student success and blame the failure of student advancement on conditions such as student ability, socio economic level, or lack of motivation of the student (Lee & Loeb, 2000; Lee & Smith, 2001).

Previous research studies have shown that the avoidance of responsibility will serve as a means of dissonance reduction (Brock & Buss, 1962; Cooper, 1971; Lerner & Mathews, 1967), a cognitive state where an individual fails to accept responsibility for behaviour or consequence of behaviour based upon their level of investment. Cooper (1971) identifies two processes by which an individual may avert responsibility: 1) the environment, individuals' claim they were forced to behave in an irresponsible manner, and 2) consequences of their attitude-discrepant behaviour was unforeseeable.

### *Responsibility Exemplified Through Knowledge*

It is impossible to address all of the influences that affect overall classroom environment, therefore, the following ideas were considered and used throughout the qualitative analysis of the research. These topics include the underlying philosophy of the classroom, teacher pedagogical content knowledge (PCK), mathematics knowledge for teaching (MKT), and instructional emphasis. Within the practice of teaching, instructional practices should not be seen only as a means to simply deliver content, but an educator's sense of what it means to obtain knowledge and their capacity to empathize with those that they teach.

Children who enter the educational arena face many obstacles both academically and socially. Therefore, it is critical that educators look beyond the surface of education and delve into what it truly means to educate the individual. PCK introduced by Shulman (1987) brought focus to aspects of classroom practices that appear to be peripheral to student learning. In the formation of his construct, Shulman examined multiple pedagogical influences in the classroom and coupled them with teacher knowledge related to content. Shulman (1987) posited that content knowledge alone was not enough to establish a positive learning environment. He felt that teachers must know and understand the underlying principles that shape and define a content area. Shulman (1986) stated:

> Teachers must not only be capable of defining for students the accepted truths in a domain, they must also be able to explain why a particular proposition is deemed warranted, why it is working, and how it relates to other propositions, both within the discipline and without, both in theory and in practice (p.9).

Therefore, a teacher can no longer simply accept rules for what is deemed legitimate within a field of study but must truly understand why the rule exists and how it impacts the structure of a discipline (Ball et al., 2008).

The final contribution to Shulman's (1986), model regarding teacher knowledge is PCK. PCK was built upon research observations that showed when diagrams and explanations used in an instructional setting were aligned with student cognitive ability, some of the various representations selected provided students with a greater understanding of specific content (Carlesen, 1988; Grossman, 1990; Marks, 1990; Wilson, 1988; Wilson et al., 1987; Wineburg, 1990).

### *Mathematics Knowledge for Teaching (MKT)*

Shulman's work involving PCK led to the development of MKT. Ball et al. (2008), extended PCK to exclusively address the content knowledge needed for teaching in a mathematics classroom. Ball et al. (2008) defined MKT as "the mathematical knowledge needed to carry out the work of teaching mathematics" (p. 395). In the MKT framework, the teaching of mathematics includes items such as planning for lessons, assessing student work, interacting with parents, addressing equity concerns in the classroom, and many other tasks that promote mathematical proficiency (Ball et al., 2008; Hill et al., 2009; Kilpatrick et al., 2001; Stipek et al., 2001).

Within the construct of MKT four subdomains exist; common content knowledge (CCK), specialized content knowledge (SCK), knowledge of content and students (KCS), and knowledge of content and teaching (KCT). The first CCK is defined as the simple calculations done when solving a mathematics problem or correctly solving a mathematics problem. Ball et al. (2008) believe that CCK is the area in which a teacher must understand the content in such a way that when information is presented, the teacher will be able to

recognize the accuracy or inaccuracy of student contributions in the classroom. In addition, the knowledge that is addressed in CCK is knowledge that is not unique to teaching, it flows beyond the constraints of educational settings. The second area found in MKT, is SCK. According to Ball et al (2008) SCK is the knowledge necessary to unfold and discover the layers of understanding that exist in a mathematics setting, it requires teachers to "hold unpacked mathematical knowledge because teaching involves making features of particular content visible to and learnable by students" (p. 400). An example of this type of knowledge being utilized in a mathematics classroom happens when alternative student solutions are presented, teachers must know how to proceed in developing student understanding by incorporating the students' personal reasoning skills as well as their own prior knowledge. KCS the third sub-domain found in mathematical knowledge for teaching. KCS requires that teachers are able to identify and address common mathematical misconceptions of the students as well as be able to identify those mathematical tasks that children may find problematic or the mathematical tasks that motivate children to engage themselves in the task. The final section is KCT. KCT is the domain in which teachers make instructional decisions that affect student learning. It is in this domain where teachers are "evaluating the instructional advantages and disadvantages of representation used to teach a specific idea and identify what different methods and procedures afford instructionally" (Ball et al., 2008, p. 401). KCT combines pedagogical issues and content specific issues into the same sphere of knowledge. To this end, teachers must choose their own opportunities for learning and must be willing to become students of mathematics so that they build an increased level of knowledge and understanding of the world around them.

The aim of this study was to fill a gap in existing mathematics literature by connecting ideas considered independent paradigms in educational settings, efficacy, responsibility, and knowledge. Through survey instruments, classroom observations and individual interviews, this study attempted to identify salient beliefs, structures and actions that are held by middle grades mathematics teachers. Four research questions focused the research task:

1. What is the relationship that exists between a teacher's sense of teaching efficacy, mathematics teaching efficacy, and mathematics content knowledge for teaching and responsibility?
2. How does a teacher's sense of teaching efficacy and mathematics teaching efficacy affect their sense of responsibility for teaching mathematics in a middle-grades classroom?
3. What aspects of the teaching context influence the teaching efficacy of middle grades mathematics teachers?
4. How do middle grades mathematics teachers convey their attitudes in regard to responsibility for teaching mathematics?

Through the proposed research questions the correlation of efficacy, responsibility, and mathematical knowledge were examined.

## Research Design

As an exploratory mixed-methods study, data from the quantitative phase helped to inform the manner in which the qualitative study was addressed. The quantitative component incorporated survey instruments to address specific constructs of Academic Agency. Specifically, action, commitment, efficacy, and MKT. The qualitative element extended the

knowledge gained from the quantitative study to provide a more concise picture of four individuals and their personal grounding within the Academic Agency model. The qualitative section incorporated the use of interviews and observations to expand and provide a platform for individual voice.

*Instrumentation*

The first phase of the research protocol looked at the framework of Academic Agency through the four identified dimensions. Four established instruments were used to collect data. Each instrument had previously shown to have high reliability and validity indices. The survey instruments selected asked teachers to respond to forced-response questions, establishing common boundaries for responses making the interpretation of data cohesive, allowing to rank order individuals based upon their self-reported data.

*Teacher efficacy.* Woolfolk and Hoy (1990), using Gibson and Dembo's (1984) original scale, constructed a 22-item Teacher Efficacy Scale to examine the meaning of efficacy for prospective teachers. The 22-items include 16 items from the Gibson and Dembo's Teacher Efficacy Scale that produced adequate reliability and four others that address teacher's pre-service preparation. Additional survey questions include two original Research and Development (RAND) items. Item one: "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment", and Item two: "If I try really hard, I can get through to even the most difficult or unmotivated students."

Within the survey instrument two sub-categories exist: Personal Efficacy and Teaching Efficacy. Item one of the RAND items focuses attention on teaching efficacy while item two looks at personal teaching efficacy. Through previous studies using the RAND items, results have indicated that teaching efficacy and personal teaching efficacy are independent. A sample teaching efficacy question is: "When a student is having difficulty with an assignment, I am usually able to adjust it to his/her level." A sample personal teaching efficacy question is: "Teachers are not a very powerful influence on student achievement when all factors are considered." Responses to the items are along a 6-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (6).

*Mathematics teaching efficacy.* The Mathematics Teaching Efficacy Beliefs Instrument (MTEBI-A) (Enochs et al., 2000) for in-service teachers was chosen to measure personal mathematics teaching efficacy. The MTEBI-A consists of 13 personal mathematics teaching efficacy (PMTE) items and eight mathematics teaching outcome expectancy items (MTOE). The MTEBI-A was developed based on the STEBI-A, a science efficacy belief instrument created by Riggs and Enoch (1990). The original instrument was modified from a five-point Likert scale to a six-point Likert scale, ranging from *strongly agree* (1) to *strongly disagree* (6).

*Teacher responsibility.* To explore teachers' sense of responsibility and commitment, Teachers' Beliefs Form I, developed by Silverman (2009) was selected. Silverman's original instrument looked at various components of responsibility including multiculturalism and diversity, economic class, gender, faith, disability, sexual orientation, and culture. For this study an abbreviated 33-item version of the Silverman (2009) Teachers' Beliefs was adapted to measure teacher beliefs regarding specific aspects of responsibility in the classroom setting. The modified instrument looked at the sub-groups of race, socio-economic status, disability, gender, and culture.

*Mathematics content knowledge.* Measuring MKT for the study was handled slightly differently. With each of the other instruments, participants self-selected responses from a Likert scale, the structure of this instrument was multiple choice and responses were identified as either correct (1) or incorrect (0) from a scoring key. To measure content knowledge for teaching, the instrument chosen was developed and tested by a research team at the University of Michigan. A version of the Learning Mathematics for Teaching (LMT) instrument was constructed for quantitative data collection. The adjusted instrument contained 14 items focused on number, algebra, and geometry in the middle grades.

## *Data Collection*

To ensure a rich quantitative data set, 49 completed instruments were compiled. A completed instrument included the mentioned four measures. After collecting the data, all scores were imported to SPSS statistical software. Pearson Correlation and Multiple Linear Regression were used to analyze numerical data. Findings are described in the Analysis section. Stepping away from the quantitative methods and going to the qualitative methods provided a more personal and descriptive picture of what was occurring within a sample population. The semi-structured interview allowed more specific questions to be addressed and provided the vehicle for the educators' voice to be heard. During the analysis of both data sources, it was critical to focus attention on why teachers held certain beliefs, not that they held these beliefs.

Participants for the qualitative section of the study came from consenting participants in the quantitative phase. According to Patton (1990), "the logic and power of purposeful sampling lies in selecting information-rich cases for study in depth" (p. 169). Although it would have been ideal to select participants from each of the various combinations available, it was not practical; therefore, rank ordering strategies were utilized. For the initial sort, each individual's survey instrument was given a cumulative score based upon self-reported data. First calculating the sum of the complete instrument, the optimum score was computed taking into account the reverse scores used on multiple questions. The highest score possible was 527 points therefore, the difference between 527 and the participants score became the gauge for selecting participants for the next phase.

To ensure a diverse data set, individuals with either the highest and lowest overall score from three school settings types; urban, suburban, and rural (see Table 2) were selected. Looking at the lowest and highest cumulative score, the individual make-up of scores varied. For example, an individual may have scored high on content, but scored low on teacher self-efficacy, mathematics teaching efficacy or responsibility, therefore, a myriad of possibilities existed when selecting individuals.

Table 2

*Purposeful Sample Demographics for Qualitative Phase*

| ID | Community | Grade | High/Low Overall Scores |
|---|---|---|---|
| Lydia | Urban | 5 | High |
| Madelyn | Suburban | 5 | High |
| Samuel | Suburban | 8 | Low |
| Anna | Rural | 6 | Low |

The second sorting strategy was more detailed. One stipulation implemented for the qualitative study was that a participant from each school setting must be included in the sample group, this allowed for equal representation from urban, suburban, and rural schools. In each of the settings, survey instruments were collected from grades five through eight.

*Observations.* Hour-long observations were performed with each of the participating teachers. Prior to each observation, a pre-observation conference was conducted. The pre-observation conference addressed the upcoming lesson to be observed, goals for the intended lesson, and how the instructor hoped to address student misconceptions during the lesson. Following the hour observation, a post-observation conference was held. During the post-observation conference time the teacher had time to reflect upon the successes and challenges that the lesson presented.

*Interviews.* Semi-structured interviews were conducted with each consenting teacher in the sample. The interviews lasted approximately 30-45 minutes and were audiotaped. Interview questions were structured around a sense of responsibility and overall teaching practices. During the interview, aspects contained in the knowledge section of the Academic Agency model were central: items such as pedagogical content knowledge, mathematics knowledge for teaching, as well as instructional emphasis. Each semi-structured interview was coded using the NVivo qualitative software. To ensure accuracy in coding, two additional individuals coded the transcribed interviews. Results of the coded interviews are displayed beginning with Figure 2.

## *Quantitative Data Analysis*

The research question to be answered through quantitative data was the first research question. Pearson Correlation was used to measure the degree and direction of the relationship between variables, see Table 3.

Table 3

*Pearson Correlation Matrix for Responsibility Sub-group, Overall Teacher Responsibility, Teaching Efficacy-Personal, Teaching Efficacy-Teaching, Mathematics Teaching Efficacy-Personal Mathematics Teaching Efficacy, Mathematics Teaching Efficacy-Mathematics Teaching Outcome Expectancy, and Mathematics Knowledge for Teaching*

| | RESP SUBGRP | OVERALL TEACHER RESP | TE PERSONAL | TE TEACHING | MTEBI PMTE | MTEBI MTOE | MEAN MKT |
|---|---|---|---|---|---|---|---|
| RESP SUBGRP | 1 | .069 | .098 | .101 | -.100 | .216 | -.196 |
| OVERALL TEACHER RESP | | 1 | .311* | .345* | .242 | .311* | .069 |
| TE PERSONAL | | | 1 | .474* | .660** | .419** | .101 |
| TE TEACHING | | | | 1 | .212 | .596** | .080 |
| MTEBI PMTE | | | | | 1 | 345* | .284* |
| MTEBI MTOE | | | | | | 1 | .234 |
| MEAN MKT | | | | | | | 1 |

**Correlation is significant at the .01 level (2-tailed)

* Correlation is significant at the .05 level (2-tailed)

As noted in the correlation matrix nine significant relationships existed. Positive relationships are as follows; overall teacher responsibility and teacher efficacy-personal, overall teacher responsibility and teacher efficacy-teaching, overall teacher responsibility and mathematics teaching efficacy-mathematics teaching outcome expectancy, teacher efficacy-personal and teacher efficacy-teaching, teacher efficacy-personal and both mathematics teaching efficacy-personal mathematics teaching efficacy and mathematics teaching outcome expectancy, teaching efficacy-teaching and mathematics teaching efficacy outcome expectancy, and the two mathematics teaching efficacy sub-categories and finally mathematics teaching efficacy-personal mathematics teaching efficacy and mathematics knowledge for teaching.

The relationship that reported the strongest relationship was teacher efficacy-personal and mathematics teaching efficacy-personal mathematics teaching efficacy, $r$ =.660, $n$=49, $\rho \leq .01$, two tailed test. Therefore, as teaching efficacy increased for mathematics there was a marked increase in a teacher's personal sense of efficacy in overall instruction.

Teachers' self-reported data also indicated that as their personal and professional responsibility increased, their expectations for student mathematics outcomes also increased, $r$ =.311, $n$=49, $\rho \leq .05$, two tailed test. Results indicate that as teachers define their role in a mathematics classroom, their overall responsibility and student mathematics outcomes are explicitly linked.

*Predictors of Responsibility*

The second research question was: "How does a teacher's sense of teaching efficacy and mathematics teaching efficacy affect their sense of responsibility in teaching mathematics in a middle grades classroom?" To address this query, Multiple Linear Regression along with ANOVA was utilized. Accordingly, the null hypothesis is that teacher's sense of efficacy, teaching or mathematics teaching, had no effect on a teacher's sense of responsibility in instructing students. Teacher's sense of responsibility was defined as the dependent variable with teaching efficacy and mathematics teaching efficacy defined as independent variables.

Table 4

*Model Summary, Dependent Variable; Overall Teaching Responsibility, Independent Variable(s); MTEBI, TE*

| Model | R | R Square | Adjusted R Square |
|---|---|---|---|
| 1 | .394a | .155 | .119 |

Using the model summary, $R^2$ becomes the focal point of beginning analysis. The data from this study generated an $R^2$ of .155 which correlates to 15.5% of the variance in Y being explained by the X variables (see Table 4). At .155, the $R^2$ is identified by statistical measures as providing a weak effect size. Moving next to the ANOVA table calculations, calculations indicate that the F statistic is equal to 4.227. With the critical error for the F statistic, $df$=2, 46 equals to 3.20, it is concluded that the regression equation does account for a significant variance for the Y scores (Table 5).

Table 5

*Analysis of Variance in Regression Model*

| Model | Sum of Squares | Df | Mean Square | F |
|---|---|---|---|---|
| Regression | .815 | 2 | .408 | 4.227 |
| Residual | 4.435 | 46 | .096 | |
| Total | 5.250 | 48 | | |

### *Qualitative Data Analysis*

With the framework of Academic Agency in place, the initial coding structure looked at overall efficacy, mathematics teaching efficacy, classroom environment, instructional emphasis, academic emphasis, PCK, and MKT. Once the initial coding was completed in NVivo, the larger groupings were then broken down into subcategories (see Figure 2). Coding and sub-coding concisely address the two qualitative research questions:

1. What aspects of the teaching context influence mathematics teaching efficacy of the four middle grades mathematics teacher participants?
2. How do the four middle grades mathematics teachers convey their attitudes in regard to responsibility in teaching mathematics?

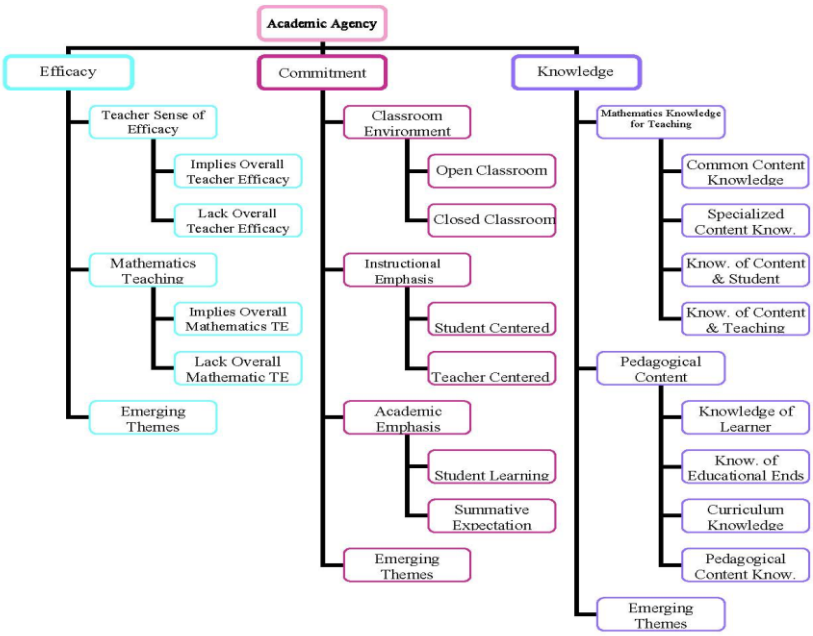


*Figure 2*. Qualitative coding tree

## Middle Grades Purposeful Sample Interviews and Observations

During the interview process, questions were posed that purposefully probed deeper into the responsibility one feels towards teaching middle grades mathematics and what choices are made to instruct all children. Questions such as: "In your mathematics classroom, do you try to implement various instructional strategies?" and "In learning mathematics, who is ultimately responsible for equipping students with the skills and knowledge necessary to move forward?" were asked of all four participants. This section addresses specifically how

each individual defined responsibility and whether their espoused and enacted responsibility was grounded in virtue or accountability. The organization described within each individual case follows the same format. First, the classroom setting will be described and then artifacts from participant interviews will be presented to sustain the conjectures regarding individual teaching structures. Included in each participant section is the qualitative coding analysis from NVivo.

### *Dispositions of Responsibility*

Four types of responsibility dispositions emerged as the framework of Academic Agency developed: custodial, commitment, knowledge and academic agent. In the following sections each exemplar will be defined.

*Custodial Emphasis.* As a descriptor, custodial emphasis refers to those instructional situations that appear to be more directive. Custodial emphasis does not mean that a teacher who subscribes to this instructional emphasis does not feel a sense of responsibility to children, it means that they may adhere to a more accountability driven sense of responsibility, where external expectations and influences outweigh the personal, long term instructional needs of the student. Research conducted by Hoy and Woolfolk (1990) established that teachers with a low sense of instructional efficacy tend to possess a more custodial orientation. Custodial orientation, because of limited student involvement, does not allow for motivation from within the teacher nor the student to drive instruction. Based on the ideals supporting the framework, teachers that identify with a custodial orientation tend to believe that education is incapable of overcoming the students' limitations.

*Knowledge Emphasis.* Knowledge emphasis acknowledges responsibility to the student, but the focus of instruction is aligned with content and curricular expectations. When an educator subscribes to knowledge emphasis, they may tend to be more concerned with overall summative assessments and see the classroom as one entity, instead of multiple identities making up one classroom. Instruction is typically more formal with goals and outcomes based upon a common indicator. Knowledge is coupled with action, but the missing piece is the commitment to the individual, and the inability to see an individual as a unique participant in the acquisition of knowledge.

*Commitment Emphasis.* The line that separates commitment emphasis and knowledge emphasis at times is somewhat difficult to distinguish. The one factor that delineates one from the other is how the teacher addresses the personal learning needs of the student. Commitment when used as a descriptor does not replace or contradict the need for knowledge but shifts the focus of classroom instruction to the student and away from summative results.

*Academic Agent.* Academic Agency, initiates both commitment and knowledge in the classroom. The role of the teacher becomes facilitator, a facilitator of knowledge, a facilitator of student independence, a facilitator of enhancing self-esteem, and a facilitator of the promotion of critical thinking skills.

Figure 1 depicts the interactions and movement toward Academic Agency. At the point where efficacy, commitment, and knowledge intersect with action, Academic Agency exists. Along with the identified constructs, four teacher dispositions can be described: Custodial Emphasis, Commitment Emphasis, Knowledge Emphasis and Academic Agent. These four descriptions will be discussed in detail in subsequent sections.

*Custodial Emphasis*

Samuel is a fourth-year suburban middle school mathematics teacher. Based upon the reported data, both quantitative and qualitative results depicted Samuel having an orientation that focused upon summative results. Samuel scored in the lowest of the four selected participants for responsibility and mathematics teaching efficacy, in the middle for overall teaching efficacy and scored the highest out of the sample of four for mathematics content knowledge for teaching.

*Classroom Environment.* Students began class by working on a problem of the day. To check the student solutions for the problem of the day, Samuel independently solved the problem on the board, walking through each formula step by step. The remainder of the class, approximately 20 minutes, was spent introducing new material on transformations and dilations. Notes for the new material were presented through a PowerPoint presentation on the monitor and a teacher-created study guide; there was no active involvement from the students during this time. Although the observation lasted 55 minutes, it was apparent that a typical classroom session lent itself to a more direct instruction orientation.

*Espoused Disposition.* In support of the conjecture of custodial emphasis, selections from the interview provide additional evidence. Knowing that a common frame was essential to compare teaching styles, direct and analogous questions were posed that focused on teacher responsibility and learning context. When posed with the question about a teacher's sense of responsibility in the classroom, Samuel responded:

> For a student that just doesn't, doesn't have that want, it is kind of hard for me to give them the time. That doesn't mean I totally ignore them that doesn't mean that I say oh yeah you don't have to whatever you know I continue to say, you need to get this done, this is going to translate to your grades, this is going to translate to you being on probation from this advanced class, this is going to translate to you not getting a good grade you know when you get to your next class in high school. But again, I can say that as many times, but if they don't pay attention to it, then, that is not going to matter much.

He continued by stating that, "I tend to spend more of my time with students that are receptive to my help because if I don't, first of all it gets me down personally, you know, oh well I am putting all of this work into them and they just don't care…"

The second aspect that became apparent during the interview was Samuel's belief that mathematics students should be held accountable for summative results. When asked about how he deals with assessing individual students, he commented, "If they don't master the learning target or at least have some progress in the learning target, it is hard to justify giving them a higher grade just for effort." To extend this idea, the questions was posed about how mathematics curriculum should be implemented, he stated:

> I mean it is really kind of, you know we teach more than just to the test, but in the end if that is what you are being evaluated on, that is what your students are being evaluated on, that is what your school district is being evaluated on that has to be one of the focuses you have.

Samuel's personal responses of how he defines academic success seem to indicate that summative assessment scores outweigh the individual learning process.

Figure 3 displays the analysis of results for Samuel based upon coding. Looking at the highest coded nodes, teacher negates responsibility, teacher-centered instruction, and lacks mathematical teaching efficacy all align themselves with the results reported in the quantitative data. Again, the one score that needs to be addressed for each individual is *Teacher Accepts Responsibility,* in Samuel's case out of the coded sections, 4.97% of his

coded interview referred to teacher accepts responsibility whereas 8.34% was coded teacher negates responsibility.

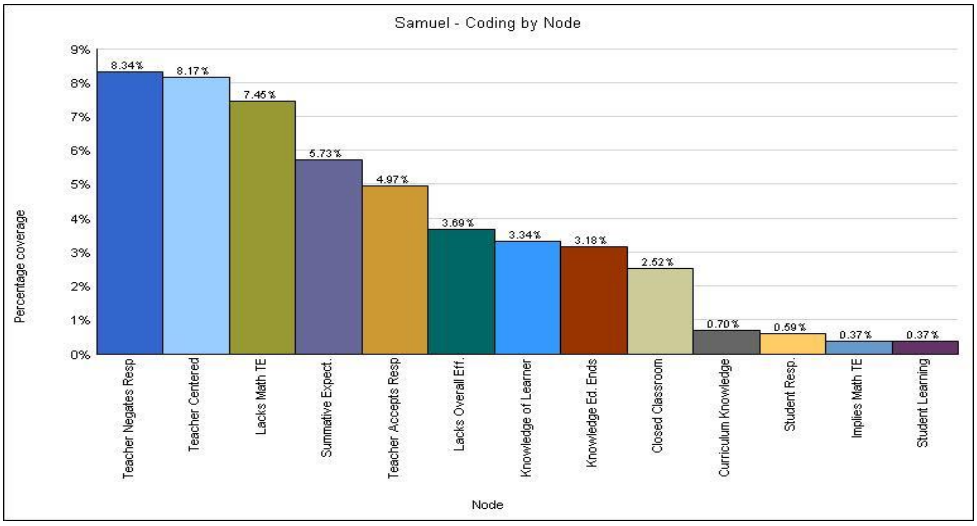


*Figure 3*. Samuel-coding by node

## *Commitment Emphasis*

Lydia, a teacher with more than six years of teaching experience, articulated that commitment to her students is the one aspect that she most subscribes to in her role as a mathematics teacher. The district that she worked in is a large suburban district and her classroom was very different from what one might deem typical. The students in her classroom represented a myriad of different nationalities. Her entire classroom was comprised of children from Japan, Mexico, Somalia, China, and other non-English speaking countries, each bringing multiple languages and cultures into the classroom environment.

Reviewing her quantitative scores so that a correlation can be made between the quantitative and qualitative data, Lydia scored in the highest section for responsibility, teaching efficacy, and mathematics teaching efficacy, she scored in the lowest for mathematics knowledge for teaching.

*Classroom Environment.* Lydia's class also began with a problem of the day. The children entered the classroom, found their seats at their table group and began working. In our pre-conference, she shared with me that in her classroom the children are given a framework to help them approach problems so that they are active in their learning process and engage in problem solving. The framework includes prompts such as; "What do you know to help you solve the problem?", "Choose a strategy. Draw a picture, choose an operation, make a table, etc." and so on. As students began work on the problem, Lydia walked around the room asking questions and engaging with the children. Once time had been given to solve the problem, student volunteers were chosen to share their explanations. At the end of this time, three solutions were given as viable strategies for solving the problem presented. The next task for this group of learners was rotating through preselected mathematical centers. During center time the students were engaged with the task, freely sharing solutions and conjectures with one another.

*Espoused Disposition.* Figure 4 shows the coding for Lydia's qualitative data. Her top three codes were student centered, 19.37%, student learning, 12.15%, and teacher accepts

responsibility, 7.41%. With over 31% of her coded data focused on the student, it appears that her disposition places commitment to the child at the forefront. Although the coding percentages are based upon words coded to total words, evidence suggests that much of her interview was devoted to student learning.

During the interview, when urged to discuss her sense of responsibility and how she viewed classroom instruction, the following thoughts were expressed. The question posed to Lydia was, "What is important in your classroom?" Her reply incorporated a recent interaction with a young girl in her classroom. The young girl had been successful in turning in the required work, but Lydia had noticed the young girl's dependence on her cousin to help her complete the tasks. She chose to broach this concern with the girl. Lydia's stated:

> I told her, I said if I didn't care about you, I would ignore this and let you go on because you're turning in completed stuff. I said, but to me it's not just doing it, it's do you understand. The whole year, I want you to know I care whether you know this or you understand or not. So, we're going to work together and you're going to learn this stuff.

This dialogue and interaction with the young girl depicts a commitment emphasis in the classroom.

Lydia went on to support this commitment sentiment when asked about how she evaluates work presented by the students. She stated, "our philosophy in the building is that we shouldn't have students failing. We should be continuing to work with them, and their grade guides our instruction and to keep intervening and helping and getting them to understand those concepts." Again, delving deeper in this line of questioning: "Do you think that you are teaching mathematics content or are you teaching mathematics knowledge?" Lydia's response:

> I am teaching the content, but what I really want to get at is the knowledge. I want to give them a real good foundation of what they're learning and really understand why am I doing this…They just get in the habit of asking themselves lots of questions thinking about their thinking. I think across the board that will help them be successful in all subject areas.

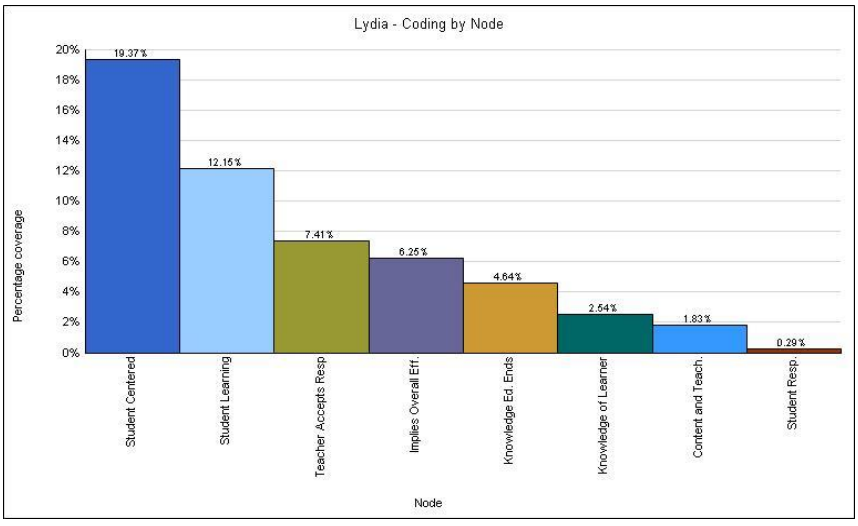


*Figure 4.* Lydia-coding by node

Lydia's interview is saturated with espoused beliefs that support the descriptor of commitment emphasis; each one providing insight into her personal belief system. It is not practical or necessary to acknowledge each interaction therefore, but a final piece of data that definitively supports the descriptor of commitment emphasis for Lydia's teaching disposition is, when asked, "Who's responsibility do you think it is to make sure kids are learning?" She replied, "definitely the teacher's responsibility…It is your responsibility to teach that student as much as you can teach them in that year. You know, move them as far forward as you can. So, I think that our success ultimately would fall on the teacher."

### *Knowledge Emphasis*

Anna has taught in the same rural district for 30 years. Anna stated that she is no longer taking any type of professional development classes and that during the day she dedicates substantial amounts of time to working with students struggling in mathematics.

*Classroom Environment.* The class session that was observed was the introduction of algebraic ideas to sixth grade students. Anna had long tables with chairs on both sides and the students were assigned to every other chair. As children entered the room, they began working on a series of problems on their whiteboards. As the children worked, Anna walked around the classroom giving students additional problems to solve on their whiteboards. After 15 minutes Anna went directly into the algebra lesson. She made the statement to the students that "today we are going to jump into the problems and then tomorrow to the reasoning and understanding." Anna proceeded to write the problem *4m=24.* At that time students had no previous discussion regarding the foundations of algebra. Anna walked through the steps of solving the equation and shared some items that she felt were important such as "always use small case letters in algebra." For the next 35 minutes, children rotated to the blackboard solving equations. During that time students were not asked to share their thinking and the teacher continued to recite the step-by-step procedures for solving an equation.

When asked about how she assesses students, Anna stated that every Friday there is a quiz over material presented that week. She stated that, "so we take one concept on Monday, we practice it Monday, Tuesday, Wednesday, Thursday we have review, which means I can hit you with anything and Friday is the test day. And next week we will start a new concept."

*Espoused Disposition.* In each category Anna scored in the middle except for Teaching Efficacy. Her score for Teaching Efficacy was the lowest amongst the four participants. Figure 5 below displays the qualitative coding for Anna.

As you can see from the identified sections of her interview, knowledge of learner, lacks overall teaching efficacy, and teacher accepts responsibility are the highest coded categories, with teacher negates responsibility almost equal to teacher accepts responsibility. During the interview, Anna made several references to personal aspects of her students but failed to identify the individual learning needs of the student, therefore, even though knowledge of the learner is recorded at 11.69% this differentiation must be made and recognized. Knowledge of the learner, when coded for Anna, did not mean knowledge of student learning style but referred to statements such as "as you need to know your student."

During our interview, when asked about what makes a teacher effective, Anna stated that "I think probably the best thing about teaching you have to have respect for the students. You have to know where they are at and where they're coming from. You have to know all of that student." With this initial statement it was presumed that, when asked how she

structured lessons and what measures she took to ensure her students were learning mathematics, her response would emulate knowing the individual. Her responses, though, side-stepped individual learning. When asked, she stated, "Everyone has the same work, the same problems, the same everything. I guess you just give verbal praise when they reach certain steps, to give them encouragement to go on to the next level, until they reach the level that they are capable of." With this assertion, it became apparent that individuality in student learning is not being emphasized. Anna also goes on to state that she believes that "anybody can go and teach anything" therefore, to her, knowledge of the individual learner may not be a significant influence in the educational process.

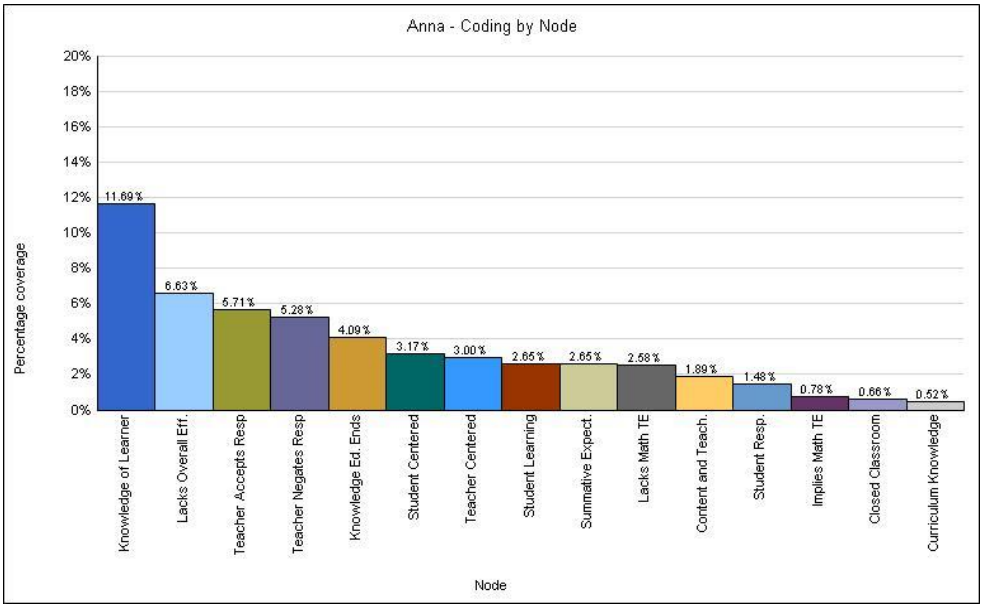


*Figure 5.* Anna-coding by node

When looking at Anna's data, the descriptor that best expressed her teaching style was not readily apparent, knowledge emphasis or custodial emphasis. Knowledge emphasis was selected for the following reasons. First, through the interview and observation process it was apparent that Anna tried to incorporate various instructional strategies into her classroom. Although some of these tasks may have been conceptually inappropriate, she did involve the students in the learning process and allowed individuals to practice the newly introduced concept in class. Secondly, she accepted some responsibility for student learning. In fact, at one point during the interview, she stated that, "the ultimate responsibility is probably mine" for student learning. In spite of making this proclamation, her limited attempt to understand and address the needs of the individual learner, and make curricular decisions based upon knowledge and understanding, restricted her sense of commitment and agency.

### *Focused Academic Agency*

Madelyn has been teaching for over ten years in the same suburban school district. Her teaching responsibilities include teaching mathematics and science to 6$^{th}$ grade students. Her classroom environment was open with a definite level of trust existing between teacher and students. Madelyn's survey results showed her scoring high in all areas recorded.

*Classroom Environment.* As the children walked into the classroom they immediately began preparing for class. They got out their homework so that it could be checked and began

working on the problem of the day that Madelyn had posed. During this time, the children were able to talk with one another, working through the problem and sharing strategies. After about 10 minutes, Madelyn called the class together. For the next 15 minutes, random students were selected to share their solutions for the problem of the day.

For the remainder of the class session, Madelyn introduced a new mathematics concept to the students, multiplication of fractions and the relationship to division of fractions. To begin this lesson the teacher drew four number lines on the board. Each number line had a question that was attached, for example the first number line was to be used to answer the following question, "How many 1/2 cm are there in 4 cm?" Students solved the four problems and the teacher continued by making the connection to division problems. The next question that she posed was "Who remembers what it meant to find a reciprocal?" At this moment she was working to make the connection between multiplication and division. A lot of discussion occurred at this time around why it was appropriate to use a reciprocal to change a division of fractions problem into a multiplication of fractions problem. Students continued to practice working on this new strategy. The class time ended with the students leaving the classroom giggling about something that had occurred during their time together.

*Espoused Disposition.* Qualitatively, her results showed that student learning, student centered, and open classroom were the most coded node with curriculum knowledge and teacher accepts responsibility accounting for similar values at 7.20% and 6.99% respectively. Although two of Madelyn's top three coded nodes correspond to Lydia, student learning and student centered, her classroom structure differs because of the manner in which she incorporated both knowledge and commitment into the classroom environment allowing components of critical consciousness and democratic education to infuse the educational setting.

Madelyn, as an instructor, sees herself as an agent of change. Throughout the interview, time and again, she made comments that support this notion. One of the first instances occurred when asked about student learning, she stated that,

> I believe in experiences. Students learn from experiences and experiences that we chose to have our students work through is, helps either to cement their knowledge in a way that is easily accessible to them or makes it knowledge that just kind of there for a moment and then gone. So, I think a teacher that provides rich experiences is just helping their students have knowledge at a deeper level.

Another powerful reference to her sense of agency occurred when asked about her sphere of influence she responded:

> I think my attitude towards what we do in class and towards students individually affects them as they're learning in class…I really, really try to accentuate the positive so students know when they walk in here this is a safe place… you know my goal is to have you try to make improvements for where you are.

It is obvious that she finds her actions and reactions to student learning unequivocal.

Looking through the lens of agency and knowledge, Madelyn recognizes that her task is far reaching. She acknowledges that mathematics "is essential because the processes involved in math are processes that a person needs to have in their life" but also recognizes that "students do need to know that they have ownership as well." She identified herself under the constructivist paradigm; therefore, Madelyn adheres to the notion that teachers support learning. Students must be actively engaged in the learning process and construction of knowledge is based upon the experiences which individuals are exposed.

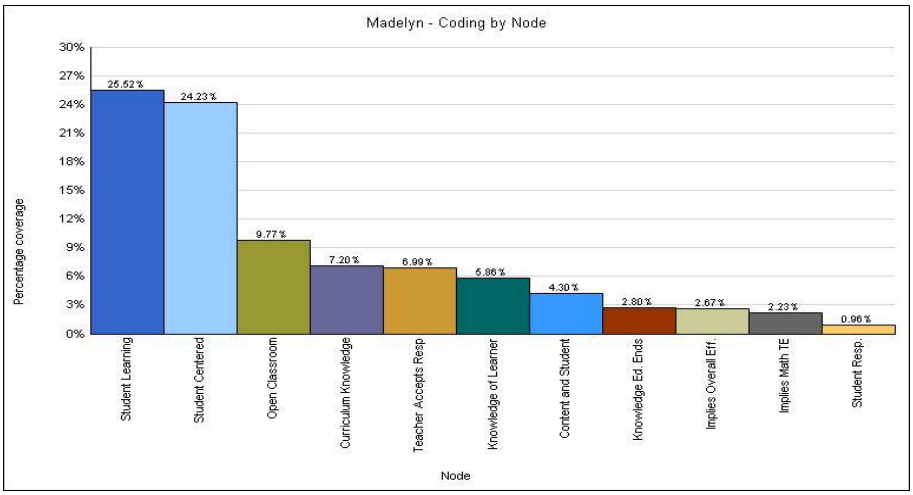


*Figure 6*. Madelyn-coding by node

# Key Findings

Three major discussion points organize the key findings section. The first finding addressed is the positive correlation between teacher efficacy, mathematics teaching efficacy and overall responsibility. The second finding looks at how a teacher's sense of efficacy and mathematics teaching efficacy can moderately predict overall sense of responsibility. The third key finding distinguishes how a teachers' sense of responsibility and the extent to which they implement Academic Agency impacts instruction in their mathematics classroom.

## *Efficacy and Overall Responsibility*

When looking at the key findings related to efficacy and responsibility, the quantitative data reports a positive relationship existing between the two, as the teacher's sense of overall responsibility increased, teaching efficacy also increased. Those members of the purposeful sample, Sam and Anna, who self-reported low teaching efficacy and low overall responsibility, aligned themselves with a more accountable sense of responsibility. From the interview and observation data it is unquestionable these two teachers also held a teacher driven instructional practice, falling prey to district pressures and unable to address individual learner needs.

Out of the sample cases, two of the four individuals scored low either in responsibility or efficacy and of those two, all subscribed to a teacher centered classroom context. So again, the implication from this key finding is that a conversation must begin so that individuals who are in the teaching profession or aspire to be a part of the teaching profession recognize their full influence in a classroom setting. This study has shown when working independently, efficacy, commitment or knowledge cannot promote the sense of responsibility to educate all children.

The coding criterion used to code the qualitative data for this study included elements of PCK. In Shulman's (1987) introduction of PCK he listed knowledge of the learners and their

characteristics and knowledge of educational ends as key elements. For this study, knowledge of the learner embraces the notion that to know your student, not only do you need to know them as a person but also as a learner. Knowing the learner means you must know their learning strengths and weaknesses and what steps are necessary to increase their mathematical knowledge. The study's key findings suggest that these two features are significant when providing student-based instruction. The coding for the case of Anna did show that she had *Knowledge of Learner*, but her knowledge of the student was superficial and played no role in the choices she made for classroom instruction. Anna did not know her students in the manner in which Shulman intended. She was able to share how they did on individual assessments but was unable to talk about their true level of understanding in mathematics.

The second piece of Shulman's model that showed a significant bearing on the advancement of student-centered context is knowledge of educational ends. Educational ends acknowledge the importance of mathematics thinking throughout an individual's lifetime. As reported in the data, Lydia and Madelyn each espoused the life-long importance of mathematics knowledge and their emphasis of instruction focused on conceptual understanding and mastery of content.

### *Efficacy as a Predictor of Overall Responsibility*

A person's efficacious feelings, whether related to self, teaching or mathematics, impact behaviour and classroom context. This key finding suggests that efficacy may be a valid predictor for responsibility. When mathematics teaching efficacy and teaching efficacy were regressed against overall responsibility a moderate ability to predict results was recorded.

During the qualitative collection process, participants in the purposeful sample could be divided into two distinct groups. Those with low combined efficacy seemed to accept responsibility for summative expectations and those with high combined efficacy accepted responsibility for providing student-centered learning. Again, those who had a lower collective sense of efficacy provided rationale for instructional choices based upon external influences such as curriculum, testing, or administrative decisions. Although responsibility was addressed verbally, the enacted instructional procedures and classroom context of those with a low combined efficacy score annulled their spoken word.

One interpretation of this phenomenon is that those individuals who have failed to understand the fundamental process of engaged pedagogy lack the skills necessary to empower children through the process of learning. Engaged pedagogy states that for teachers to be able to empower students they must first be committed to self-actualization (hooks, 1994). The act of self-actualization requires responsibility to one's person, therefore, if a person's sense of responsibility is wavering, he or she is unable to move themselves forward in personal growth, inhibiting the acts and processes they chose to incorporate in a classroom context.

### *Responsibility in a Mathematics Classroom*

In the previous sections, efficacy and responsibility have been addressed, but the goal of this final section is to look at how responsibility is supported by the framework of Academic Agency. Three of the four major components of Academic Agency, efficacy, commitment and knowledge, have been addressed through data analysis. The issue remaining vague is how is responsibility expressed? The conjecture based on this study is that the answer is simple, action. Although action is required for enacted dispositions, Academic Agency states

that all three; efficacy, commitment, and knowledge in unison must embrace action to promote personal growth.

In this study, evidence indicated that only one of the four sample participants subscribed to Academic Agency. Madelyn's classroom context not only embraced efficacy, commitment, and knowledge, but as a teacher she saw herself as an agent of change. During her observation, Madelyn enacted her espoused beliefs and held student learning as her top priority. During the interview conversation she stated that, "I believe in constructivism. I believe you have to construct your knowledge I can't get in there and pour it in there. What is your brain doing to make the connection? What are you actively doing right now to make those connections, so you understand it?" It is evident by this excerpt she is addressing her responsibility to action as well as to students.

So how can this discussion further promote Academic Agency? When constructing the conceptual framework of Academic Agency, it was important that the framework be succinct. This preliminary study proposes a hypothetical framework that will be refined through further studies. In choosing what to include, efficacy, commitment, and knowledge seemed to reflect the structures, as noted in the literature that best supported learning. Such a framework allows those in education to assess personal dispositions in a manner that will allow strengths and weaknesses to be identified and addressed.

## Limitations

Like most studies, there are limitations that need to be acknowledged. Limitations include the number of participants, the number and timing of observations, the influence of school culture on teacher dispositions, and the generalizability of the results. The number of consenting participants for the quantitative section of this study is a weakness. Forty-nine usable instruments were collected from the three settings. Although analysis showed significant findings, a larger population might have provided more insight into the correlations between efficacy, responsibility, and mathematics knowledge for teaching by providing opportunities to run additional analyses, for example, comparing data within grade levels. The second limitation for this study was that observations and interviews were only conducted one time with each participant. Although the findings clearly indicated specific characteristics and classroom procedures being present, it would have been beneficial to delve more deeply into the choices that the individuals made concerning classroom instruction. School culture is another influence that may have subconsciously impacted participant responses. In using three different school settings, urban, suburban, and rural, the hope was to compensate for the different dispositions held based upon setting. Unfortunately, only three of the schools were somewhat diversified, the remaining schools appeared to be heterogeneous in race, economic status, and culture, therefore possibly influencing self-reported data.

In the quantitative phase limitations also existed. The first limitation is the low Cronbach's alpha coefficient for Teacher Responsibility, $\alpha = .604$. Although Silverman's instrument focused on sense of responsibility, its focus was clearly aligned with social justice issues in education and was not specific to mathematics education. Within the qualitative section, using data from only four individuals, the limitation became the ability to make the findings generalizable. Although the focused study provided the depth necessary to adequately identify individuals by descriptor, it did not promote wide-spread classifications

for the larger population. To adequately identify instructional groundings, it would be necessary to conduct semi-structured interviews and observations with each individual.

## Future Research

This study represents an initial exploration into the constructs of responsibility and mathematics education. Little research has been done to connect the foundational aspects of Academic Agency to middle grades mathematics, as well as mathematics education in general, therefore; additional research on the intersection of these constructs is needed. This project sought to begin a dialogue that has not been addressed sufficiently in mathematics education literature. Much of current research in mathematics education is focused on student learning, which cannot and should not be neglected, but in the United States children are still failing to make adequate progress in mathematics. To improve student learning and provide children the opportunity to compete in a global society, teachers must become Academic Agents.

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# Appendix A

*Data Collection (Quantitative/Qualitative) Related to Research Questions*

| Question | What is the relationship that exists between a teacher's sense of teaching efficacy, mathematics teaching efficacy, mathematics content knowledge for teaching and responsibility? | How does a teacher's sense of teaching efficacy and mathematics teaching efficacy affect their sense of responsibility for teaching mathematics in a middle grades classroom? | What aspects of the teaching context influence teaching efficacy of the six middle grades mathematics teacher participants? | How do the four middle grades mathematics teachers convey their attitudes in regard to responsibility in teaching mathematics? |
|---|---|---|---|---|
| Survey | Items analyzed based upon individual responses. | Items analyzed based upon individual responses. | Measured teacher's sense of teaching efficacy/mathematics teaching efficacy. | Measured responsibility attributes. |
| Observation (Completed by researcher – Approximately 1 hour) | Observations of enacted responsibility based upon One-On-One interview and survey instrument | Observations of enacted responsibility based upon One-On-One interview and survey instrument | Observations based upon enacted beliefs and articulated beliefs. | Observations based upon enacted beliefs and articulated beliefs |
| Interview (Completed by researcher.) | | Questions such as "In learning mathematics, who is ultimately responsibility for equipping students with the skills and knowledge necessary to move forward" | Questions such as "In your mathematics classroom, do you try to implement various instructional strategies? If so, can you provide examples." may be asked. | Questions such as "Could you tell me your views on your role as the teacher and the students' role in learning mathematics?" may be asked. |