TEACHER-CHILD INTERACTIONS AROUND ACADEMIC ERRORS IN PRESCHOOL

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ABSTRACT

Extensive research in the achievement motivation literature has demonstrated that students’ experiences with academic errors can shape their motivation and achievement in adaptive or maladaptive ways. Since academic errors are predominantly identified and addressed by teachers, teacher responses to students’ academic errors play a pivotal role in shaping student interpretations of errors. To guide teachers toward productive use of errors for instruction and adaptive motivation and prevent maladaptive motivational trajectories for students, we must first understand the nature of students’ errors and how teachers’ respond to them early on in students’ schooling. To this end, the current study examines academic errors and teacher responses to them in the preschool classroom. Thirty teachers were observed during whole group book-readings, which were transcribed and coded both inductively and deductively. Findings indicated children’s errors most often arose because of deviations from behavioral norms or teachers’ content expectations. Teachers responded to children’s errors most often by correcting students’ errors and providing information or asking closed follow up questions. The findings from this study are important to consider for researchers, teachers, parents, and teacher preparation and in-service professional development programs.
DEDICATION

This dissertation is dedicated to my mom, MaryAnn, and my youngest sister, Olivia. Mom, you paved the way for my every opportunity with your unending strength, tenacity, and love. I am forever grateful for your unconditional love and sacrifice in the name of my growth and success. Olivia, your unbridled joy and confidence gave me strength when I didn’t know I needed it. I am beyond thrilled to see you grow up and change the world with your brilliance and kindness.
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CHAPTER 1

INTRODUCTION

How students experience and interpret academic errors in the classroom is crucial to their motivation and learning. Extensive research in the achievement motivation literature has demonstrated that student interpretations of academic errors can shape their self-concept and motivational patterns in adaptive or maladaptive ways (Arens, Marsh, Craven, Yeun, Randhawa, Hasselhorn, 2016; Dweck & Leggett, 1988; Elliott & Dweck, 2005; Marsh, Cairns, Relich, Barnes, & Debus, 1984; Weiner, 2000). For instance, when students interpret errors as an opportunity for learning they are likely to increase their effort or strategy use. In contrast, when students interpret errors as a risk of being viewed as incompetent, they tend to reduce effort and use ineffective strategies. Recent research has demonstrated that such student perceptions of errors in the classroom can facilitate or diminish their learning (Steuer & Dresel, 2015), anxiety (Aksu, Ozkaya, Gedik, & Konyahoglu, 2016), and affect (Tulis & Ainley, 2011).

Such research has also connected students’ error interpretations to achievement outcomes. For example, Blackwell, Trzesniewski, and Dweck (2007) found that, when provided with explicit guidance toward a growth mindset, students demonstrated increases in adaptive motivation and academic achievement across a two-year period. Mindset theory (Dweck & Leggett, 1988) posits that students with growth and fixed mindsets are likely to interpret errors differently based on their beliefs about intelligence. Given the relationship demonstrated by Blackwell et al. (2007) between these mindsets and achievement outcomes, it may be the case that different interpretations of academic errors may also relate to more or less adaptive achievement outcomes. Importantly, this
notion is supported by recent work in mathematics education grounded in achievement motivation theory. Tulis, Steuer and Dresel (2017) found that secondary math students’ positive beliefs about errors predicted their affective and behavioral reactions to errors.

Research has also found an important connection between academic errors and the process of learning. That is, academic errors as useful tools for instruction in the classroom. For instance, Borasi (1994) proposed the use of errors as a springboard for inquiry in the classroom, where errors are natural stimuli for reflection and exploration. In his study on the actual enactment of using errors for inquiry, Borasi had 11 math teachers focus on errors as learning opportunities in their classroom activities, either through planning around previous errors or using errors in real time. His findings indicated that this focus on errors as instructional tools allowed the students to view math as a more accessible and creative domain. In addition, when their errors were embraced, students felt more confident in their ability to do math and more willing to pursue math courses in the future.

Since academic errors are predominantly identified and addressed by teachers, student-teacher interactions around academic errors play a pivotal role in shaping student interpretations. Teacher responses to student errors were found to relate to students’ perceptions of errors as learning opportunities (Tulis, 2013) and to students’ fear of errors (Rach, Ufer, & Heinze, 2013). Research has shown that teacher responses to student errors vary in type (e.g., correcting or redirecting) and depth (e.g., probing or passing over); but, unfortunately, teachers very often fail to take advantage of errors as learning opportunities (Brodie, 2014; Santagata, 2005; Schleppenbach, Flevares, Sims, & Perry, 2007; Tulis, 2013; Warshauer, 2015).
Research on perceived error climate has also demonstrated that teacher reactions to student errors can impact student achievement. Perceived error climate refers to teacher attitudes and behavior towards student errors in the classroom. For instance, whether teachers support or react negatively to student errors, and the extent to which they utilize errors for instruction. Steuer and Dresel (2015) found that students’ perception of teacher’s recognition, support, and use of errors in the classroom was positively related to secondary student’s math achievement. More recently, Grassinger, Scheunpflug, Zeinz and Dresel (2018) found that students’ individual reactions to errors mediated the relationship between positive error climate and academic achievement. Moreover, teachers’ supportive and constructive responses to students’ academic errors can potentially increase student achievement.

Student-teacher interactions that shape students’ interpretations of errors occur across grades and contexts. Most research has focused on such interactions in secondary school. Yet, arguably, the influence of student-teacher interactions around academic errors on students’ approaches to learning would likely manifest already in preschool (Heyman, Gee, & Giles, 2003). Potentially, such early experiences may even set students on different educational trajectories. However, very little is known about the nature of these interactions in the preschool classroom.

In the preschool environment, shared book reading represents one of the most instructionally intensive experiences of the day and is a widespread part of classrooms’ schedules. Shared book reading, when teachers read a book aloud to children and often ask questions and offer commentary, typically involves richer, more decontextualized talk (e.g., predicting, recalling, making personal connections) relative to play-based
activities (Hindman, Connor, Jewkes, & Morrison, 2008). Consequently, it provides an optimal, teacher-managed instructional context in which to examine error interactions. In the current study, I investigated student-teacher interactions around academic errors in the preschool classroom during shared book reading, with an aim toward further understanding of the nature of preschooler’s academic errors and the ways in which teachers respond to them.

**Research Questions**

Specifically, this study asks the following research questions:

1) What types of errors do students make in the preschool classroom?
   1a) How do error types relate to the academic task at hand?

2) How do preschool teachers respond to student errors?
   2a) Who do teachers identify to correct errors?
   2b) How do teacher responses reflect the norms of the classroom?
   2c) How do teachers use errors as tools for learning?
   2d) Do teachers respond adaptively or maladaptively to student errors?

3) How do preschool teacher responses to student errors relate to student error types?
CHAPTER 2
LITERATURE REVIEW

Defining Academic Errors

Academic errors constitute a diverse phenomenon. Errors have been defined differently across various literatures, such as cognitive psychology, industrial and organizational psychology, math education, and educational psychology. Within these literatures, errors have been defined differently along the dimensions of identification, valence, task, type, function, and norms. Some definitions are more explicit in the way they address each dimension, while others highlight specific dimensions but are vague in others.

Dimensions of academic errors. In order to conceptualize such a complex phenomenon as academic errors, it is useful to consider academic errors along specific dimensions, including: 1) Identification—who identifies that the student action is an error (e.g., teacher, student, peers) and who will correct the error? (e.g., student who made the error, teacher), 2) Valence—is the error interpreted positively (e.g., adaptively as a growth-opportunity) or a negatively (e.g., maladaptively as a problem to be avoided) event? 3) Task—what is the type of task at hand and what is its level of difficulty? (e.g., define a word), 4) Type—is the error characterized by misunderstanding of the question or content, by improper application of information (e.g., terminology), or by teacher expectations (e.g., took too long to answer), 5) Function—how, if at all, is the error used for instruction?, 6) Norms—what are the implicit and explicit norms set by the school, teacher, or classroom that could inform error experiences? In this review, I will consider
how differences on these dimensions may relate student error types and teachers’ responses to their errors.

Although the majority of work in this area has been conducted with children in the K-12 arena, this review concludes with a discussion of how this work might be relevant in the preschool context. It is important to note that some of the details of these dimensions are not yet known, and some may not ultimately be meaningful for understanding student interpretations at the preschool age. Therefore, I outline these dimensions and their potential implications for student interpretations of errors given what is known and what can be extrapolated based on the literature. Although student interpretations of academic errors are not assessed in the current study, it is critical to consider such interpretations as potential consequences of how academic errors are defined and treated.

**Who identifies the error.** The identification of academic errors (or, put another way, the designation that a particular student response is, in fact, an error) is important to consider given that academic errors are only given attention if they are explicitly identified. Errors may be identified in the classroom by the teacher, the student identifying their own error, or by a classmate. Categorizing how academic errors are identified is important because how they are identified could result in different student interpretations of errors that impact motivation. For instance, if the error is identified by the student who made the error, the student is more likely to interpret the error as resulting from internal, personal forces and perhaps as something that is controllable. The student may interpret the error similarly (i.e., internal and controllable) if their error is identified by a classmate given that they are more likely to see their classmate as equal to
themselves in ability to answer correctly. In addition, the teacher may identify the error with varying focus on the student or the academic task; if the teacher focuses on the student rather than the task, the students’ interpretation of the error may be more internal than if the teacher focused on the task.

Following the identification of the error itself, there is an implicit decision made about who should correct the error (i.e., the teacher, student, or entire class). Categorizing who is identified to correct academic errors is important given the potential influence of this identification on student learning. For example, if teachers continuously identify themselves to correct errors, students are likely less engaged and active in their own learning process.

**Is the error interpreted positively or negatively.** The valence of academic errors is also important to consider because the ways in which errors are interpreted can result in reactions that are either adaptive or maladaptive. Specifically, when errors are interpreted positively, more adaptive reactions are likely to follow (e.g., exploring the error source) whereas if they are interpreted negatively more maladaptive reactions may follow (e.g., ignoring the error). Understanding how valence is placed on academic errors also has important implications for how errors are interpreted overall by students. For instance, if errors are continuously identified by teachers as having a negative valence, students may interpret errors as something to avoid or even be fearful of.

**How difficult is the task.** The difficulty of tasks should also be considered in conceptualizing academic errors; some academic tasks are inevitably far more challenging than others, might involve vastly different materials, or be specific to a particular domain. The difficulty of the task is also important to consider given its
potential implications for student interpretations of errors; if the task is perceived as easy, students are more likely to interpret the error as being driven by internal, personal forces whereas a more difficult task is more likely to elicit an interpretation of the error as deriving from the external source of the task situation. The type of the task might also impact student interpretations of errors given previously established perceptions about skill levels. For instance, teachers may view students (or students may view themselves) as being strong in math but weak in literacy; this then orients teachers and/or students in a specific way toward math or literacy types of tasks.

**What type of error is it.** The type of error is also worth considering, given that there are a multitude of potential types of errors in any given situation. Drawing on prior research with older children, some examples might include conceptual errors types relating to general lack of understanding, either of the actual content (e.g., not understanding the concept of addition) or of task expectations (e.g., what the question is asking). Procedural types of errors may also emerge, related to a specific technical mistake (e.g., forgetting to carry a number while adding), or improper application of information (e.g., using incorrect vocabulary or terminology to refer to a concept). Student errors may also be characterized solely relative to teacher expectations of appropriate student behavior in the classroom (e.g., a student took too long to answer).

**Are errors used for learning.** The function of academic errors differs in that errors are sometimes used as a learning tool, while other times are corrected or ignored without making connections to academic content. The ways in which teachers employ errors functionally for learning could have important implications for student
interpretations of errors; errors used for instructional purposes are more likely interpreted positively as opportunities rather than negatively as something to avoid or fear.

**What are the norms of the classroom.** Finally, the norms that are set within the classroom, whether implicit or explicit, will inevitably influence how errors are defined. For example, perhaps in one classroom a response that is accurate but not the precise response the teacher expected is considered an error (e.g., student says “sea” while the teacher is expecting “ocean”), while in another classroom the accurate but unexpected response is considered correct solely based on the accuracy of the content; this is an example of an implicit norm. Explicit norms might relate to the teacher’s explicit explanation of raising a hand in order to provide an answer, where even a correct answer is considered incorrect because the child called out rather than raising their hand. Implicit norms of the classroom in particular might influence student interpretations of errors; when teacher identification of errors is confusing given the implicit nature of their expectations for the answer, student interpretations of errors may be more negative given students’ confusion or disagreement. An additional layer of complexity emerges from the fact that some teachers might leave implicit what others make explicit.

**Cognitive psychology.** In the field of cognitive science, Reason (1990) proposed a broad definition of errors as, “all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome” (p. 9). Another definition comes from Hollnagel’s (1998) cognitive reliability analysis, in which errors are an “erroneous action; a post hoc attribution of a cause to an observed outcome, where the cause refers to a human action or performance characteristic” (p. 23). These definitions focus on cognitive tasks as particularly relevant for errors, though do not
detail how the difficulty of the cognitive task might impact errors. In addition, these authors seem to presume a negative valence of errors, identify errors through observable action outcomes, and identify the individual making the error to correct the error. Types of errors here might relate to mental and physical activities. However, in these conceptualizations, errors are not explicitly defined in terms of function or norms.

**Industrial organizational psychology.** Researchers in the industrial organizational domain define errors based on their potential for productivity, such as “productive failure” (Kapur, 2008). Other researchers in this area often define errors as goal-oriented but as avoidable, non-attainments of a goal (Zapf, Brodbeck, Frese, Peters, & Prumper, 1992), as “deviations from goals that are potentially avoidable” (Heimbeck et al., 2003, p. 335) or “actions that endanger the attainment of desired goals” (Gartmeier, Bauer, Gruber, & Heid, 2008, p. 95). Across these conceptualizations, the student making the error seems to be identified as the one to correct the error. In addition, there is a positive valence related to productivity, but a negative valence in relation to deviating from goals. Specific tasks are considered (e.g., computer or math based), however the types of errors themselves are not. Finally, errors are considered as a function of advancing individuals in their thinking and understanding. These definitions do not provide sufficient information regarding the identification of errors or norms that may influence them.

**Math education.** Researchers focusing on the academic nature of errors sometimes define errors in terms of norms, such as in Oser and Spychiger’s (2005) definition, “a process or fact that does not match a given norm” (as cited in Rach, Ufer, & Heinze, 2013, p. 22). Other norm-focused definitions frame errors as unintentional
deviation from a certain norm that prevents the attainment of a specific goal (Grassinger & Dresel, 2017; Zhao & Olivera, 2006).

Some work from math education present types of errors rather than providing a specific definition. For example, Santagata’s work (2005) describes conceptual, procedural, drawing, computational, distraction, and principle or definition errors in mathematics, however it does not define academic errors overall. Gardie and Brodie (2015) also examined academic mathematical errors, characterizing them as slips, errors derived from misconceptions, and errors related to language or calculator use. Other work in math education overlaps with industrial organizational psychology in the characterization of errors as productive, but in this case as “productive struggle” (Hiebert & Gouws, 2007) toward math learning rather than productive failure.

These conceptualizations present a positive valence of errors by recognizing their productivity for learning. In addition, they consider identification by individuals other than the student through their focus on norm setting. Function of errors is also addressed through this productivity; errors are viewed as a way for the learner to engage with content and grow. These conceptualizations also take task differences into account, looking specifically at different types of mathematical tasks. Finally, the types of errors are also explicit, for instance focusing on procedural types of errors within a particular task. It is unclear who is identified to correct errors within these conceptualizations.

Educational psychology. Similar to math education, the field of educational psychology examines the academic nature of errors and often lacks conceptual definitions. Academic errors are most often discussed in this field within the achievement motivation literature, in which academic errors are often discussed as achievement failure
or simply failure. For example, Seligman, Maier, and Geer (1968) provided a specific definition of failure: “an aversive event that is non-contingent (i.e., independent of the subject’s response) and unavoidable” (as cited in Dweck & Reppuci, 1983, p. 110). However, errors in these contexts are typically defined operationally rather than conceptually, such as the inability to solve a puzzle (Smiley, Tan, Goldstein, & Sweda, 2015) or problems with homework or low grades (Haimovitz & Dweck, 2016). This conceptualization of academic errors reveals a primarily negative valence of errors given the emphasis on failure; it also considers tasks in terms of types of induced failure (e.g., unsolvable puzzle). However, this conceptualization does not thoroughly consider the identification, type, or function of errors, nor the norms surrounding them.

It is also worth noting that much of the research on academic errors in the achievement motivation literature has been conducted in experimental settings, in which participant experiences are typically manipulated based on standardized definitions. For example, many achievement motivation studies manipulate student’s experience of academic errors by providing an impossible task (e.g., puzzle without correct pieces) in a laboratory setting. Here, the academic error is defined solely through the task; an operational definition defining the error through an impossible task.

Without a clear a priori, conceptual definition of academic errors in such studies, assumptions are made about student perceptions and experiences of academic errors. For instance, the experimenter is assuming that this experience will be interpreted as an error by the student. Such experiments also limit the scope of academic errors to the inability to solve a problem. More descriptive and contextualized research on academic errors is needed to clearly establish how academic errors are defined in achievement settings.
beyond their operationalization, such as by exploring the dimensions discussed in this review.

**Inconsistencies in Terminology**

Related to issues of definition are problems with terminology. Researchers often refer to errors as synonymous with misconceptions, setbacks, challenges, difficulties, or failure. This is problematic because it assumes common characteristics about errors that are not necessarily present in every academic error situation that students experience. For example, discussing academic errors as difficulties, challenges, or setbacks assumes that the student exerts a relatively high level of effort due to task difficulty, yet academic errors might occur as a careless error when a student is simply rushing through a task. In addition, discussing errors as misconceptions assumes that the student demonstrates a lack of understanding or missing of information related to the academic concept. However, in some cases students may simply experience an academic error due to a teacher’s poorly worded question rather than their own misunderstanding. Finally, considering academic errors as synonymous with failure assumes that academic errors hold some level of negative valence, but students do not always view errors negatively, and even in cases where they do, the extent to which this impacts their motivation and achievement is highly variable.

While a certain degree of disagreement or inconsistency in the definition of terms is inevitable across research studies and literatures, the current level of inconsistency in the construct of academic errors is a great hindrance to any research on this topic. In order to understand how students perceive and experience academic errors, we first must understand the nature of academic errors themselves. The present study contributes to
this further understanding of the nature of academic errors, particularly in the preschool context.

**Current Study Definition**

For the current study, academic errors are broadly conceptualized within a dynamic process in which the meaning of the student behavior is constructed through the interaction between the teacher and student in the context of the academic task (Borasi, 1994). In this way, a specific student’s action is neither correct nor an error in and of itself; rather, students’ actions are identified as errors within the framing of particular features of the people involved and the situation (Ohlsson, 1996).

The current conceptualization of academic errors along the dimensions identified above primarily emphasizes the key role of the teacher in identifying academic errors, identifying who will correct the error, presenting the task type and difficulty, utilizing the errors as a function for learning, and setting the norms of the classroom. That is, academic errors are based largely on teachers’ beliefs, expectations or goals, and interpretations or judgment (Grassinger & Dresel, 2015). The type of errors made, in addition to the valence errors hold, are considered to be influenced both by teachers and students. Academic tasks, in which academic errors occur, are defined as any task presented by the teacher in relation to an academic concept (e.g., a question about a book). This study defines academic errors specifically as any student action that, intentionally or unintentionally, deviates from the teacher’s expected or desired student action (and is therefore judged to be incorrect).

**Teacher-Student Interactions around Academic Errors**
It is reasonable to assume that students’ interpretations of academic errors are framed early on through their interactions with teachers. That is, young students’ academic errors are very likely identified by teachers, and students’ interpretation of the error is influenced by the teacher’s response to the error. The current study conceptualizes teacher-student interactions as occurring in a nested ecological system. However, while we acknowledge the dynamic, complex, and myriad systems of influence on these interactions, the current study focuses specifically on the interaction between the teacher and student during academic error experiences in shared book reading. The research on teacher responses with older students provides a starting point for how to characterize and categorize teacher responses to academic errors in preschool. In addition, the ways in which teacher-student interactions can influence student interpretations of errors, and therefore their motivation and learning, highlights the importance of investigating interactions around academic errors in the classroom.

**Teacher responses.** The way in which teachers respond to students’ academic errors could relate to student’s more or less adaptive interpretations of errors, and therefore it is crucial to understand the various ways that teacher responses have been observed and categorized. While teachers’ assumptions about the academic task (i.e., the situation), goal(s) for student behavior, and self-perceptions (e.g., self-efficacy, perceived relationship with the student) are important to consider as potential antecedents to teacher responses to errors, the current study focuses specifically on how teachers actually respond to students’ errors. Therefore, this review focuses on research examining teachers’ behavioral responses to student errors and their potential relations to students’ interpretation of errors.
Research on teacher responses to student errors differs in the purposes for examining teacher responses as well as the extent to which errors are considered in relation to student motivational and learning outcomes. Some work focuses on teacher responses to errors as a way to examine teacher knowledge or instructional strategies (e.g., Seifried & Wuttke, 2010; Son, 2010, 2013). Other research focuses on how teacher responses compare across cultures (e.g., Santagata, 2005; Schleppenbach, 2007) or relate to teacher beliefs about errors (Bray, 2011; Matteucci, Corazza, & Santagata, 2015). Most relevant for the current study, some research in this area directly assesses potential relations between teacher responses to errors and student’s motivational or learning outcomes. Studies focused on student’s motivational outcomes emphasize potential impacts of teacher responses on student perceptions of errors (Rach et al., 2013; Tulis, 2013), and research on learning outcomes focuses on student mathematical learning (e.g., procedural knowledge in geometry) or theoretical models for learning from errors (Gardee & Brodie, 2015; Heinze & Reiss, 2007; Tulis, 2016).

Some research on teacher responses to academic errors focuses on cultural comparisons. For example, Santagata (2005) examined American and Italian math teacher responses to secondary students’ errors by identifying what he termed Mistake Management Sequences. These sequences are based on the Initiation-Response-Feedback (IRF) sequence developed by Sinclair and Coulthard (1975) and include the teacher’s elicitation (i.e., initiating question), the student’s answer, and the teacher’s feedback. Another study built off Santagata’s work, comparing Chinese and U.S. math teacher responses to elementary school student errors (Schleppenbach, Flevares, Sims, & Perry, 2007). Across these studies, teacher responses included correction, hinting to the same or other student, repeating the question to same student,
asking for explanation, redirecting the question, providing the right answer, or asking the class to evaluate. In Schleppenbach et al.’s study, these same responses were further categorized into statements or questions. Statements included telling the student the answer is wrong, giving the correct answer, ignoring the error, or providing explanation or direction. Teacher responses in the form of a question included re-asking the question, clarifying, asking for an addition, asking for certainty or agreement, redirecting, or asking for an explanation.

Findings from this cross-cultural research indicated that although Italian and U.S. teachers were alike in deciding what was right or wrong, Italian teachers most often discussed errors publicly (97% average per lesson) whereas U.S. teachers discussed only 61% of errors publicly and 39% privately. Additionally, U.S. teachers, more often than Italian teachers, asked other students (different from the student who made the error) to correct the error. Compared to Chinese teachers, U.S. teachers were more likely to respond to student errors with a statement rather than a question (i.e., provide the answer or tell the student they were wrong). Santagata (2005) found that teachers most often corrected the student’s error, gave a hint, or redirected to another student, but Schleppenbach et al. (2007) found that teachers most commonly redirected the discussion (with a question) or provided the correct answer, rather than providing hints. In addition, Schleppenbach and colleagues found that teachers initiated over 93% of corrective actions (as compared to the student who made the mistake or other classmates). Because these studies primarily focused on cultural comparisons, they did not examine teacher responses related to student outcomes such as learning or motivation.

Other research on teacher responses focus on the relationship between teacher beliefs about errors and their error handling practices. For instance, Matteucci, Corazza, and Santagata (2015) examined teacher responses to secondary students, identifying teachers as having a
positive or negative orientation toward errors (as indicated by the Error Orientation Questionnaire by Rybowiak, Garst, Frese, & Batinic, 1999). Teachers with a positive orientation toward errors were better able to help students deal with errors in the classroom. That is, teachers with a positive error orientation less often redirected questions to other students and more often demonstrated positive affective toward students following errors. Bray (2011) also focused on teacher beliefs and practices in a case study with fourth grade mathematics teachers. The author found that teachers’ beliefs about errors related to their error handling practices. For example, some teachers avoided discussing errors because they believed students would be embarrassed to have their mistakes shared publicly or that emphasis on errors would confuse students.

Other research on teacher responses to student academic errors focus explicitly on teachers’ content knowledge and instructional strategies (Brodie, 2013; Peng & Luo, 2009; Prediger, 2010; Ledesma, 2011; Seifried & Wuttke, 2010, Son, 2013). For example, Son’s work (2013) investigated preservice teacher responses to students’ ratio and proportion errors as a way to investigate teachers’ proportional reasoning. Son found that most teachers responded to student errors based on procedural aspects of the error, when in fact the student errors were conceptual in nature. This finding provided the researchers with insight into the preservice teachers’ limitations in the content area of proportional reasoning.

Son (2013) also identified whether teacher responses were teacher- or student-focused. Teacher focused responses included “show and tell” response types, in which teachers delivered mathematical information for students to see or hear (e.g., showing a picture or telling the definition). In contrast, student focused responses included “give and ask” response types, where teachers asked students to physically complete a task or
verbally respond to a question. Son found that teachers more often responded to student errors with teacher rather than student focused responses. Finally, Son investigated how often (rare, intermediate, or active) teachers used the student error for instructional purposes, finding that teachers rarely (i.e., primarily provided correction only) used student errors for student learning. Ledesma (2011) found similar results with elementary and secondary Mexican teacher responses to student mathematical errors; teachers most often responded to student errors based on procedural aspects of the task and in a teacher (rather than student) focused manner. In this study, teacher-focused responses included telling or explaining and student focused responses included questions or activities.

Although it is not the focal point of the research, much of the work using teacher responses as a way to evaluate teacher knowledge also highlights the importance of accessing students’ errors and thinking processes for deeper learning. For example, in research on South African teachers’ responses to secondary students’ math errors, Brodie (2013, 2014) highlights the shift from teachers correcting or avoiding errors to understanding and eventually embracing student errors. Specifically, Brodie emphasizes errors as a way to access student thinking and as a jumping off point for new learning – for both students and teachers. Ingram, Pitt, and Baldry (2015) similarly highlight the learning potential of errors in a study examining teacher responses to high school student math errors. These researchers found that teachers avoided explicitly negatively evaluating student errors and instead ambiguously searched for the error. Interestingly, this ambiguous search for the error ultimately enabled errors to be used as support for instruction and learning by allowing the teacher to emphasize key math concepts within
the search (e.g., “so we have .1 seconds and Sam has times’d it by…and his answer is…I saw people doing different things…what did you do?”).

Another study focused on student learning built on Brodie’s (2014) earlier work, categorizing South African teacher responses to secondary student math errors as correction, avoidance, probing, and embracing (Gardee & Brodie, 2015). In this approach, probing errors involved teachers’ attempts to understand how errors made sense to learners. For example, teachers might have asked a student why they provided their answer in order to access their thinking process. Embracing errors occurred when teachers used errors constructively to generate new knowledge for the student who made the error, as well as for the whole class. The authors found that teachers corrected errors more often than probing or embracing them. In addition, correcting and probing responses increased over time while embracing errors remained relatively constant. Most notably, the embracing of errors was found to generate discussions about mathematical ideas and contribute to the enrichment and development of students’ mathematical knowledge.

Some research has examined student learning outcomes more explicitly as they relate to teacher responses to errors. For example, in a study with seventh and eighth grade math students, Heinze and Reiss (2007) found that students who were taught by teachers trained in adaptive error handling practices performed better on geometry tests than students taught by teachers trained only in the state math standards. In this study, adaptive error handling training included aspects of negative expertise, students’ learning by mistakes and the productive use of mistakes in the mathematics classrooms.
The research reviewed thus far on how teachers handle student errors has examined such practices as a way to investigate cultural comparisons, teacher knowledge, and student learning. A small but growing body of work has extended this work to consider student motivation as it relates to teacher responses to errors. Specifically, this research incorporates student motivation by examining student perceptions of teacher responses to errors in the classroom (i.e., perceived error climate) as well as student perceptions of errors generally (Steuer, Dresel, & Rosenbritt, 2013; Steuer & Dresel, 2015; Tulis, 2013; Tulis, Steuer, & Dresel, 2016).

For example, in 2013, Tulis (2013) examined teacher responses to middle and high school students’ errors, categorizing responses as maladaptive and adaptive. In this study, maladaptive responses included ignoring errors, criticizing the student, redirecting to another student, humiliating or laughing, and demonstrating disappointment or helplessness. These types of responses were considered maladaptive because teachers were communicating maladaptive attributional information to the students through expressions of disappointment, hopelessness, or humiliation following student errors. Adaptive responses in this study included whole-class discussion about the error, waiting, emphasizing learning potential, and impeding negative reactions from the class. These responses were considered adaptive because they emphasized the learning potential of the error or provide time for the student to re-think his or her answer. Interestingly, basic teacher correction of errors was not classified a priori as maladaptive or adaptive, presumably because providing the answer alone was considered a neutral response.

In line with Santagata’s (2005) and Schleppenbach and colleagues’ (2007) work, Tulis (2013) found that teachers most often provided students with a hint or redirected to
another student. In addition, she found that adaptive responses were more frequent than maladaptive responses, though very little emphasis was placed on the learning opportunities presented by errors. Tulis extended the examination of teacher responses to look at the congruence between observations of teacher responses and students’ perceptions of error climate in the classroom. Findings indicated that students in a classroom with high error tolerance, in which teachers provided support following errors (e.g., explanations, patience, help), reported less need to hide or avoid errors and more support from the teacher than those in a classroom with low error tolerance.

Rach et al. (2013) also examined teacher responses to errors as they relate to student perceptions of errors. Specifically, these researchers found that students who were taught by teachers trained in error tolerance reported less fear of mistakes than students taught by teachers trained in mathematical proofs and reasoning. In this study, error tolerant teachers were trained through a program in which they were informed about the potential use of errors for learning and some of the empirical results from research in this area (e.g., Borasi, 1996; Spychiger, Kuster, & Oser, 2006). Teachers were also encouraged to consider errors as learning opportunities instead of useless interruptions in classroom.

Overall, the research on teachers’ responses to students’ academic errors provides important insights into the extremely varied ways in which teachers respond to students’ errors in the classroom in a variety of K-12 settings. It is clear that teacher-student interactions around academic errors can play an important role in student learning and motivation. However, current work is limited by its primary focus on older students and the domain of mathematics.
**Student interpretations.** Underlying students’ experiences and interpretations of errors is an attributional process that occurs for both teachers and students, in which the student’s error is attributed to some specific cause. This attributional process assumes that when individuals experience failure or success, they try to interpret the cause of these events (Weiner, 1970, 2000). This interpretation, although not directly assessed in the current study, is critical to consider as a potential outcome of teacher-student interactions around academic errors. Because errors can constitute a potential experience of failure, I will use the term *academic error* in place of failure for the purposes of consistency and application to my study.

Attribution theory includes two specific frames for understanding how errors are explained: one focuses on the teacher’s perspective of the student’s error, and the other focuses on the student’s perspective. The intrapersonal frame, which focuses on the student’s attribution of errors, assumes that following the academic error, the student first experiences an emotion, then chooses a cause to explain the error. In achievement situations, such explanations, or attributions, may include ability, effort, strategy, task, luck, or others. These causal attributions are assumed to hold meaning through their placement on three dimensions: the location of the cause (i.e., internal or external), the duration of the cause (i.e., stable or unstable), and how controllable the cause is (i.e., controllable or uncontrollable). Although there are some trends characterizing causal attributions to particular dimensions (e.g., ability as stable and uncontrollable), how a student interprets cause along these dimensions is dependent on the student and their experience.
The student-focused intrapersonal frame assumes that, following the student’s attribution of the error to a certain cause, and based on the student’s characterization of the cause along the three dimensions, the student experiences cognitive and affective responses. Specifically, the locus of the student’s error attribution impacts their feelings of self-esteem; if the error attribution is placed internally it is more likely to lower self-esteem than if it is placed externally. In addition, this theory assumes that how students interpret the controllability of their attribution (e.g., effort is controllable) can lead to feelings of shame or guilt; shame is more likely when the cause is perceived as uncontrollable whereas guilt is more likely when the cause is perceived as controllable.

The duration or stability of the error attribution can also have psychological consequences, though they are cognitive rather than affective in nature, including students’ expectancies for success. If the cause is perceived as stable, the error is expected to occur again; if the cause is perceived unstable, the error is not expected to occur again. The final step in the student-focused attributional process is the behavioral consequences or actions taken by the student in relation to achievement striving, such as their choices, persistence, and intensity.

The interpersonal, teacher-focused attributional frame assumes that the teacher makes a causal attribution of the academic error parallel to the student’s attribution, including but not limited to lack of effort or lack of ability. Following the error attribution, the attribution is again placed in a dimensional space, however controllability is the primary dimension in consideration for the interpersonal theory. The teacher’s perception of the error attribution (i.e., effort or ability) as controllable or uncontrollable directs whether the teacher interprets the student as being responsible for the error or not.
It is assumed that if the teacher attributes the academic error to effort, they experience anger because the cause is typically considered controllable. That is, the student is assumed to be able to control the effort he or she exerts, and therefore is responsible for the error and elicits anger. In contrast, if the error is attributed to ability, the teacher experiences sympathy because ability is considered uncontrollable. Moreover, if the student does not control their ability, they are not held responsible for the error and elicits sympathy.

While attribution theory details the interpretation process itself, other theories in the achievement motivation literature address personal dispositions and goals that can precede this attributional process, such as achievement goal theory (Ames & Archer, 1984; Elliot & Dweck, 1988; Nicholls, 1984) or mindset theory (Dweck, 1986; Dweck & Leggett, 1988; Yeager & Dweck, 2012). Both theories discuss students’ motivational patterns related to the interpretation of academic errors and situate the interpretation in the attributional process, in which students’ attributions of academic errors mediate adaptive and maladaptive motivational behavioral patterns (Hong, Chiu, Dweck, Lin, & Wan, 1999).

These theories highlight the potential personal dispositions and goals that can act as antecedents to student error interpretations. For example, mindset theory posits a belief system that directs students’ goal pursuits along with the motivational reaction patterns that follow. Specifically, a growth mindset, in which intelligence is viewed as incremental leads to mastery goals, which focus on increased learning and competence. In contrast, a fixed mindset in which intelligence is viewed as stable, leads to performance goals. Rather than focusing on increasing competence and learning,
performance goals seek to demonstrate competence or avoid incompetence. Importantly, these dispositional beliefs (i.e., mindsets) can result in specific motivational responses reflected in students’ cognition, affect, and behavior. For instance, a student with a fixed mindset, viewing intelligence as stable and aiming to avoid incompetence, may interpret errors as a low ability cue and consequently experience negative affect and/or avoid future challenging tasks. In this way, the student’s mindset and personal goals act as an antecedent to the interpretation (i.e., attribution) of the error, which in turn results in more or less adaptive motivational responses to the error.

The personal dispositions and goals within achievement goal theory not only lead to individual interpretations of errors but can also direct error experiences and interpretations at the classroom level. The classroom environment, often through teacher beliefs and behavior, communicates purposes and meanings for students related to academic content and tasks. This notion of classrooms communicating different meanings is encompassed by research on classroom goal structures (Ames, 1992; Kaplan & Midgley, 1999; Meece, Anderman, & Anderman, 2006; Patrick, Anderman, Ryan, Edelin, & Midgley, 2001; Turner & Patrick, 2004; Urdan & Midgley, 1998). Classroom goal structures relate specifically to the personal achievement goals focused on mastery and performance; a mastery goal structure conveys a perception that students’ learning and understanding are valued, and that success is accompanied by effort and demonstrated through personal improvement. A performance goal structure conveys to students that learning is primarily a way to achieve recognition, and that success is indicated by outperforming others or surpassing normative standards established in the classroom.
How students interpret classroom messages (i.e., the classroom goal structure) can relate to their participation in class, and potentially their experiences with and interpretations of academic errors. For example, Turner and Patrick (2004) examined teacher practices related to achievement goals, finding that differences in middle school teachers’ expectations and calling patterns influenced students’ perceptions of the classroom goal structure. Specifically, when confronted with incorrect responses, one teacher often called on another student to answer rather than diagnosing the difficulty or providing help; this type of instructional interaction supported students’ perceptions of a classroom seeking to demonstrate high performance rather than deep understanding. This research exemplifies the critical relationship between classroom level factors such as teacher-student interactions and goals with students’ perceptions and interpretations of errors.

In a dissertation study at Seoul National University, Yeon (2014) examined classroom goal structures specifically as they relate to elementary student’s error perceptions. The author found that students in a classroom with a mastery goal structure were more likely to have positive error perceptions, where error perceptions were defined positively or negatively based on Rybowiak and colleagues’ (1999) Error Orientation Questionnaire, including components of risk, emotional strain, reflection, anticipation, and covering up errors. Furthermore, the author found that students with more positive error perceptions were more likely to perform better on a proverb learning task.

The achievement motivation literature provides extensive theory and research outlining the potential antecedents to student error interpretations as well as how students may go through the interpretation process itself. This literature also discusses student experiences with errors following the error interpretation, particularly in its discussion of
achievement emotions. Specifically, the experience of failure is associated with emotions such as anger, shame, or anxiety (Elliot & Dweck, 1988, 2005). Pekrun (2006) expanded the concept of achievement emotions from experimental studies to a Control Value Theory of Achievement Emotions, in which the experience of failure is associated with anticipatory relief, anxiety, hopelessness, sadness, shame, or anger depending on whether the failure already occurred or is anticipated.

Tulis and Ainley (2011) bridged math education and achievement motivation literatures in a study specifically aimed at understanding emotions related to academic errors. The authors found that math students who were more oriented toward learning held more positive attitudes toward errors and experienced more positive emotions after errors compared with students who were oriented toward performance. Other research on academic errors has also begun to unpack the cognitive and affective components of academic error experiences.

For example, Zander, Kreutzmann, and Wolter (2014) proposed an affective dimension (fear of making errors) and cognitive dimension (proactively dealing with errors) of students’ error reactions. Dresel and colleagues (Grassinger & Dresel, 2017; Steuer & Dresel, 2013; Tulis et al., 2017) propose adaptive affective-motivational reactions to errors, which they conceptualize as the students’ ability to maintain positive affect and motivation to learn in the face of errors. Still other researchers highlight cognitive elements of academic error experiences such as error risk taking as well as affective components like fear or anticipation of errors (Rybowiak, Garst, Frese, & Batinic, 1999). Such research further highlights the potential influence of academic error
experiences and interactions on student outcomes, however remains limited by its focus on older students.

The Current Study

The existing theory and research on academic errors has provided vital insights toward potential antecedents to student error interpretations such as students’ personal dispositions and goals, classroom goals, and teacher responses to students’ errors. In addition, attribution theory provides a framework for the actual process of interpreting an error and the control value theory of achievement emotions suggests how error experiences and interpretations might result in particular emotions. However, current conceptualizations of academic errors are inconsistent and lack in-depth consideration of important dimensions. Additionally, research on teacher responses to academic errors has been predominantly conducted in math classrooms with elementary aged students and older. Therefore, very little is known about how young learners experience and interpret academic errors. The current study seeks to address this gap by exploring academic errors in-depth in the preschool classroom.

The preschool context. Preschool programs in the United States differ in regard to large- and small-scale features (Pianta et al., 2005). One large scale feature involves how preschool programs are funded and the populations that they serve. For example, the largest early childhood education program in the United States is Head Start, which offers education, health, and nutrition services to underserved children and families at or below the poverty level, enrolling nearly a million three- and four-year-old children across the country (Kline & Walters, 2016). Although Head Start programs exclusively serve
families in poverty, both Head Start and public preschool programs serve diverse populations in regard to income and ethnicity.

Other large-scale characteristics include location and whether the school is full or half day, while proximal features refer to characteristics like teacher training and student-staff ratio. More consistent across preschools are the actual activities engaged in within the classroom; these activities generally consist of structured, more academic activities led by the teacher alongside more open, free-play activities directed by students. The remainder of the preschool day consists of meals and routines such as lunch or using the bathroom (Early et al., 2010; Powell, Burchinal, Filec, & Kontos, 2008).

The academic, more structured parts of the preschool day are typically teacher-led and consist of activities like whole-group instruction (e.g., circle time or shared book reading), in which teachers provide verbal instruction and clear expectations for student engagement (e.g., watch and listen). Other activities might include teacher selected small group-work or working alone (e.g., individual worksheets). In more student-centered parts of the preschool day, activities involve students choosing what to do from a variety of materials and specified areas (e.g., center time). Meals and routines, which take up the remainder of the preschool day, involve students engaging in personal or classroom activities such as eating, using the bathroom, cleaning up, or transitioning between activities (Early et al., 2011).

Some research has been done on the type of talk that typically occurs between teachers and students in the preschool classroom. For instance, Early and colleagues categorized teacher-student interactions as scaffolded or didactic; scaffolded interactions involve teachers providing new challenges and information to students alongside
appropriate support, while didactic interactions are more rote in nature, providing students with information through modeling, practice, explanation, recitation, or closed-ended questioning. Other researchers examining teacher-student talk in preschool found that teacher talk such as directives, questions, and praise or affirmations can also provide students with varying levels of guidance (Powell et al., 2008). Specifically, directives like verbal instruction, demonstration, requests, and redirection can provide students with guidance on ways to engage in the activity at hand. Teacher questions might elaborate on students’ behavior (e.g., “What are you building?”) and affirmations can provide positive feedback (e.g., “Nice work!”).

Importantly, some researchers in the preschool context have found that teachers demonstrate more effective instructional interactions with students during teacher-led rather than student-led settings (Cabell, DeCoster, LoCasale-Crouch, Hamre, & Pianta, 2013). These whole- or small-group teacher-led activities often include shared book reading (Fuligni, Howes, Huang, Hong, & Lara-Cinisomo, 2012; Hamre, 2014), which provides a context in which teachers and students engage in continuous interaction through question-and-answer exchanges about a particular topic. Given the instructional nature and increased teacher-student interactions within these teacher-led activities, whole-group shared book reading is an optimal setting to examine teacher-student interactions around academic errors. Specifically, the question and answer exchanges that occur about the book act as the academic task that the teachers and students engage in together and encounter academic errors.

Regarding interactions around errors in the classroom, a construct that may be of particular importance to the preschool classroom is self-esteem. For some preschool
teachers, focusing directly on errors in the classroom may risk hindering students’ self-esteem. Anecdotal evidence (Champagne, 2017) suggests that preschool teachers may shy away from recognizing young students’ errors in the classroom in order to avoid diminishing students’ enthusiasm for learning. Such fear may be rooted in a strong emphasis on cultivating self-confidence and high self-esteem in early childhood.

Beginning in the 1980s and 1990s, early childhood educators began to discuss the need to boost students’ self-esteem as a strategy for building a solid foundation for future self-confidence (Bridgeman & Shipman, 1978; Haltiwanger, 1989; Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995).

In this literature, self-esteem is generally defined globally as a student’s positive or negative attitude toward the self as a totality, and preschool teachers have embraced this construct. The emphasis on self-esteem has support at the policy level as well; Head Start’s Early Learning Outcomes Framework mandates several objectives for teachers in social and emotional development, one of which states that students should express confidence and positive feelings about his or herself (Office of Head Start, 2017).

Although self-esteem is not directly measured in the current study, it is necessary to acknowledge this focus of some early childhood classrooms as a potential influence on teacher responses to students’ errors and motivational characteristics.

It is also necessary to acknowledge some developmental considerations regarding the study of motivation in young learners. Early research on children’s motivation suggested that preschool-aged students are essentially immune to experiences of failure because they cannot reliably distinguish between ability, effort, and outcome (Nicholls, 1978; Nicholls & Miller, 1985). That is, if young learners don’t understand that task
difficulty and personal ability place limits on the efficacy of effort, it follows that they would exhibit very optimistic and adaptive motivation as compared with older students and adults.

However, subsequent research has found that children do not often attempt tasks they cannot do, they respond to difficulty with distress, and they often abandon challenging activities (Butler, 2005). Specifically, research examining young children’s achievement goals (Day & Burns, 2011; Smiley & Dweck, 1994), motivational beliefs (Mantzicopoulos, Patrick, & Samarapungavan, 2008), self-evaluations (e.g., Heyman, 2009; Stipek, Recchia, & McClintic, 1992) and social comparisons (e.g., Rhodes & Brickman, 2008) suggest that young children may be vulnerable to the same maladaptive interpretations and reactions to failure as older children. Additionally, many studies conducted with young learners often employ unnecessarily complex methods that can result in children simply not understanding a question rather than the concept of interest (Butler, 2005; Dweck, 1999). Moreover, although previous studies have had difficulty conducting research with such a young population, meaningful research can and should be conducted in the early childhood context.

**Research questions.** The current study examines teacher-student interactions around academic errors by asking the following research questions:

1) What types of errors do students make in the preschool classroom?
   1a) How do error types relate to the academic task at hand?

2) How do preschool teachers respond to student errors?
   2a) Who do teachers identify to correct errors?
   2b) How do teacher responses reflect the norms of the classroom?
2c) How do teachers use errors as tools for learning?

2d) Do teachers respond adaptively or maladaptively to student errors?

3) How do preschool teacher responses to student errors relate to student error types?
CHAPTER 3

METHODS

Data Sources

The current study is situated within a larger research project entitled Text to Talk, a three-year project funded by the William Penn Foundation. The aim of this development grant was to develop and then test, in a small randomized control trial, an intervention in which teachers are guided to select target vocabulary words from their curriculum (Creative Curriculum) and share information about these words with families. Specifically, teachers disseminated this information through text messaging with students’ families. This dissertation study included four teachers (11%) from the treatment condition of this larger study. The remainder and majority (89%) of teachers in the current sample were in the comparison condition of this larger study, whose classrooms are pre- and post-tested but who follow business-as-usual professional development and family involvement strategies throughout the year. In other words, these teachers should be generally representative of Philadelphia pre-kindergarten teachers.

It is important to note that it is possible that, as a result of participation in the treatment group of the larger study, those four teachers expressed different vocabulary or emphasis in their instructional practices compared to teachers in the control group. Given that the intervention of this larger study targeted families (not teachers), it is unlikely that this had an impact on the current study findings. However, these teachers’ question types and talk were examined to identify whether a potential differential effect took place (resulting in clear indications that no differences were present).
Participants

Students and teachers from 19 preschools in the School District of Philadelphia (SDP) participated in this study, many of which (79%) were Head Start programs. Participants included 30 head teachers in classrooms of on average 17 students each. Most teachers (63%) taught in a school that included at least one other teacher participating in the study (no more than three total), while others (37%) were the only participating teacher from their school. Most teachers identified as White (80%), while 13% identified as African-American, 3% identified as Latinx, and 3% identified as Other. All but one teacher was female (97%) and most held master’s degrees (73%). The remaining teachers held a bachelor’s degree (17%) or less (10%).

Most teachers in this sample (60%) reported holding 16 or more years of teaching experience, while 17% had 11-15 years, 10% had six to ten, and 13% had five or less years of experience. Students were three to five years of age and predominantly African American and Latinx. The majority of classrooms (70%) included at least one Dual Language Learners (DLL), and 37% of teachers reported having at least six DLL students in their classroom. Across all classrooms, 27 languages were represented.

Procedures

Teachers were recruited during a teacher training session in January of 2018 and data collection took place in April and May of 2018. Recruitment procedures included brief 1:1 conversations with each teacher as I was helping them to sign up for the Text to Talk spring observation dates. Specifically, I introduced myself as a doctoral student at Temple completing my dissertation and that my project was a completely separate from Text to Talk and optional to participate in. I explained that if they were willing to
participate, I would visit their school on the spring observation date and observe their classroom for a maximum of two hours in the morning, including the shared book reading videotaped session.

During this school year, for Text to Talk, all teachers, including these 30 participating teachers, were video-taped in their classrooms for a full morning of instruction in April including at least two to three hours of observations at each time point. Observations for the current study included these video-taped sessions as well as more direct observations before and after the videotaping when possible (i.e., provided there was not a special event going on at the school). These direct observations allowed for a rich description of the context. At least 30 minutes of these video-taped observations focused on large group book readings. I transcribed all talk during the book reading, including teacher reading of the text, teacher remarks to the group about behavior, teacher remarks about the book content and, as much as possible, students’ talk. Transcriptions of video-taped book readings and field notes from direct observations were then coded in the analysis phase.

**Measures**

The nature of students’ errors as well as teacher response to students’ errors were assessed through video-taped observations of book readings, which often serve as the focal point of the instructional day in preschool. The video-taped observations were 15 minutes long on average, ranging from nine to 32 minutes. Book readings included (a) the teacher’s introduction of the book, (b) the actual reading of the words of the book and group discussion of the book, and (c) any follow-up conversation about the book after the reading of the text is complete.
A total of 26 books were read across the 30 classrooms, with four books read in two different classrooms. In other words, eight teachers (27%) read a book that was also read by another teacher. Most books (80%) were fictional (e.g., “Lily’s Purple Plastic Purse”), however some books (20%) were explicitly informative in some way (e.g., “A Tree Is A Plant”). Only one book appeared to be completely non-fiction (“Just Like Josh Gibson”). All books related to particular curricula themes; all teachers used Creative Curriculum. Although specific data is not available regarding whether the class had previously read the book before, we know that in at least seven classrooms (23%) the teacher had read that particular book before.

Direct classroom observations were conducted for 21 teachers (60%) and took place during morning routines and transition periods on the day of videotaping, with the exception of one classroom that was observed in the afternoon a week following videotaping. These direct observations were 25 minutes long on average, ranging from five to 45 minutes.

**Analyses**

This study employed an exploratory, descriptive qualitative approach to investigate types of student errors, types of teacher responses to student errors, and the potential relationships between them. Specifically, data analysis consisted largely of coding processes, which allowed for increased level of complexity and meaning to arise from simple open codes to more patterned codes, all of which provided a basis for assertions and propositions (i.e., conclusions) made about the data (Miles, Huberman, & Saldana, 2014). All three research questions were answered through these coding processes (described in-depth below) and subsequent examination of code frequencies.
Specifically, the first research question involved frequency calculations of all child error categories. In addition, RQ1a required assigning codes to teacher elicitation questions, counting their frequency of occurrence and cross-examining these frequencies with child error codes. The second research question involved frequency calculations of all teacher response categories. For RQ2a, we looked at the frequency of teacher correction and redirect codes. RQ2b examined the frequency of norm-based error codes and RQ2c looked at the frequency of connection-based teacher correction codes. RQ2d drew on achievement motivation theory to examine how often teachers responded to errors in adaptive and maladaptive ways. Finally, the third research question cross-examined the frequencies of both child error and teacher response codes to understand how they occurred together; this allowed me to map out what kinds of teacher responses generally followed particular kinds of errors.

A priori review. Before directly coding children’s errors, I reviewed the literature on definitions of errors and failure to identify elements that would potentially relate to my data and inform my coding process. Specifically, I reviewed rule- and knowledge-based errors (Zhao & Olivera, 2006); displacement errors (Ohlsson, 1996); computational errors including those related to knowledge, memory, omission, or recognition (Zapf et al., 1992); action slips (Heckhausen & Beckman, 1990); and mathematical errors (Gardee & Brodie, 2015; Ledesma, 2011; Peng & Luo, 2009; Santagata, 2005; Warshauer, 2014).

Additionally, I reviewed what was available for conceptual definitions of errors, breaking them into those that were more objective and concrete (Heimbeck et al., 2003; Ohlsson, 1996), those that were more subjective and dependent on context or judgment (Gartmeier et al., 2008; Grassinger & Dresel, 2015; Rach et al., 2013; Zhao & Olivera,
and those that seemed to lie somewhere in the middle relating to things such as persistence of errors (Brodie, 2014; Gardee & Brodie, 2015). I also had in mind the potential dimensions of academic errors including identification, task, type, valence, norms, and function.

Because the research on teacher responses to student errors is more extensive and concrete, I had a clear list of potential codes to use for teacher responses. This list was based primarily in those studies that discussed general types of errors applicable to the preschool context (Gardee & Brodie, 2015; Santagata, 2005) as well as those that emphasized potential connections to student motivation (Tulis, 2013).

**Data organization and management.** First, data were organized for coding by creating excel sheets detailing each interaction excerpt from the transcript, error and response codes, and notes. Error interaction excerpts were identified primarily based on what Santagata (2005) termed the Mistake Management Sequence (also referred to as the Initiation-Response-Feedback, Sinclair & Coulthard, 1975). This sequence includes the teacher’s elicitation (i.e., initiating question), the student’s answer, and the teacher’s feedback. All three of these conversational turns were coded in this study. However, in some cases, children’s errors were explicit comments or questions that were NOT in response to a teachers’ elicitation question. That is, some sequences identified for coding (24%) included *only* the 2nd turn (student’s answer) and 3rd turn (teacher feedback) of the typical IRF sequence; the only difference being that they did not include an elicitation question from the teacher.

After coding the first two participants, it became clear that including verbatim excerpts from the transcript within the excel coding sheet was not efficient, and more
importantly that it discouraged referencing utterances in the transcript that fell before or after the error interaction and provided context. In addition, this initial method made it difficult to keep track of multiple errors that occurred in one conversational turn. As a result, starting with the third participant, the excel coding sheet included the teacher’s pseudonym and a numbered list of teacher elicitation questions with their respective errors, and then a separate numbered list directly below with the same errors and their respective teacher responses, with codes and notes recorded directly within each row (See Appendix A for examples). This structure was used to code all remaining child errors and teacher responses (and the first two participants were later revised to match this structure).

In addition, transcripts of each teacher’s book reading sessions were color-coded to highlight the teacher’s elicitation question, the child’s action, and the teacher’s response to that action. During coding of each participant, the highlighted transcripts were viewed simultaneously with the structured coding sheet. Videos of the book readings were referenced as needed during coding to confirm specific language or gestures made by children or teachers that informed error interactions. The initial coding scheme was quickly developed into a codebook that included the code abbreviation as well as the name, description, and examples of the code. This codebook was edited continuously as codes were added, omitted and revised, and was ultimately split into three sections focusing on child errors, teacher response questions, and teacher response statements (See Appendix B for the child error codebook and appendices G and I for teacher response codebooks).
**First coding cycle.** I then began coding based on the distinct definitions, dimensions, and types of errors and teacher responses reviewed. These initial codes took the form of descriptive, straightforward labels (e.g., “behavior” or “correction”) and can be considered provisional codes (i.e., a start list of researcher-generated codes) since they were based on a priori definitions, dimensions, and types reviewed in the literature (Miles et al., 2014). Some of these initial codes were used for organizational purposes such as sub-codes (e.g., correction providing information) and simultaneous codes (e.g., “persistent” and “relevant”). Other types of codes were based on the interactional nature of the study, such as in vivo codes using phrases of participants’ own language as codes (e.g., “no” or “not”) and process codes, which identified observable action in the data such as a child calling out (Miles et al., 2014).

**Second coding cycle.** All initial codes acted as triggers for deeper reflection into the meaning of the data toward this next cycle of codes, which focused on identifying patterns. Jottings (written on the right-hand margins of coding sheets) and analytical memos were written throughout this cycle. This second cycle of coding included codes related to broader categories and themes (e.g., teachers’ content expectations). These codes were identified through careful consideration of common threads throughout the data that acted as leads and were then reconfigured and segmented through cross-checking and reflection.

Specifically, I utilized clustering (Miles et al., 2014) to group and then conceptualize types of errors and responses with similar patterns or characteristics. For example, when children called out or when they did not answer when called on, these were grouped based on the fact they were both characterized by child behaviors.
Similarly, when teachers made reminder statements or provided the beginning of a word, these were grouped as hints based their common characteristic of guiding children toward the correct answer without actually providing it.

Codes at this stage were solidified by writing about the most promising pattern codes in analytical memos that expanded on their significance. For instance, early on in my data analysis log I wrote, “What I’m finding after going through 2-3 errors is that it will always inherently be a deviation from a norm (i.e., of the teacher/classroom). Where the difference seems to lie is in the level of academic content and the root/source for the child” (07/03/18). As I continued coding error interactions, I began to see my codes and categories bolstered by new data, which tested their validity and began to solidify major distinctions such as norm versus expectation-based codes. As needed, codes and categories were partitioned (Miles et al., 2014) to avoid oversimplification (e.g., splitting expectation-based codes into irrelevant and relevant). However, as a result I learned the pitfalls of extreme differentiation (e.g., creating a code for every closed follow up question that occurred).

Codes were then verified based on the conditions under which they held, which was established through checking the meaning of outliers, following up on surprises, ruling out spurious relations, and checking rival explanations (Miles et al., 2014). For instance, teacher brief utterances often appeared at the end of teachers’ follow up questions (e.g., “okay?”) that were difficult to decipher as an individual question or part of the previous question, especially given their lack of clear meaning or opportunity for children to answer. By checking the meaning of these outliers, I eventually created the rhetorical type of closed follow up question. I also ruled out spurious relations, such as
the assumed connection between refocusing and hints. This is demonstrated by an excerpt from my data analysis log: “Also within hints, refocus was omitted and replaced by a code outside of the hint category – “refocus discussion content” – as this really was used not for hint information but as a function of redirecting the conversation back to the question, book, or topic at hand” (02/09/19). I continued the process of abstracting until reaching a saturation point (i.e., when new data did not add meaning to the general category).

**Descriptive analysis.** Once the coding process was complete, descriptive statistics were calculated for all demographic and coding categories. Specifically, sums averages and standard deviations were calculated for teachers’ gender, ethnicity, education, and years of experience. Classroom context data were also calculated (number of Head Start schools, number of DLL students, etc). Regarding error interactions, sums averages, and standard deviations were calculated for all teacher elicitation questions, child error categories, and teacher response categories. Initial sums were calculated by hand using the coding sheets, but Excel functions were used to confirm hand-tallied sums and to calculate averages and standard deviations. In addition to descriptive statistics of each category, the most common types of student errors, teacher response questions and statements were also calculated. Finally, rates of errors, teacher questions and statements per minute were calculated based on video-taped observation length.

**Confirmability.** The confirmability, or objectivity, of this study was established through explicit, detailed description of how the data were collected, processed, analyzed, and displayed (Miles et al., 2014). That is, the methods and procedures are detailed enough to be replicated by an outsider. In addition, conclusions are explicitly linked to
displayed data (i.e., tables and figures), and rival conclusions were examined (e.g., perhaps teachers correct error themselves more often given the context of preschool book reading rather than thinking children aren’t capable of correction). Finally, I was explicit and as self-aware as possible regarding personal assumptions, values, biases and affective states that may have come into play during the study.

**Dependability.** The dependability, or reliability, of this study was established through the clear and consistent congruence between the research questions and study design, as well as through the clear specification of analytic constructs. Dependability was most established through the convergence of intercoder agreement checks (at least 80%), data quality checks (e.g., for bias), and peer review (Miles et al., 2014). Specifically, a graduate student unfamiliar with the project coded the errors and responses from a single transcript based on the codebook, which we then reviewed to address discrepancies and questions. Following that, this secondary coder coded 10% of the sample, which we reached 86% agreement on. Additionally, throughout data analysis I sought contrasting cases as I developed coding categories and descriptions, while also consistently submitting my codebook for review by independent experts (i.e., auditors) in the field.

**Credibility.** The credibility, or internal validity, of this study was established through context-rich and meaningful descriptions (Geertz, 1973) and unified, systematic findings. Specifically, confirmation procedures are described in detail for any assertions, propositions, and/or conclusions made. In addition, negative evidence and rival explanations were sought, and any areas of uncertainty or confirmed negative evidence
were clearly identified. Lastly, when possible, findings were replicated in other parts of the data different from the point at which they originated (Miles et al., 2014).

**Transferability.** The transferability, or external validity, of this study was established by providing the specific characteristics and description of the original sample and context. In doing so, adequate comparisons with other contexts as well as similar contexts can be made. Relatedly, I specify limitations of the sample selection to critically consider the ability to generalize to other settings and contexts. Transferability is also demonstrated through connections between the findings and theory. Lastly, I provide suggestions for other settings where the findings could be fruitfully tested further (Miles et al., 2014).
CHAPTER 4

RESULTS

RQ1: What Types of Errors do Students make in Preschool?

A total of 469 errors were identified and assigned a total of 562 codes (only two error codes were mutually exclusive and therefore many errors received more than one code). Three errors were deemed uncodeable due to the inability to hear the child’s verbal response. Five main categories of student academic errors emerged: Deviation from Content Expectation (45% of total error codes), Deviation from Behavioral Norm (26%), Lack of Knowledge (15%), Primed (7%), Persistent (5%), and Uncertainty (2%). Within three of these categories, additional sub-categories were identified.

Deviations from Behavioral Norms could include Calling Out (59%), Incomplete (12%) answers, No Answer (12%), Routine violations (8%), or Repeated (5%) answers. Child errors that included No Answer were mutually exclusive given that any other code required some type of verbalization. Because this study focuses on academic errors, only behavioral errors that were connected to academic tasks (i.e., teachers’ elicitation questions) were coded (See Appendix D for a visual depiction of these Norm-based errors alongside other potential types of behavior). Lack of Knowledge errors could be coded as the child having a General lack of knowledge, or as that lack of knowledge being specifically related to the Book or the teacher’s Question.

Deviations from the teachers’ Content Expectations could include Relevant (90%) and Irrelevant (10%) answers. Several types of errors Relevant to the teachers’ Content Expectations were identified, including answers that were Too General, Too Specific, provided the Wrong Word, pronunciation or grammar, the Wrong Kind of example from...
a larger category, applied information in the Wrong Context, were Tangential to the question or discussion, were Visually Relevant, or incorrect based on the teachers’ Expectation Only. Child errors that deviated from the teachers’ Expectations Only were mutually exclusive given that any other code requires some level of logical inaccuracy outside teacher expectations.

**Deviation from behavioral norms.** Some errors were identified by teachers as a result of the child deviating from behavioral norms of the classroom, including when children Repeated an Answer, Called Out their answer, violated a Routine (e.g., picking a classmate who didn’t have their hand raised), gave an Incomplete Answer, or gave No Answer at all. Multiple types of Calling Out emerged, including when children did Not raise their Hands, answered Out of Turn, or Interrupted the teacher. Each of these specific types of Calling Out were only coded if the teachers’ response explicitly stated this as the reason they were incorrect (e.g., “I need to see a quiet hand”).

Any other answers that were called out and deemed incorrect by the teacher (e.g., “shh”) were coded as general Call Outs (N-CL); these differed from other Calling Out error types only in that the teacher’s response did not point out their hand raising, being out of turn, or interruption as the explicit reason for being incorrect. Child utterances that were called out and not explicitly acknowledged by the teacher in some way (i.e., potentially ignored) were not included in analysis; we were unable to determine with certainty that the teacher ignored the child rather than did not hear them. Across teachers, we identified 71 potential errors that teachers did not openly recognize; these were omitted from coding and will be considered further in the discussion. See Appendix B for
specific descriptions and examples and Appendix E for descriptive statistics of these
Norm based error codes.

**Deviation from content expectations.** The vast majority of errors that occurred in this study were those that related to the specific Content of the teachers’ Expectations (i.e., their desired answer). These types of errors were either Irrelevant (10%) or Relevant (90%) to the specific content at hand (i.e., the book and surrounding discussion). Irrelevant errors included answers from children that strayed completely from the topic and discussion at hand (e.g., bringing up homeless people during a discussion about buildings). More often, children made errors that were within the scope of the book and/or discussion but fell short of the teachers’ Expectations for the answer (i.e., Relevant errors). For example, the child’s answer might be Relevant to the discussion of sports but provide the wrong kind of sport (e.g., football instead of baseball).

These errors Relevant to the teachers’ Content Expectations varied most notably in the distance from the teachers’ expected answer. That is, all errors in this category related to the answer the teacher was looking for but differed in how far off they were from that desired answer. For example, errors that were Too General in relation to a location (e.g., “over there”) were much further from the expected answer (e.g., on the water) than errors that gave the Wrong Word pronunciation (e.g., “on the wabber”). See Appendix C for a visualization of these distances.

The Relevant errors furthest from teachers’ expected answer were Tangential errors, which broadly related to the question or discussion at hand (e.g., hurting your arm) but were primarily a tangent (e.g., suggesting the character fell off a ladder instead of sliding into a base). One level closer to the teachers’ expected answer were Too General
errors, which fell directly within the topic discussion (e.g., recycling), but were not specific enough (e.g., child says recycled instead of recycled materials). Closer to the teachers’ expected answer were those that incorrectly applied information based on the Wrong Context, were Visually Relevant, or Too Specific. Specifically, Wrong Context errors were relevant to the larger category of discussion (e.g., insects), but were somehow applied incorrectly based on the specific context of the question or discussion (e.g., insects with cocoons). Visually Relevant errors occurred when children identified visual similarity (e.g., thinking larvae are corn) or misinterpreted an image (e.g., thinking a blue tablecloth is a river). Answers that were Too Specific occurred when the child’s answer provided a specific detail (e.g., a character) rather than the more general desired answer (e.g., the title of the book).

Three types of Relevant Content errors fell closest to the teachers’ expected answer: Wrong Word, Wrong Kind, and Expectation Only. Wrong Word errors included synonyms (e.g., hallway instead of aisle), pronunciation or grammar issues. Wrong Kind errors fell within the correct category (e.g., sports) but were the Wrong Kind (e.g., basketball instead of baseball) within that category. Finally, some children’s errors were coded solely as Expectation Only because the content of their answer was logically accurate (e.g., “cuh” for “cat”) but did not meet the specific expectations of the teacher (e.g., “cuh” for “camera”). For specific descriptions and examples of Content Expectation based error codes See Appendix B, for a visual depiction see Appendix C, and for descriptive statistics see Appendix E.

**Uncertainty and lack of knowledge.** Sometimes, children’s answers were incorrect specifically due to being Uncertain (i.e., “I don’t know” or “I don’t remember”)

or Lacking the Knowledge required to answer the question. Most of the time, if children expressed Uncertainty it was of their own volition, but at times if children paused, teachers might ask if they were unsure or don’t remember, which the child then affirmed. Children’s Lack of Knowledge emerged generally such as when definition type questions were asked (e.g., “what’s a diet?”), but also in relation to the Book content (“Does Tia know about the surprise yet?”) or failure to understand the Question being asked (e.g., answering “who” to “who is the party for?”). That is, Lack of Knowledge errors could be coded as general (LK) or related to the book (LK-B) or question (LK-Q) asked by the teacher. For specific descriptions and examples of these error codes see Appendix B and for descriptive statistics see Appendix E.

**Primed and persistent.** Some of children’s errors were in part a result of the child being primed by some stimuli. Specifically, children were primed by the teacher (e.g., teacher explaining butterflies have a chrysalis leading child to state bees have a chrysalis), another student (e.g., a child repeats a previous child’s answer or comment), or by the book. For example, in response to the question, “What is weeping?” a child stated that weeping meant sweeping. In the teachers’ response, she acknowledged that the child had noticed a broom on the same page of the book with the child weeping, connecting weeping to sweeping. Persistent errors were those that occurred more than once, committed either by the same child or a different child. In this way, a repeated error was always coded as Persistent, but was only coded as Primed if the errors were committed by different children (i.e., a child couldn’t prime themselves). For specific descriptions and examples of these error codes see Appendix B and for descriptive statistics see Appendix E.
**RQ1a: How do Error Types relate to the Academic Task?** In the current study, the academic tasks associated with children’s errors were the teachers’ elicitation questions (i.e., the question initially asked by the teacher to elicit an answer from the children). Some (24%) child errors occurred independent of a specific elicitation question (e.g., a child’s comment) and are therefore not included in this particular analysis; examination of these non-elicited errors is addressed in discussion. An average of 38 questions were asked per teacher throughout the entire book reading sessions. For most teachers (93%), child errors occurred for less than half of these elicitation questions. That is, for majority of the book reading sessions, question and answer exchanges between teachers and students did not include error interactions. Specifically, on average, teachers encountered errors for 10 of their 38 questions, or 26%. For descriptive statistics on teachers’ elicitation questions, see Appendix F.

The academic task presented by a teachers’ elicitation question was identified in two ways: 1) Whether the teacher’s question was open or closed, and 2) What specific content was being asked of the child to answer the question. Teacher questions were considered open when there were multiple answer possibilities (e.g., “How do you know?”). Teacher questions were considered closed when there was only one answer possibility (e.g., “Is it heavy or light?”) or when it was clear that the answer was known to the teacher prior to asking. For example, when a teacher counted the number of legs a bug had and then said, “so bugs have…” looking for the answer “six legs”.

Overall, teachers most often asked closed questions (66%), but this differed based on whether interactions included errors. On average, teacher questions that did not result in child errors were mostly (69%) closed questions. Teacher questions that did result in
child errors were also mostly (57%) closed-ended but included more open-ended questions (44%). Therefore, children were more likely to offer an answer that the teacher recognized as incorrect when responding to an open-ended question. In fact, for some teachers (27%), most questions that resulted in errors were open-ended whereas most of their questions that did not result in errors were closed. For descriptive statistics on teachers’ elicitation questions, see Appendix F.

A total of 25 types of academic tasks were identified based on teacher questions, but children were most often tasked with Naming (21%), Recall (14%), Definition (10%), Prediction (7%), Location (6%), and Description (6%) based questions (for the complete list see Appendix F). Specifically, Naming questions asked children to name specific things or people (e.g., “What’s the punctuation mark for guess?”). Recall questions required children to remember a detail about the book (e.g., “Who lived under the bridge?”). Children were also asked to make predictions about what might happen later in the book (e.g., “So what do you think they’re going to tear down?”) or to locate something on a book page (e.g., “Where are Jack and Jill?”). Description based questions asked children to describe an object, event, or person (e.g., “What happened?”).

Frequencies of each type of academic task were calculated across child error types to identify whether particular types of errors might occur during specific tasks. All but one of these top tasks were most frequently accompanied by Relevant Content Expectation errors. Specifically, Description tasks most often (48%) involved Norm-based errors. It is also worth noting that Lack of Knowledge errors most frequently (21%) occurred in response to Definition based questions. In addition, while other types of academic tasks were far less frequent, some demonstrated clear patterns in the types of
errors that emerged as a result. For example, Quantity based questions only accounted for 2% of academic tasks, but most of the time these tasks were presented (63%), children demonstrated errors through Lack of Knowledge.

**RQ2: How do Preschool Teachers Respond to Student Errors?**

A total of ten categories were identified based on teacher responses to students’ academic errors, including Question (33%) and Statement (67%) based responses. Three main categories of teacher response Questions emerged: asking a Follow-Up (70%) question, Re-Asking (15%) the original question, or Redirecting (15%) the question. Nine total categories of teacher response Statements were identified, including those that Corrected (63%) children’s answer, provided Support (20%) or a Hint (7%), made an Exclamation (2%), Redirected the question (2%), Refocused the content of discussion (2%), Affirmed the Correct Student (1%), or Cut Off the child answering (<1%). Additional types of Follow Up questions, Corrections, Support, and Hints. Exclamations and physical Gestures were also identified but occurred rarely. It is important to note that the physical gesture teacher response code was mutually exclusive; teachers made many physical gestures throughout observations, but this code was only used when the teacher responded with only a physical gesture and no verbal response. Below, these response questions and statements are explained.

**Response questions.** In response to children’s academic errors, teachers sometimes Re-Asked the original question or Redirected the question, but teacher response questions were most often in the form of a Follow-up question. Follow-up questions were first differentiated into Open (7%) and Closed (93%) types of questions. Several types of Closed Follow up questions were then identified, including Rhetorical
questions (e.g., “Right?”), questions that phrased the child’s Answer as a Question (e.g., “A horse? Doesn’t look like a horse to me.”), asked children for Permission to Move on (e.g., “Should we come back to you?”), to Fill in a Blank (e.g., “This is the…”), choose from Dichotomous Options (e.g., “Is it hollow or solid?”), provide a Label (e.g., “But what is it called?”), or Ask for an Additional detail (e.g., “Which tree?”). Some Closed Follow up questions were not meaningful enough to fall into these categories (e.g., “A what?”), and therefore were coded as General Closed Follow up questions (QFU-C). Potential further examination of these questions is addressed in the discussion. See Appendix G for specific examples and Appendix H for descriptive statistics of teacher’s response questions.

**Response statements.** Most commonly, when teachers responded to children’s errors with statements, they did so through Corrections. Four specific types of Corrective statements emerged, including when teachers Told children their answer was Wrong (e.g., “That’s not a river”), Gave the child the Answer (e.g., “A diet is what you eat”), Directed the child’s Behavior (e.g., “Hands down”), or Provided Information. Teacher Corrections most commonly Provided Information (49%), and as a result three types of Information were identified that teachers could provide: Information about the child’s Error (e.g., “That’s in a different story”), the Target answer (e.g., “Recycled materials like juice or cans”), or Connecting the child’s error to the target answer. These Connections could be Low- (e.g., “It’s the same sound”) or High- (e.g., describing why paper towels aren’t recycled) level connections.

Second most common of teacher response Statements were those that provided children with some form of Support (20%). Specifically, teachers showed Support by
Encouraging (50%) the child (e.g., “Right, but…”), Restating (39%) the child’s Answer (e.g., “It does look like corn”), stating that they would Revisit (29%) the child at a later time (e.g., “Save your story for later, I wanna hear it”), or rarely (1%) by providing Consolation (e.g., “It’s okay”).

Teacher statements also included Hints (7%), which could include drawing the child’s Attention (22%) to specific information (e.g., “Look up here”), Reminding (46%) the child of content already covered (e.g., “Well he grew taller, so longer or shorter?”), providing the first Word or Letter (17%) of the desired answer (e.g., “It starts with an O”), highlighting what was Missing (12%) from the child’s answer (e.g., “Not just karate”), or rarely (3%) by hinting at the Proximity of the child’s answer to the desired answer (e.g., “Almost”). The final teacher statement response category that was further specified were teacher Exclamations (2%), which included Positive (e.g., “Wow, big”) and Negative (e.g., “Oh no!”) exclamations. For detailed examples of each teacher statement category see Appendix I and for descriptive statistics see Appendix J.

**RQ2a: Who do Teachers Identify to Correct Errors?** To examine who teachers identified to correct child errors, each error interaction was examined according to whether the teacher selected themselves to correct the error or whether they left correction of the error to the children. Specifically, children were identified to correct their own error when teachers Re-asked the question, asked a non-rhetorical Follow up question, or provided a Hint. Other children (i.e., a different child than who committed the error) were identified to correct the error when teachers Redirected the question to another student or to the class. Teachers identified themselves to correct the error when they provided any form of correction. On average, in most of teachers’ error interactions
(51%), they identified themselves to correct errors. Identifying other students to correct errors was less common, occurring for 17% or less of error interactions for all teachers. In fact, some teachers (20%) never identified other students to correct errors.

**RQ2b: How do Teacher Responses reflect the Norms of the Classroom?**

The Norms of the classroom emerged distinctively in how teachers responded to children’s behavior during book reading, reflecting both implicit and explicit behavioral norms of the classroom. Explicit norms were reflected when teachers responded to children violating Routines, Repeating or Calling Out answers. Specifically, when children provided an answer that a different child had already stated, teachers identified this behavioral norm violation by explicitly stated something like, “yes we have that”. When students called out their answers without first raising their hand, teachers explicitly stated something like, “I’m waiting for a quiet hand”. Teachers also explicitly identified norm violations in their response when answers were called out after another child had been called on (e.g., “it’s not your turn”) or when it interrupted the teacher (e.g., “you’re interrupting me and that’s rude”). Sometimes students violated set routines of the classroom (e.g., picking a classmate to share, only if the classmate has their hand raised), which teachers explicitly identified by correcting that child’s behavior (e.g., “she doesn’t have her hand up”).

Teacher responses also reflected implicit behavioral norms of the classroom, specifically when children gave Incomplete Answers or No Answer at all. When students were called on and began to answer but did not complete their thought or sentence, this was implicitly identified as violating a norm, and teachers often followed by providing the answer themselves. When children were called on and then did not speak, teachers
implicitly identified this as violating a norm, often by redirecting the question to another student. Many other behavioral norms likely exist in these preschool classrooms (e.g., not touching classmates) but were not identified in the current analysis given the focus on behaviors related to academic errors. For a visualization of these behavioral norms in conjunction with other potential behavioral norms, see Appendix D. For a description of behavioral norm codes see Appendix B and for descriptive statistics see Appendix E.

**RQ2c: How do Teachers Use Errors as Tools for Learning?** Teacher responses were considered to use children’s errors as tools for learning when they made a connection between the child’s error and the desired answer (STCR-IC). Such connections could be at a low level (e.g., “Yes it’s the same sound”) or high level (e.g., explaining why “rhino” is a form of “rhinoceros”). Across teachers, a total of 34 Connection type statements were made, which constitutes 14% of the broader Providing Information corrections and 7% of all Corrections. While most teachers (60%) made at least one of these Connection statements, most of the connections (62%) were at a Low rather than High level. In addition, of the teachers who made these Connections, only 33% made more than one, and the highest for any one teacher was six total connective statements.

**RQ2d: Do Teachers Respond Adaptively or Maladaptively to Student Errors?** To examine whether teachers responded adaptively or maladaptively to child errors, each error interaction was examined according to whether teacher responses included mostly (over 50%) adaptive or maladaptive responses. Adaptive responses included those that helped rather than reprimanded children (Weiner, 2000) as well as those that focused
more on the process of learning or effort rather than the product of performance or ability (Dweck & Leggett, 1988).

Moreover, error interactions were considered adaptive if they included over 50% Supportive statements, Hints, Providing Information, and non-rhetorical Follow up questions. In contrast, error interactions were maladaptive if they included over 50% Corrections (Behavioral, Tells Wrong, Give Answer), Negative Exclamations, Cutting Off the child, Affirming the Correct Student, or Redirecting to a different child. For many teachers (87%), some interactions were equal parts adaptive and maladaptive (e.g., one supportive statement and one behavioral correction). However, most teachers (60%) exhibited adaptive responses in more than half of their error interactions. Only one teacher (3%) predominantly responded maladaptively.

RQ3: How do Teacher Response Types relate to Student Error Types?

Frequencies of teacher response types and student error types were cross-examined to explore potential patterns. Question and statement forms of Redirecting the question were merged given that they serve the same function, and these responses were most often used in response to Norm-based errors. Overall, all child error types except for Uncertainty errors were most often responded to with Corrective statements, however specific types of corrections varied by error type (detailed below). Errors of Uncertainty ($N = 5$) were most often responded to with Support (36%).

Expectation based errors. Overall, child errors that were Irrelevant to the content most often received closed Follow up Questions (24%) or Corrections that Provided Information (21%). Child errors that were Relevant to teachers’ content Expectations most often (47%) received Corrective statements from teachers, which
varied depending on the specific type of Relevant error. Specifically, teachers responded to Tangential errors most often with Information about the Target (36%) or by telling children their answer was Wrong (31%). Wrong Kind errors were most often responded to by teachers telling them their answer was Wrong (32%) or by Giving the Answer (27%).

When children applied the Wrong Context, teachers most often responded with Information about the Target (35%) and when children said the Wrong Word, grammar, or pronunciation, teachers most often Gave the Answer (61%). When children were wrong due to the teachers’ Expectation Only, teachers most often responded by Providing Information about the Target (50%). Children’s Visual errors most often received Information about the Target (36%) or Supportive (35%) statements. Finally, errors that were Too General or Too Specific most often were Given the Answer (56% and 43% respectively).

**Norm based errors.** Overall, child errors related to behavioral norms were most often (47%) responded to with Corrective statements from teachers. Specifically, errors Called Out were responded to most often (45%) with Behavior related Corrections. In fact, each specific type of Call Out error was responded to with Behavioral Corrections; 54% of General call outs, 43% of No Hand raised call outs, 46% of Out of Turn call outs, and 61% of Interruption call outs. Regarding other Norm based errors, Incomplete answers most often received a Redirect (22%) or Supportive (19%) statement. Repeated answers similarly received Supportive (37%) statements most often, while Routine based errors most often received responses Providing Information (36%). Lastly, when children
provided No Answer, teachers most often responded with a closed Follow up Question (25%) or by Redirecting (20%).

**Uncertainty, persistence, primed, and lack of knowledge.** Errors of Uncertainty ($N = 5$) were most often responded to with Support (36%). Teachers most often responded to Persistent errors ($N = 29$) by Providing Information (16%) and Giving the Answer (16%). Overall, Lack of Knowledge errors ($N = 85$) were most commonly responded to with Information about the Target answer (15%) or Giving the Answer (12%). However, additional types of common responses emerged as this category was broken into Book and Question types. For both subtypes, Providing Information about the Target answer was still the most common, but for Book related Lack of Knowledge errors, Rhetorical Follow up questions were just as common of a teacher response (13%). For Question related Lack of Knowledge errors, Re-Asking the question was just as common of a response (12%) as Providing Information on the Target. Primed errors most often received Corrective responses (48%), and specifically teachers most often Gave the Answer (34%).
CHAPTER 5

DISCUSSION

This study identified several ways in which children make errors in the preschool classroom in addition to the varied ways teachers respond to them. Specifically, children’s errors were most often in response to naming and recall based tasks and were deemed incorrect based on teachers’ content expectations or behavioral norms of the classroom. Teachers responded to children’s errors with both questions and statements, most often with corrective statements that provided children with information or with closed follow-up questions that limited children’s range of answers.

In addition, teachers tended to identify themselves (rather than students) to correct errors and rarely used children’s errors as tools for group instruction during the book reading. However, overall teachers responded more adaptively than maladaptively during their error interactions with children. Lastly, nearly all children’s errors were most often responded to with corrective statements. Specifically, norm-based errors most often received behavior focused corrections whereas expectation based (relevant) errors varied by type. Exceptions were irrelevant content errors and errors of uncertainty, both of which often received supportive statements. Irrelevant errors were also often responded to with closed follow up questions.

The coding schemes developed in this study provide a foundational conceptual framework for the achievement motivation of young children, particularly their experiences with academic errors. Specifically, the current findings provide a definition of academic errors from a motivational perspective, exhibiting how powerful teachers’ expectations and interpretations are in defining children’s academic errors and their
experiences with them. Furthermore, the current findings provide a tool for investigating children’s experiences with academic errors, which can be adapted to examine such processes in older children as well.

**Children’s Academic Errors**

Teacher-child interactions are a critical part of the classroom, especially teacher-child language during instructional contexts like shared book reading, when higher level cognitive questions and comments can lead to more sustained and complex thinking about words and concepts (Dickinson, Darrow, Ngo, & D’Souza, 2009). Because shared book reading is a time of the preschool day that is rich in teacher-child language and instruction, much of the research looking at teacher-child interactions in preschool has examined how shared book reading contributes to early literacy skills like vocabulary (for a review see Wasik, Hindman, & Snell, 2016). Error interactions during shared book reading is an important window into how teachers could capitalize on children’s errors to further develop such skills, but research to date has not examined how teachers and children talk about errors when they arise in this preschool context. The current study addresses this gap by shedding light on the types of teacher questions that tend to elicit child errors as well as the types of child errors that follow them.

During error interactions, the first turn typically includes teachers’ elicitation questions, which present the academic task for the children to engage in and potentially make an error. The types of tasks most often presented by teachers’ elicitation questions (i.e., naming, recall, definition, prediction, locating, describing) are consistent with common teacher questions asked during shared book reading (Hindman, Wasik, & Erhart, 2012; Massey, Pence, Justice, & Bowles, 2008). Teachers tended to ask more
closed than open-ended questions, which is also consistent with other research in the preschool context (Hindman, Wasik, & Erhart, 2012; de Rivera, Girolametto, Greenberg, & Weitzman, 2005).

It is particularly interesting that more open-ended (rather than closed) questions were found in error interactions compared to non-error interactions. Given that open-ended questions provide a wider range of answer possibilities, this finding is somewhat surprising; if there are more “correct” answer possibilities, then more of these questions should produce more correct answers (i.e., less errors). It is also possible, however, that the broader nature of most open questions (compared to the specificity of most closed questions) does not provide some children with enough of a scaffold to answer correctly. For example, teachers often use a series of closed questions to essentially lead children to the correct answer (e.g., “Well, what are his feet doing? Okay, so could he be walking? What is he doing then?”). It may be that children are so accustomed to this level of scaffolding that when open questions are posed, the child perceives them as overwhelmingly vague. It could also be that children have a harder time understanding the actual content or task of open questions compared to closed questions; it may be easier, for example, to identify the task of saying yes or no to a closed question (e.g., “Does she know yet?”) than it is to realize you need to provide evidence to an open question (e.g., “Why do you think that?”).

It is also important to note that some of children’s errors in this study (24%) occurred without a teachers’ elicitation question. Furthermore, many child errors throughout the book reading sessions were not acknowledged by teachers at all, which were not included in the present study given the inability to determine if the teacher could
hear the child (i.e., that they identified them as errors and responded by ignoring them). These unsolicited child errors ranged from calling out irrelevant details to anticipating specific book content, often seeming to exhibit a strong desire for attention from the teacher. Importantly, in several classrooms it was often one or two children in particular who seemed to be ignored consistently, which could send negative messages to those children about the value of their ideas. Moreover, these types of child errors appear to be a unique phenomenon that should be examined in future research.

The types of academic errors that occurred in response to teachers’ elicitation questions were also identified in the current study, including errors that violated behavioral norms of the classroom or teachers’ content expectations, errors of uncertainty or lack of knowledge, persistent and primed errors. The category of errors characterized by deviations from norms relates broadly to error definitions proposed by Grassinger and Dresel (2017) and Zhao and Olivera (2006). Specifically, these researchers define errors in part as unintentional deviations from specific norms of the classroom (e.g., behavioral). However, the current conceptualization predominantly constitutes new findings in the field. We found that preschoolers’ academic errors most often related to behavioral norms and teachers’ content expectations. In other words, when children violated behavioral norms (e.g., not raising their hand) or did not provide the answer teachers were looking for (e.g., their answer was too general), teachers most often corrected their behavior or answer.

It is somewhat surprising that children’s errors were primarily related to the teachers’ content expectations (rather than behavioral norms) given how young children are in our sample. While off-task behavior tends to be less frequent in whole-class
teacher-directed settings (Rimm-Kaufman, La Paro, Downer, & Pianta, 2005), the preschool years are a time where most children are developing behavioral self-regulation. Indeed, it is in preschool that children have to, for the first time, demonstrate skills like paying attention, remembering and following instructions, and resisting impulses (Tominéy & McClelland, 2011). For children from underserved low-income families such as those in the current study sample, skills like regulating attention can be especially difficult (e.g., Evans & Rosenbaum, 2008). Moreover, preschool teachers spend a lot of time guiding children’s behavior. In this way, it was surprising that children’s errors weren’t overwhelmingly behaviorally based, but rather predominantly a result of not meeting teachers’ content expectations. This finding implies that although preschool children struggle to self-regulate their behavior in formal classroom settings, they are able to regulate their behavior enough to attend to and participate in content specific discussions.

Relatedly, it is surprising that the vast majority of child errors were relevant (rather than irrelevant) to the teachers’ question and topic of discussion. It appears that although young children have more issues with attention and cognitive load than older children (Byrnes, 2008), most children in the current study made errors that not only related to content more than behavior, but also included content relevant to the discussion. In fact, some children’s errors were objectively correct in their content but rejected by the teacher due to their expectations for a different answer. This finding is important because if teachers (or parents) assume that young children will struggle to stay on topic during instructional exchanges, they may ask less challenging questions than if they thought children would remain focused on the topic. This finding also suggests that
children’s errors in this study are primarily a result of highly specific, potentially unreasonable teacher expectations for correct answers. It’s possible that, even when asking closed questions, reducing specific expectations for children’s answers may help teachers more effectively use errors as learning tools for the group.

The typification of preschoolers’ academic errors provided by the current study provides insight into the ways in which young students process and understand information. Higher levels of certain error types (e.g., wrong word) could point to particular weaknesses in children’s understanding and in turn, help teachers target corresponding instructional strategies (e.g., vocabulary). Such understanding of children’s errors could also point to aspects of teacher practices that may hinder student participation (e.g., redirecting after incomplete responses) or understanding (e.g., lacking knowledge of the teacher’s question).

Findings on teachers’ elicitation questions as they relate to child errors also provide unique insights into how different types of errors could facilitate particular aspects of learning. For example, description-based questions often resulted in norm-based errors like an incomplete answer or lack of any answer. Here, it may be that children are overwhelmed by the task of description given that it is far less concrete than a naming or quantity type task. In such a case, teachers could make their questions more specific (e.g., describe this part of the car), providing more of a scaffold for children’s answers. By providing this scaffold, teachers could make it more likely that children provide complete answers rather than incomplete or no answers at all. Time permitting, teachers should also give children more time to respond before correcting or redirecting;
analysis of these teachers’ wait time following child errors is an important area for future study.

Teachers could also use definition-based questions, which were often accompanied by knowledge related errors, to more strategically scaffold children’s understanding of a concept. For example, instead of asking children to define a term (e.g., lullaby), teachers could enact the concept (i.e., sing one) or provide examples (i.e., name lullabies) and then ask children what they’re called. This could then lead to a discussion of what specifically makes up a lullaby, providing more opportunities for children to make connections (e.g., characteristics of lullabies versus other songs) rather than their only engagement being an attempted abstract definition. In this way, children may still demonstrate a lack of knowledge, but teachers could more efficiently identify where children’s gaps in knowledge are while simultaneously helping them to construct new knowledge about the concept.

**Teacher Responses to Child Errors**

This study also examined how teachers respond to children’s academic errors. The categories and frequencies of teacher responses identified in the current study reflect and extend current research in this area. Specifically, similar to the current study, Schleppenbach and colleagues (2007) found that U.S. teachers were more likely to follow student errors with statements rather than questions. In addition, questions that involved re-asking the original question, asking for additional details, or redirecting to other students as well as statements that told the student the answer was wrong, gave the correct answer, and provided hints or explanations were also identified in previous work conducted with older students (Santagata, 2005; Schleppenbach et al., 2007; Tulis, 2013).
For example, U.S. teachers in the Schleppenbach et al. (2007) study gave mathematics students the answer to fraction-based questions (e.g., “Okay. When I’m multiplying two fractions together…I just multiply them across”). In Tulis’ (2013) study, teacher’s re-asking the question and providing hints were the most common responses, and hints involved rephrasing the question. This is in contrast to the current study, which is described further below in the specific discussion on hints.

Additional categories that emerged in the current study included several types of closed follow up questions (rhetorical, fill in a blank, choose from dichotomous options, answer as a question, ask for a label, permission to move on). Interestingly, some of these forms of teacher question responses appear in prior work but are not coded or emphasized. For example, in Schleppenbach and colleagues’ (2007) study, multiple examples of teacher-student exchanges include the utterance “okay?” within teacher responses but are not acknowledged as rhetorical follow up questions. This points to the importance of considering all elements of teacher talk as they respond to student errors, and also highlights the different purposes of studies in this literature (i.e., cultural comparison versus description).

Statement categories uniquely presented by the current study include support, exclamations, refocusing, cutting students off, affirming correct students, and corrective statements that directed children’s behavior or made connections (i.e., between the child’s error and the intended answer). It is likely that some of these teacher statement responses did occur in prior work (e.g., encouraging statements) but are simply not of focus (e.g., in teacher belief studies). It is also likely that corrections based on behavior
did not emerge in prior research because explicit behavioral instruction is more prominent with young children.

However, it is surprising that connective statements didn’t come up in previous research, especially given that these types of statements seem more likely to occur in classrooms with older students (i.e., when students develop more capacity for complex thought) as well as in domains with co-dependent, overlapping curricula (i.e., mathematics). It is likely that these connection-focused corrections are important for learners of all ages; concrete demonstrations of how errors relate to accurate information can point students to more and less effective strategies (Heemsoth & Heinze, 2014). It is important to note that such connections may be most beneficial, however, for more advanced students with prior knowledge.

In addition, although not common as an exclusive response, this study identified instances of teachers responding solely through gesture (e.g., nodding no); this points to important questions future research examining teachers’ nonverbal responses to children’s errors. Specifically, the non-verbal communication that teachers use when they respond to children’s errors such as physical gestures and tone likely carry important messages to children in the classroom setting (Bunglowala & Bunglowala, 2015; Hellermann, 2003). For example, teachers re-stating of children’s answer may be positive or negative in emphasis depending on their tone. In addition, gestures like eye contact, smiling, and humor could enhance closeness and comfort whereas avoiding eye contact, frowning, or backward leaning could reduce them.

Because observations of the lead teachers in this study were video-taped, I plan to examine teachers’ non-verbal responses by recording any and all physical gestures as
well as shifts in tone that occur following a child’s answer. Preliminary examination of such teacher response behavior specifically includes instances of smiling, laughing, touching, leaning, nodding, and pointing as well as shifts in tone and facial expression (e.g., eyebrows raised or furrowed). These types of teacher non-verbal responses will then be examined to identify whether teachers’ non-verbal behavior differs in response to correct versus incorrect answers and whether any particular gestures relate to specific error types.

Results indicated that teachers most often responded to children’s errors with corrective statements that provided information. For example, correcting a child calling out by saying “I didn’t see a quiet hand” or correcting an irrelevant comment by saying “let’s stick to the story”. Here, the first example shows a teacher providing information about the child’s error (i.e., why calling out was incorrect) and the second about the target answer (i.e., relevant to the story). This high frequency of correction is consistent with research with older students (Santagata, 2005; Schleppenbach et al., 2007), and is likely in part due to the structure and culture of classrooms, where the teacher functions as the primary expert and deliverer of information.

While instructional practices that focus more on questioning and give students an active, exploratory role in their learning are ideal, a social constructivist approach to teaching can be difficult to enact in practice (Windschit, 2002). Preschool teachers in particular face challenges in this area, such as issues related to differences in children’s prior knowledge, the ability to rely on open-ended questions for learning, and understanding and applying constructivist theory to the classroom (Muller, Gorsetman, & Alexander, 2018). Given such constraints, it is unreasonable to simply advise teachers to
ask questions rather than making corrective statements. Rather, we recommend that preschool teachers be mindful of giving students at least one chance to respond on their own and use open-ended questioning techniques when time permits.

Teacher corrections were more common than hints, which is in contrast to prior research in this area that found hints more common than corrections (Tulis, 2013). Hints in the current study also differed from prior work in that we identified much more specificity in the types of hints teachers provided. For example, Tulis (2013) identified hints simply as teachers rephrasing the elicitation question but did not describe specifically how teachers did so. The current study accounted for several ways in which teachers used hints, such as by drawing the student’s attention to important information (e.g., “Look right here”) or reminding them of previous content (e.g., “Well, the story says he slid into the base”).

It's difficult to say whether teachers’ hints in this study actually helped students better understand the information, but it did seem as though attention-based hints were most successful in guiding children to the correct answer. This may be because pointing to a picture is a more concrete guiding message than a reminder of previous content; with a visual, children can exclusively process the connection between the hint and the target, whereas when reminded of previous information children are required to hold that in working memory while trying to identify the connection. Future work should examine the specifics ways in which hints do contribute to children’s learning and motivation.

Current findings also showed that teachers most often corrected errors themselves rather than giving children the opportunity to do so, which is consistent with research on older children. For example, Ingram et al. (2015) found that secondary teachers most
often initiated repair of student mathematical errors. Similarly, Ledesma (2011) found that elementary and secondary teacher responses to student mathematical errors were more teacher- than student-focused (i.e., telling/explaining versus asking/activities). It’s likely that teachers correct errors themselves for the same reasons they make mostly corrective statements; they are seen as the experts expected to deliver information.

An additional potential explanation specific to the preschool context is that young children enter the preschool classroom with far less prior knowledge than older students simply as a byproduct of having less life and educational experiences. However, it is also important to note that teachers were only slightly more likely (51%) to correct errors themselves than to give students a chance to correct first. Preschool teachers should consider allowing children to attempt to self-correct more frequently, within or outside the context of book-reading.

Interestingly, the Bermuda triangle of error correction (Oser & Spychiger, 2005) discussed in many studies on teacher responses (teacher redirects the question to another student) did not emerge as frequently in the current findings. This discrepancy may be due to the preschool context; because children are still learning the behavioral norms of question and answer exchanges (e.g., not calling out all at once), it is more frequent for the preschool teacher to hear multiple answers at once rather than a single individual incorrect answer to call on and redirect. It’s also possible that in preschool, because less children have their attention directed at the teacher, the teacher perceives less options for redirecting the question. The preschool teacher’s calling patterns may also operate based on which child is likely to answer correctly, such that if the preferred child has already
answered, the teacher might assume no one else will be able to provide the correct answer.

Another potential element impacting teachers’ calling patterns is the preschool book reading context, which seems to facilitate more informal whole-group discussion (i.e., sitting together closely on a carpet) compared to a secondary mathematics classroom (i.e., sitting in separated rows of desks). As a result, during preschool book reading there seems to be more actual whole-group conversation that involves minimal formal calling patterns. Specifically, when whole-group discussion gets lively during preschool book reading (e.g., because the children to share a personal example), their close physical proximity to each other and the teacher (i.e., on the carpet) often results in quick spurts of question and answer exchanges that don’t leave time for formal selection of a student to answer let alone redirection of the question. Moreover, this varying degree of formality in whole-group instruction may influence teachers’ calling patterns.

Teacher responses to children’s errors in this study also reflected norms of book reading in the preschool classroom, particularly explicit and implicit behavioral norms. The norms identified through teacher responses in this study point to important ways in which children are granted or denied participation in the content discussion (see Appendix D for visualization). For example, when children provided incomplete answers in this study, they were seldom if at all given the time to complete their answer. Rather, teachers often provided the answer themselves or redirected to another student. Teachers may respond in this way out of fear of embarrassing the child or losing control (behaviorally) of the classroom. Alternatively, teachers may simply become
uncomfortable in the silence of waiting and choose to alleviate this discomfort by answering themselves or redirecting the question.

The potential consequences of such restrictive norms are likely more harmful in cases of implicit rather than explicit norms of book reading; while both appear to restrict children’s participation, implicit norms are not communicated clearly to children and therefore it is unlikely that the children really understand why they are being excluded. Furthermore, in the current study even explicit norms (e.g., requiring children to raise their hand to answer) were not consistently enforced. For example, there were many occasions in which the same teacher that had corrected a student for calling out instead of raising their hand later responded to a different child with praise when they called out an answer (i.e., a correct answer). This type of inconsistency likely creates even more confusion for children regarding the parameters around acceptable participation. In addition, although the inconsistency did not always occur for correct versus incorrect answers, such instances may send messages to children that if your answer is correct, the rules don’t apply.

The current findings on teacher responses to children’s academic errors also demonstrated that teachers seldom used errors as teaching tools for the group, which is consistent with research in this area with older students. For example, Son (2013) found that undergraduate teachers rarely used student mathematical errors for instruction. Gardee and Brodie (2015) similarly found that high school teachers more often corrected than embraced (i.e., used constructively to generate new knowledge) student errors. This finding is particularly troubling considering the growing evidence connecting students’ adaptive error experiences to academic learning and motivation (Grassinger, et al., 2018;
Tulis et al., 2016, 2018). Presumably, the source of student errors is a key indicator not only of student understanding, but also of what response is pedagogically productive. Yet, teachers don’t appear to be engaging in attempts to identify the source of students’ errors or thinking process. In the current study, open-ended follow up questions constituted only 10% of all follow up questions and 7% of all response questions.

Young students’ motivation and achievement would likely benefit from teachers engaging in more explanation (“why?”) or evidence-based (“how do you know?”) questions, as these not only probe into children’s errors and thinking process, but also provide a wider range of possibilities for their answer. To be sure, not all child errors necessarily require probing into their thinking process (e.g., incorrectly identifying colors). In addition, as previously mentioned, this constructivist approach to learning is difficult for teachers to enact in practice, especially within preschool classrooms. Additional research is needed to explore effective ways in which teachers can adaptively approach children’s errors while taking into account the constraints of teaching young children.

Overall, in most of their error interactions, many teachers responded to children’s errors in adaptive rather than maladaptive ways. While research on the adaptive motivational nature of teacher responses to student errors is limited, Tulis (2013) found similar results with secondary teachers. Specifically, she found that teachers most often allowed students to correct their errors rather than redirecting the question or correcting themselves, and this was also more frequent than teachers criticizing or ignoring the student. It is important to note that the current analysis did not use Tulis’ method to
determine the adaptiveness of teacher responses, but rather was grounded directly in theories of achievement motivation (Dweck & Leggett; Weiner, 2000).

In addition, the method used in the current analyses could have been more or less restrictive in what was considered maladaptive. For instance, teachers giving children the answer or telling them their answer was wrong could be examined in more detail to distinguish between when these were the only teacher responses versus when they were accompanied by hints, support or explanation. That is, the adaptiveness of giving the answer or telling children the answer is wrong may depend on the specific content and interaction. On the other hand, a more restrictive analysis could have rendered an error interaction maladaptive if any negative exclamation occurred rather than allowing those to be balanced out by more adaptive responses (e.g., a follow up question). Given the nuances that emerged in types of teachers closed follow up questions, it’s also possible that some of these newer types of follow up questions are more maladaptive than adaptive based on the range of answers they allow for. These results are the basis for future research to continue investigating young students' actual interpretations of different behaviors in different contexts to determine a teacher's behavior as motivationally adaptive or maladaptive.

The final question examined in this study was how child error types might relate to teacher response types. Given that corrective statements were teachers’ most common response overall, it’s not surprising that this was the most common type of response across most error types. More specifically, norm-based errors were most often responded to with behavioral corrections. Irrelevant content errors most often received closed follow up questions whereas teachers responded to relevant content errors most often by
providing information, giving the answer, or telling the child their answer was wrong. Some more specific types of relevant content errors showed interesting trends in how teachers responded to them and are discussed below.

Over half the time children made errors that were too general or the wrong word, teachers responded by giving the child the answer. To be clear, because most error codes were not mutually exclusive, teachers did not necessarily only respond by giving the answer in these cases (i.e., they may have also provided information or support). However, if the answer was provided, the teacher clearly corrected the error themselves rather than giving the child the opportunity to do so first. For errors that involved the wrong word, teachers may give children the answer because they want children to know the correct vocabulary words. For these errors, it seems reasonable to want to fill gaps in children’s knowledge, and questioning techniques might not prove fruitful in guiding children’s thinking to the correct terms (e.g., “aisle” instead of “hallway”). When children’s answers are too general, however, there seems to be more room for a teacher to guide children to correct the error on their own. For example, when a child says, “they color stuff” in response to a question about what an illustrator does, the teacher could ask, “what kinds of things do people color?” rather than simply stating, “they make the pictures”.

Another interesting finding related to this question was that when children’s answers were only incorrect based on the teachers’ expectations, teachers most often provided information about the target (i.e., expected) answer. Again, most of the teacher response codes were not mutually exclusive, so it is possible that these errors also received support or other information. However, it is interesting that when confronted
with an alternative answer that was logical based on their elicitation question, teachers often appeared to double down by explaining why their target answer was correct. This is important because this type of continuous interaction may communicate to children that their main task is anticipating their teachers’ expectations rather than the question.

**Limitations**

The current study is not without limitations. Specifically, the current sample was quite homogenous across several demographic variables including teacher gender (mostly female), ethnicity (mostly White), education (most had master’s degrees), and years of experience (most had 16+ years). It is important to note that such teachers may have similar specific experiences as highly educated White females that inform how they interact with students.

Given student ethnicity was also quite uniform (mostly African-American and Latinx) and many children were DLL, it is particularly important to consider how teachers in this sample might interact differently with children who are a different ethnicity or speak a different primary language. Majority of the preschools in this sample were also Head Start programs; it’s possible that features of the classroom and book reading sessions were characteristics of this particular context rather than representative of most preschool programs. Future research in this area should make use of purposeful sampling to increase the generalizability of findings.

It is also important to consider that data collection took place during the Spring term of the school year, which may involve distinctly different instructional interactions than would take place in the Fall. In addition, only a single part of the preschool day was observed and only about an hour was observed directly for each teacher. Teachers also
chose their own books to read during the book reading sessions, which engenders variability in the questions teachers asked. Such limitations must be considered when interpreting the findings of this study.

**Conclusions**

Findings from the current study extend the current literature on academic errors, achievement motivation, and early childhood instruction in addition to informing the development of cognitive motivational interventions and teacher preparation programs. Specifically, this is the first known study describing the types of academic errors that occur in the preschool classroom. Providing the first step in typifying academic errors gives teachers and parents a developing road map for children’s understanding and thinking process during difficult academic tasks, which can in turn inform more targeted instructional or parenting practices. Furthermore, the findings from this study emphasize the importance of the teachers’ role in shaping how children understand themselves as learners; teachers are ultimately the ones who decide when an academic error has occurred, what it is, and what it means in the achievement context.

This typification of academic errors also informs researchers, who can use this conceptualization as a way to seriously consider the conceptual nature of achievement failure and how this construct differs across developmental stages and classroom contexts. In addition to the development of a richer theory of achievement motivation, researchers can use this conceptualization of academic errors to develop more targeted cognitive motivational interventions for young students (e.g., identifying errors that happen during particular types of academic tasks). Moreover, this study provides a conceptualization of academic errors from a motivational perspective that informs the
definition of academic errors as well as the future study of achievement motivation in young children.

The current study is not the first to examine how teachers respond to student errors, but it is the first to do so in the preschool classroom. Understanding the ways that teachers respond to student errors can help illuminate potential teacher attributional bias (e.g., attributing a child’s error to a general lack of knowledge when they just didn’t understand the question being asked). In addition, these findings point to important broad implicit messages that teachers send children about what it means to be in school or be a student (e.g., anticipating the teachers’ expectations). Finally, current findings on both child errors and teacher responses could help teacher preparation programs more efficiently prepare teachers to consider and practice how they might react to, address, and utilize different types of errors in their classroom.

**Future Research**

While significant, the current study is merely a first step that presents many more questions for future research. Specifically, future work should consider teachers’ non-verbal communication and wait time, teacher errors, and teacher interpretations (i.e., attributions) of children’s errors. As previously mentioned, teachers’ physical gestures and vocal tone can communicate diverse types of messages to children. I plan to examine these aspects of teachers’ non-verbal communication by systematically recording all teacher non-verbal behavior through the video-taped observations and by exploring relationships between types of non-verbal communication and teachers verbal responses as well as child errors types. Similarly, I can measure how many seconds teachers wait following incorrect versus correct answers to determine these preschool teachers’ average
wait time, whether that differs from wait time of errors, and how wait time might differ based on error type.

The kinds of errors that teachers make and how they react (i.e., model reacting) to their own errors in the classroom is also an important next step. Some teachers in this study did make mistakes during their book reading sessions, and therefore I can extract excerpts from transcripts to examine and code the types of errors teachers made in addition to their reactions. With this data, I could then hypothesize the ways in which teacher reactions to their own mistakes might shape student errors and error interpretations based on interpersonal and intrapersonal attribution theory.

Future work should also investigate specific categories identified in this study and how they relate to other early childhood classrooms as well as older students. For instance, future research should explore child errors that are unsolicited and ignored; it may be that children who call out in this way have a unique relationship with the teacher. Using the unsolicited and potentially ignored errors in my data, I could examine these errors by identifying each instance in the transcript and develop a coding system that displays how teachers may react to specific child errors differently than others. This particular question would also benefit from additional data collection, including direct observations and interviews with teachers utilizing stimulated recall. Specifically, by showing teachers video of their own reactions to children, I could identify with more confidence whether a child was ignored and why.

Future research can also make use of the current coding schemes by examining how children’s academic errors might differ based on the academic content. For example, how might children’s errors differ in early math or science (rather than reading) contexts?
It is possible that child math errors would not demonstrate as much complexity compared to book reading related errors given the more concrete nature of the math domain. It is also possible that new conceptualizations that will emerge with different students, especially older students. For example, we might see more peer correction with older students, which could initiate the development of an entirely new category related to types of peer correction. To this end, future research should examine how academic error types and teacher responses are conceptualized in other preschool classrooms as well how they might vary by student age or grade. The current coding scheme could also be examined alongside other classroom coding systems such as the CLASS scoring system (La Paro, Hamre, & Pianta, 2012; Pianta, La Paro, & Hamre, 2007), potentially to investigate whether types of child errors or teacher responses to them relate to classroom management or teachers’ instructional and emotional support.

Given that most of teachers’ response questions in this study were closed, the several types of closed questions should be further examined to see if they occur in other preschool times of day as well as other preschool programs and with older students. I could examine these question types by looking at what other types of responses teachers made in tandem, and also by collecting additional data specifically oriented to teacher closed questions. Finally, classroom norms should be examined to see if book reading norms differ in other preschool classrooms or from other contexts within preschool classrooms such as centers. In addition, the norms of elementary or secondary classrooms where behavioral norms are likely less of a focus should be examined to explore how classroom norms inform error interactions. To this end, I could view videotaped observations of different times of day in preschool classrooms for comparison and
develop a norm specific coding scheme to explore what other norms are present in the preschool day.
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# APPENDIX A

## CODING WORKBOOK

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<th>Error</th>
<th>Error Code</th>
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<td>EXPREL-TS</td>
<td></td>
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<td>EXPREL-TS</td>
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<td>big bad wolf</td>
<td>no the three...</td>
<td>STCR-W; QFUC-F</td>
</tr>
<tr>
<td>April</td>
<td>in buildings</td>
<td>IGN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>VERONICA</strong></th>
<th>Question</th>
<th>Error</th>
<th>Error Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>illistrator job</td>
<td>color stuff</td>
<td>EXPREL-S</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>this is the what</td>
<td>cover</td>
<td>EXPREL-TG</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>rabbit?</td>
<td>unmm</td>
<td>N-INC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>rabbit?</td>
<td>idk</td>
<td>UNC</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>sound letter c</td>
<td>for cat</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>//</td>
<td>and for cat</td>
<td>N-CL</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>F for what</td>
<td>Friends</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>//</td>
<td>rope</td>
<td>EXPREL-TG</td>
<td>Or similar because not about rope but the word jump</td>
</tr>
<tr>
<td>9</td>
<td>//</td>
<td>halloween</td>
<td>EXPRHR; N-CL</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>what sound q</td>
<td>quail</td>
<td>LK-Q; N-RT</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>//</td>
<td>she got a</td>
<td>EXPREL-TG</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>//</td>
<td>playing w it</td>
<td>EXPRHR; N-CL</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>why ears covered</td>
<td>calling out</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>why ears covered</td>
<td>paper in ears</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>w for</td>
<td>williams</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>marks spot what</td>
<td>treasure</td>
<td>EXPRELS</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>//</td>
<td>done</td>
<td>N-CL</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>say it slowly</td>
<td>letters fast</td>
<td>N-RT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Error</strong></th>
<th><strong>Response</strong></th>
<th><strong>Response code</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>color stuff</td>
<td>draw pictures</td>
<td>STCR-G; STOR-IT</td>
</tr>
<tr>
<td>cover</td>
<td>this is the</td>
<td>QFA</td>
</tr>
<tr>
<td>umm</td>
<td>why say that</td>
<td>QFU-O</td>
</tr>
<tr>
<td>idk</td>
<td>alright, this book</td>
<td>IGN</td>
</tr>
<tr>
<td>foot cat</td>
<td>okay for camera</td>
<td>STSU-E; STOR-G this is a correct of “for cat” bc camera is what in the picture</td>
</tr>
<tr>
<td>and for cat</td>
<td>don’t call out</td>
<td>STOR-B; QFUC</td>
</tr>
<tr>
<td>friends</td>
<td>Friends out for</td>
<td>STSU-RA; QFA</td>
</tr>
<tr>
<td>rope</td>
<td>jump rope</td>
<td>STSU-RA; STOR-IT</td>
</tr>
<tr>
<td>halloween</td>
<td>continues book</td>
<td>IGN</td>
</tr>
<tr>
<td>quail</td>
<td>for?</td>
<td>IGN</td>
</tr>
<tr>
<td>she got a</td>
<td>what mouse carrying</td>
<td>IGN</td>
</tr>
<tr>
<td>playign w it</td>
<td>what letter</td>
<td>IGN</td>
</tr>
<tr>
<td>calling out</td>
<td>wait emily said</td>
<td>STCR-B; STOR-IE; STOR-IT</td>
</tr>
<tr>
<td>paper in ears</td>
<td>like cotton</td>
<td>STOR-IE; STOR-IT</td>
</tr>
<tr>
<td>williams</td>
<td>for wagon</td>
<td>STOR-G; STSU-RA</td>
</tr>
<tr>
<td>treasure</td>
<td>treasure chest</td>
<td>STOR-G</td>
</tr>
<tr>
<td>done</td>
<td>Need calm down</td>
<td>STOR-B</td>
</tr>
<tr>
<td>letters fast</td>
<td>excuse me, slow</td>
<td>STOR-HT Need something for phrases like “excuse me”?</td>
</tr>
</tbody>
</table>
APPENDIX B

CHILD ERROR CODES

Table 1

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example (not provided for the larger categories N, EXP, or EXP-REL as they are not used as independent codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Deviation from Behavioral Norm</td>
<td>The child’s action deviates from an established (implicitly or explicitly) norm of the classroom that is set by the teacher.</td>
<td>Teacher: When they say &quot;He wasn't too bright&quot;, what does that mean? Child: I think he... Teacher: Listen to the story. It says he wasn't too bright. So what does that mean?</td>
</tr>
<tr>
<td>N-INC</td>
<td>Incomplete answer</td>
<td>The child begins to answer but does not complete their thought or sentence (must be some vocalization).</td>
<td></td>
</tr>
<tr>
<td>N-RP</td>
<td>Repeated answer</td>
<td>The child’s answer was already given by another child.</td>
<td>Teacher: What other reptiles? Child: Snake Other child: A snake</td>
</tr>
<tr>
<td>N-RT</td>
<td>Routine violation</td>
<td>The child violates or incorrectly applies rules or procedures that are based on classroom norms (e.g., selecting a student who did not volunteer).</td>
<td>Child: I'll pick Maura Teacher: She didn't have her hand up</td>
</tr>
<tr>
<td>N-NA</td>
<td>No verbal response</td>
<td>When the teacher poses a question, there is no immediate verbal answer (time varies widely).</td>
<td>Teacher: Darien, what could he make with the jacket now? Darien: ... Teacher: Who else had something?</td>
</tr>
</tbody>
</table>
Table 1  
Continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| N-CL | Calling out | The child calls out their answer. | **Teacher:** And you have to pour the dough, the liquid, into an iron. And-  
**Child:** I wanna tell you something.  
**Teacher:** Wait, let me tell you. |
| N-CL-NH | No hand | The child does not raise their hand (must be clear from teacher’s response). | **Teacher:** Ahhh!  
You're not raising a quiet hand and you're calling out. |
| N-CL-OT | Out of turn | The child answers when another child was called on (must be clear from teacher’s response). | **Teacher:** What type of foods do you eat at a birthday party?  
**Child:** Cake.  
**Teacher:** I'm asking Jason. |
| N-CL-IN | Interruption | The child interrupts teacher or child while they are talking (must be clear from teacher’s response). | **Teacher:** I'm not answering you until you're criss cross applesauce and you're quiet because you are interrupting me and that is rude. |
| EXP | Deviation from Expectation | The content of a child’s answer deviates from the teacher’s expected response during discussion. |
### Table 1

*Continued*

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| EXP-IRRR | Irrelevant| The content of child’s answer is unrelated to the content of the teacher’s question. | **Teacher**: What else? [could happen in police building]  
**Child**: I saw someone homeless sleeping on the steps... |
| EXP-REL  | Relevant  | The content of the child’s answer is relevant, but is not what’s desired or expected from the teacher. | **Teacher**: That is going to be taken to recycling center to be broken down to make what?  
**Student**: Recycled  
Teacher: Recycled materials |
| EXP-REL-TG | Too General | The child’s answer is related, but broader than the teacher’s expectation. | **Teacher**: What are we learning about this week?  
**Student**: Karate  
**Teacher**: Not just karate |
| EXP-REL-TS | Too Specific | The child’s answer is related, but more specific than the teacher’s expectation. | **Teacher**: This is inside a supermarket, and they're walking down the what?  
**Students**: Hallway!  
**Teacher**: It looks like a hallway, but that is called an aisle. |
| EXP-REL-W | Wrong word | The child’s answer is related but is either grammatically incorrect, pronounced incorrectly, or a synonym. | |

101
<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXP-REL-K</td>
<td>Wrong kind in category</td>
<td>The child’s answer is relevant to the specific category of discussion (e.g., sports), but is the wrong kind or type from that category (e.g., football).</td>
<td>Teacher: So if she had put on Danny's baseball shoes, what is Grandmama getting ready to do? Students: Play basketball</td>
</tr>
<tr>
<td>EXP-REL-C</td>
<td>Wrong application of context</td>
<td>The child’s answer is relevant to the larger category of discussion (e.g., insects), but is applied incorrectly based on the specific context of the question or discussion (e.g., insects with cocoons).</td>
<td>Child: They [yellowjackets] have a cocoon. Teacher: Well that's a butterfly that has a cocoon and a chrysallis</td>
</tr>
<tr>
<td>EXP-REL-V</td>
<td>Visually relevant</td>
<td>The child’s answer is visually similar to the expected answer or the child misinterprets a visual image.</td>
<td>Teacher: I have some of them right here. Child: Corn. Teacher: It looks like corn, it does. These are eggs.</td>
</tr>
<tr>
<td>EXP-REL-T</td>
<td>Tangential</td>
<td>The child’s answer is broadly related to the question or discussion (e.g., falling) but the child’s answer is primarily a tangent.</td>
<td>Child: I think we went on a ladder and then he fell. Teacher: Well, what the story says, is that he was sliding into the base, and then he fell, and he hurt his arm.</td>
</tr>
</tbody>
</table>
### Table 1

*Continued*

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| EXP-REL-E | *Expectation violation only* | The child’s answer is related and logically accurate, and is therefore solely incorrect because it does not meet the teacher’s desired expectation. | **Teacher:** What’s the sound of the letter C?  
**Student 1:** Cuh  
**Student 2:** For cat.  
**Ms. Veronica:** Okay, for camera. C- c-camera. |
| UNC     | Uncertainty      | The child expresses explicit uncertainty (of knowledge or memory) in their answer.                                      | **Teacher:** What’s a diet?  
**Child:** I don’t know.                             |
| LK      | Lack of Knowledge | The child’s answer demonstrates an explicit lack of knowledge related to the specific question or discussion content.   | **Teacher:** Anybody know what a diet is?  
**Child:** You die.  
**Teacher:** No, a diet is what you eat, so the foods that you eat are your diet. |
| LK-B    | Book             | The child’s answer demonstrates an explicit lack of knowledge related to the book being read and discussed.             | **Teacher:** Does Tia know about the party now?  
**Child:** No  
**Teacher:** Yes, she does. |
| LK-Q    | Question         | The child’s answer demonstrates an explicit lack of knowledge related to the question being asked.                      | **Teacher:** The party is for who?  
**Child:** Who |
| PERS    | Persistent       | The child repeats the same error at least once, which may be committed by the same or different student provided the error content is the same. | **Teacher:** How did the teacher feel when she did not listen?  
**Child 1:** Sad.  
**Ms. Susan:** Charlie, what do you think?  
**Charlie:** Sad. |
Table 1

*Continued*

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| PRI  | Primed    | The child’s answer was primed by something they saw or heard during the book reading session (e.g., teacher, book, other child) | *Teacher:* Does anyone know what weeping is?  
*Child:* Weeping you have to have sweeping  
*Teacher:* It sounds like the word sweeping, right? *You* see a broom here. |
APPENDIX C

DEVIATIONS FROM CONTENT EXPECTATIONS

Figure 1. Content expectation deviations.
APPENDIX D

DEVIATIONS FROM BEHAVIORAL NORMS

Figure 2. Behavioral deviations in the classroom.
APPENDIX E

DESCRIPTIVES STATISTICS OF CHILD ERRORS

Table 2

Child Error Descriptives

<table>
<thead>
<tr>
<th>Code</th>
<th>Total Codes (%)</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Norm Deviations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incomplete</td>
<td>147 (26%)</td>
<td>4.90</td>
<td>3.41</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Repeat</td>
<td>18 (3%)</td>
<td>.60</td>
<td>.93</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Call out</td>
<td>8 (1%)</td>
<td>.27</td>
<td>.74</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>General</td>
<td>86 (15%)</td>
<td>2.87</td>
<td>2.60</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Out of turn</td>
<td>28 (5%)</td>
<td>.93</td>
<td>1.26</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>No hand raised</td>
<td>18 (3%)</td>
<td>.60</td>
<td>1.00</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Interrupted</td>
<td>35 (6%)</td>
<td>1.17</td>
<td>1.34</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Routine</td>
<td>12 (2%)</td>
<td>.40</td>
<td>.77</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>No Answer</td>
<td>23 (4%)</td>
<td>.77</td>
<td>1.57</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><strong>Content Expectation Deviations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrelevant</td>
<td>255 (45%)</td>
<td>8.50</td>
<td>5.33</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Relevant</td>
<td>230 (41%)</td>
<td>7.67</td>
<td>4.94</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Tangential</td>
<td>41 (7%)</td>
<td>1.37</td>
<td>1.54</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Too General</td>
<td>57 (10%)</td>
<td>1.90</td>
<td>2.25</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Wrong Context</td>
<td>14 (2%)</td>
<td>.47</td>
<td>.78</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Wrong Kind</td>
<td>33 (6%)</td>
<td>1.10</td>
<td>1.37</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Wrong Word</td>
<td>28 (5%)</td>
<td>.93</td>
<td>1.05</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Too Specific</td>
<td>20 (4%)</td>
<td>.67</td>
<td>.92</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Visually Rel</td>
<td>8 (1%)</td>
<td>.27</td>
<td>.64</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Expec Only</td>
<td>28 (5%)</td>
<td>.93</td>
<td>1.31</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Uncertainty</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 (2%)</td>
<td></td>
<td>.17</td>
<td>.46</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Lack of Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>85 (15%)</td>
<td>2.83</td>
<td>2.28</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Book</td>
<td>38 (6%)</td>
<td>1.27</td>
<td>1.39</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Question</td>
<td>15 (3%)</td>
<td>.50</td>
<td>1.14</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Primed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 (7%)</td>
<td></td>
<td>1.27</td>
<td>1.51</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td><strong>Persistent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 (5%)</td>
<td></td>
<td>.97</td>
<td>1.27</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

*Note. Percentages refer to the percent that each category represents out of all error codes.
APPENDIX F

DESCRIPTIVES STATISTICS OF TEACHER ELICITATION QUESTIONS

Table 3

<table>
<thead>
<tr>
<th>Teacher Elicitation Question Descriptives</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Elicitation Questions</strong></td>
<td>1154</td>
<td>38.5</td>
<td>21.6</td>
<td>12</td>
<td>96</td>
</tr>
<tr>
<td>Open</td>
<td>397</td>
<td>13.2</td>
<td>8.05</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Closed</td>
<td>757</td>
<td>25</td>
<td>18.2</td>
<td>3</td>
<td>86</td>
</tr>
<tr>
<td><strong>Non-Error Elicitation Questions</strong></td>
<td>835</td>
<td>27.8</td>
<td>18.6</td>
<td>8</td>
<td>86</td>
</tr>
<tr>
<td>Open</td>
<td>259</td>
<td>9.10</td>
<td>6.40</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>Closed</td>
<td>576</td>
<td>19.3</td>
<td>16.0</td>
<td>2</td>
<td>79</td>
</tr>
<tr>
<td><strong>Error Elicitation Questions</strong></td>
<td>319</td>
<td>10.63</td>
<td>7.07</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>Open</td>
<td>138</td>
<td>22.0</td>
<td>4.12</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Closed</td>
<td>181</td>
<td>23.2</td>
<td>5.07</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Naming</td>
<td>61</td>
<td>2.03</td>
<td>2.40</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Recall</td>
<td>43</td>
<td>1.40</td>
<td>1.83</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Define</td>
<td>30</td>
<td>1.00</td>
<td>1.66</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Predict</td>
<td>20</td>
<td>.67</td>
<td>1.21</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Locate</td>
<td>22</td>
<td>.73</td>
<td>3.83</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Describe</td>
<td>21</td>
<td>.70</td>
<td>1.37</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Share</td>
<td>12</td>
<td>.40</td>
<td>.86</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Explain</td>
<td>11</td>
<td>.37</td>
<td>.85</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Inference</td>
<td>12</td>
<td>.40</td>
<td>1.00</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Compare</td>
<td>7</td>
<td>.23</td>
<td>.77</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Phonics</td>
<td>13</td>
<td>.43</td>
<td>.94</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Apply</td>
<td>12</td>
<td>.40</td>
<td>1.52</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Quantify</td>
<td>6</td>
<td>.20</td>
<td>.48</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Personal Ex</td>
<td>4</td>
<td>.13</td>
<td>.51</td>
<td>0</td>
<td>2</td>
</tr>
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<td>Examples</td>
<td>2</td>
<td>.07</td>
<td>.37</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Book</td>
<td>7</td>
<td>.23</td>
<td>.50</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Evidence</td>
<td>8</td>
<td>.27</td>
<td>.74</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Guess</td>
<td>5</td>
<td>.17</td>
<td>.91</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Translate</td>
<td>2</td>
<td>.07</td>
<td>.37</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Emotions</td>
<td>4</td>
<td>.13</td>
<td>.43</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Characterize</td>
<td>7</td>
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<td>.97</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Confirm</td>
<td>6</td>
<td>.20</td>
<td>.41</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Similarity</td>
<td>2</td>
<td>.07</td>
<td>.37</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>-------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Routine</td>
<td>1</td>
<td>.03</td>
<td>.18</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Setting</td>
<td>1</td>
<td>.03</td>
<td>.18</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
## APPENDIX G

### TEACHER QUESTION RESPONSE CODES

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Teacher Question Response Codebook</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td><strong>Code Name</strong></td>
</tr>
</tbody>
</table>
| Q-RA | Re-ask | Teacher re-asks original question. | **Teacher**: All right, so before we start, eyes are for what?  
**Child**: Listening.  
**Teacher**: What are eyes for? |
| Q-FU | Follow-up | Teacher asks a follow up question following the child’s answer (different from the original question) to the same child or the entire class. | |
| Q-FU-C | Closed | Teachers’ question provides opportunity for a single or limited range of responses | **Teacher**: “Tia” means what? |
| Q-FU-C-AQ | Answer as question | Teacher’s question rephrases the students’ answer into a question. | **Child**: It goes in the trash.  
**Teacher**: You think it goes in the trash? |
<p>| Q-FU-C-F | Fill in the blank | Teacher’s question trails off, leaving a blank for children to answer | <strong>Teacher</strong>: When you have a competition, you have a... |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-FU-C-D</td>
<td>Dichotomous options</td>
<td>Teacher’s question sets up two specific alternatives for the child’s answer</td>
<td><strong>Teacher:</strong> Does it go in the trash or the recycling bin?</td>
</tr>
<tr>
<td>Q-FU-C-PM</td>
<td>Permission to move on</td>
<td>Teacher seeks the child’s permission to move on</td>
<td><strong>Teacher:</strong> Do you want to tell me what you think happens inside of a hospital? Or do you want me to come back to you?</td>
</tr>
<tr>
<td>Q-FU-C-L</td>
<td>Ask for label</td>
<td>Teacher asks for the specific name of something or someone</td>
<td><strong>Teacher:</strong> But what is it called?</td>
</tr>
<tr>
<td>Q-FU-C-AA</td>
<td>Ask for additional detail</td>
<td>Teacher asks for an additional detail based on the child’s answer.</td>
<td>Child: You get a pinata if it's gonna be your birthday and you get all the candy from the grass. <strong>Teacher:</strong> But how does it fall on the grass?</td>
</tr>
<tr>
<td>Q-FU-C-R</td>
<td>Rhetorical</td>
<td>Teacher asks a rhetorical question.</td>
<td><strong>Teacher:</strong> Yes we said they have legs so they can walk right? And they have wings so they can also…</td>
</tr>
<tr>
<td>Q-FU-O</td>
<td>Open</td>
<td>Teacher asks an open-ended follow up question.</td>
<td><strong>Teacher:</strong> What do you think happens inside a police building?</td>
</tr>
<tr>
<td>Q-RD</td>
<td>Redirect</td>
<td>Teacher redirects the question to another student or the entire class.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Code Name</td>
<td>Description</td>
<td>Example</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>-----------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Q-RD-S</td>
<td>Another student</td>
<td>Teacher redirects the question to another student.</td>
<td>Child: I'm not sure. Teacher: You're not sure? Albina?</td>
</tr>
<tr>
<td>Q-RD-C</td>
<td>Entire class</td>
<td>Teacher redirects the question to the class.</td>
<td>Teacher: What's a diet? Child: I don't know. Teacher: Anybody know what a diet is?</td>
</tr>
</tbody>
</table>
## APPENDIX H

### DESCRIPTIVES STATISTICS OF TEACHER RESPONSE QUESTIONS

Table 5

*Teacher Response Question Descriptives*

<table>
<thead>
<tr>
<th>Code</th>
<th>Total Codes</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions</td>
<td>391</td>
<td>13.0</td>
<td>10.4</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>Re-ask</td>
<td>59 (15%)</td>
<td>1.97</td>
<td>1.99</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Redirect</td>
<td>58 (15%)</td>
<td>1.93</td>
<td>2.53</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Other student</td>
<td>49 (13%)</td>
<td>1.63</td>
<td>2.34</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Class</td>
<td>9 (2%)</td>
<td>.30</td>
<td>.60</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Follow up</td>
<td>274 (70%)</td>
<td>9.13</td>
<td>7.06</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>Open</td>
<td>28 (7%)</td>
<td>.93</td>
<td>1.86</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Closed</td>
<td>246 (63%)</td>
<td>8.20</td>
<td>6.40</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>General</td>
<td>59 (15%)</td>
<td>1.97</td>
<td>2.34</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Fill in</td>
<td>19 (5%)</td>
<td>.63</td>
<td>.72</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Dichotomous</td>
<td>49 (13%)</td>
<td>1.63</td>
<td>2.01</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Answer as question</td>
<td>30 (8%)</td>
<td>1.00</td>
<td>1.31</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Ask for label</td>
<td>7 (2%)</td>
<td>.23</td>
<td>.68</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Ask for addition</td>
<td>10 (3%)</td>
<td>.33</td>
<td>1.06</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Rhetorical</td>
<td>68 (17%)</td>
<td>2.27</td>
<td>2.24</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

*Note.* Percentages refer to the percent that each category represents out of all error codes.
### APPENDIX I

#### TEACHER STATEMENT RESPONSE CODES

**Table 6**

*Teacher Statement Response Codebook*

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example (not provided for the larger categories STCR, STCRI, STCRIC, STSU, STEXC, STH as they are not used as independent codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-CR</td>
<td>Correction</td>
<td>Teacher corrects the student’s error through a statement.</td>
<td></td>
</tr>
<tr>
<td>ST-CR-B</td>
<td>Behavior</td>
<td>Teacher corrects the student’s behavior in some way.</td>
<td><strong>Teacher</strong>: Raise a quiet hand please.</td>
</tr>
<tr>
<td>ST-CR-I</td>
<td>Information</td>
<td>Teacher provides information with or following their correction.</td>
<td><strong>Teacher</strong>: What's our favorite bug song? You taught it to all the moms and dads. <strong>Child</strong>: Bugs, Bugs, Bugs. <strong>Teacher</strong>: That was your book, but what's the song we sang after your book?</td>
</tr>
<tr>
<td>ST-CR-I-E</td>
<td>Error</td>
<td>Teacher provides information about the incorrect answer or behavior.</td>
<td><strong>Teacher</strong>: To make what? <strong>Child</strong>: Recycled. <strong>Teacher</strong>: Recycled materials. New juice boxes, new cans.</td>
</tr>
<tr>
<td>ST-CR-I-T</td>
<td>Target</td>
<td>Teacher provides information about the expected/desired answer or behavior.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Code Name</td>
<td>Description</td>
<td>Example</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| ST-CR-I-C | Connection| Teacher provides information about how the incorrect answer relates to the target/expected answer | Teacher: Sharp as a tac
Child: As a tic tac
Teacher: Part of the sound is the same |
| ST-CR-I-C-L | Low connection | Teacher makes a low level connection between the child’s answer and the target answer | Child: I call it a rhino.
Teacher: It is, that’s exactly what it is. But, rhino is the short way that we say rhinoceros; because rhinoceros is a really long word so kind of like a nickname. |
| ST-CR-I-C-H | High connection | Teacher makes a high level connection between the child’s answer and the target answer | Teacher: You die.
Child: No, a diet is what you eat, so the foods that you eat are your diet. |
| ST-CR-W  | Tells wrong | Teacher says “no” or “not”, in any way (including contractions like don’t) to indicate that the child is wrong. | Teacher: She used to play ball when she was a young girl, when she lived in where?
Students: …
Teacher: Say "Mexico" |
| ST-CR-G  | Gives answer | Teacher states the desired/expected answer/information. | |
| ST-SU    | Support    | Teacher demonstrates support for the child’s incorrect answer in some way. | |
Table 6
Continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| ST-SU-RA | Restate answer | Teacher expresses support by re-stating the students’ answer in some form. | **Student:** That one has an S  
**Teacher:** There is an S in *there*, but what do you have? |
| ST-SU-C | Consolation | Teacher expresses support by consoling the child in some way.               | **Child:** I don't remember. **Teacher:** That's okay, you're really young. |
| ST-SU-RV | Revisit    | Teacher expresses support by stating they will revisit the child’s comment or concern. | **Teacher:** Okay, we're gonna try to stick with what we're talking about in the story, okay? You can tell me that at the end. |
| ST-SU-E | Encouragement | Teacher provides encouragement to the child in some way.                    | **Teacher:** What is it [algae]?
**Child:** A turtle  
**Teacher:** Good try. It's not a turtle. It grows in the ocean. |
| ST-EXC  | Exclamation | Teacher makes an exclamation before or during their response.               | **Teacher:** [elephant] trunk
**Child:** Like a car
**Teacher:** Like a car, yes it's the same thing that a car has...it's the same word but it has two different meanings. **Wow. Big.** |
| ST-EXC-P | Positive | Teacher’s exclamation has a positive valence.                               |                                                                         |
Table 6

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| ST-EXP-N  | Negative  | Teacher’s exclamation has a negative valence.                               | Carol: A guess
Teacher: Uh-oh! Carol said a guess again. Is this a guess? |
|           |           |                                                                             |                                                                         |
| ST-H      | Hint      | Teacher draws the students’ attention to specific content related to their expected response. |                                                                         |
|           |           |                                                                             |                                                                         |
| ST-H-A    | Attention | Teacher draws the child’s attention to content using sensory content or strategies. | Teacher: So I'm giving you a specific building. Look up here! This is a police building. |
|           |           |                                                                             |                                                                         |
| ST-H-RM   | Reminder  | Teacher draws the child’s attention to content already stated, read, or seen. | Teacher: Well, the pig's not too bright, so what is the pig? Is he really smart? |
|           |           |                                                                             |                                                                         |
| ST-H-M    | Missing   | Teacher draws the child’s attention to specific details that are missing from the incorrect answer. | Teacher: What are we learning about this week? Student: Karate? Teacher: Not just karate |
|           |           |                                                                             |                                                                         |
| ST-H-W    | Word/letter beginning | Teacher provides the initial part of the answer in word or letter form | Teacher: But where were they? Child: In the water. Teacher: It starts with an 'O' They're in the O ... |
Table 6

Continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Name</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| ST-H-P | Proximity                | Teacher draws child’s attention to the proximity of their answer to the desired answer. | **Child:** Two books.  
**Teacher:** *It's almost like two books*, but when I opened this is there a booklet inside? |
| ST-RD  | Redirect who will answer | Teacher redirects the question to another student.                           | **Teacher:** Tell her. Tell her Alison.                                  |
| ST-RF  | Refocus content          | Teacher refocuses the content of discussion                                  | **Teacher:** Oh, that was a homeless person, right?  
**Alright, but we want to know, now this building right here.** |
| ST-CS  | Affirmation of correct student | Teacher makes a statement about a student who answered correctly             | **Child:** They can eat bugs too.  
**Teacher:** Umm I don’t think they eat other bugs, *I think Matt’s on the right track.* |
| G      | Physical gesture only    | Teacher’s responds exclusively with a physical gesture (e.g., shakes head no) | **Teacher:** Lily went to the…  
**Child:** Office  
**Teacher:** [*Shakes head no*] |
### Table 7

**Teacher Response Statement Descriptives**

<table>
<thead>
<tr>
<th>Code</th>
<th>Total Codes ( %)*</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statements</td>
<td>808</td>
<td>26.9</td>
<td>16.6</td>
<td>3</td>
<td>87</td>
</tr>
<tr>
<td>Refocus</td>
<td>16 (2%)</td>
<td>.53</td>
<td>1.22</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Cuts off</td>
<td>3 (&lt;1%)</td>
<td>.10</td>
<td>.40</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Affirms correct student</td>
<td>6 (1%)</td>
<td>.20</td>
<td>.61</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Redirect</td>
<td>20 (2%)</td>
<td>.67</td>
<td>1.54</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Other student</td>
<td>18 (2%)</td>
<td>.86</td>
<td>1.11</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Class</td>
<td>1 (&lt;1%)</td>
<td>.05</td>
<td>.22</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Support</td>
<td>158 (20%)</td>
<td>5.27</td>
<td>4.10</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Restate answer</td>
<td>61 (8%)</td>
<td>2.03</td>
<td>2.16</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Console</td>
<td>1 (&lt;1%)</td>
<td>.03</td>
<td>.18</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Encourage</td>
<td>79 (10%)</td>
<td>2.63</td>
<td>2.09</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Revisit</td>
<td>17 (2%)</td>
<td>.57</td>
<td>1.30</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Hint</td>
<td>59 (7%)</td>
<td>1.97</td>
<td>2.16</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Attention</td>
<td>13 (2%)</td>
<td>.43</td>
<td>.82</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Reminder</td>
<td>27 (3%)</td>
<td>.90</td>
<td>1.42</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Word/Letter</td>
<td>10 (1%)</td>
<td>.33</td>
<td>.71</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Missing</td>
<td>7 (1%)</td>
<td>.23</td>
<td>.50</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Proximity</td>
<td>2 (&lt;1%)</td>
<td>.07</td>
<td>.25</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Correction</td>
<td>507 (63%)</td>
<td>16.9</td>
<td>11.3</td>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>Tells wrong</td>
<td>84 (10%)</td>
<td>2.80</td>
<td>2.37</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Gives answer</td>
<td>96 (12%)</td>
<td>3.20</td>
<td>2.43</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Directs behavior</td>
<td>75 (9%)</td>
<td>2.50</td>
<td>2.52</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Provides Info</td>
<td>250 (31%)</td>
<td>8.33</td>
<td>6.22</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Error</td>
<td>92 (11%)</td>
<td>3.07</td>
<td>2.59</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Target</td>
<td>125 (15%)</td>
<td>4.17</td>
<td>3.88</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Connection</td>
<td>34 (4%)</td>
<td>1.13</td>
<td>1.46</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Low</td>
<td>21 (3%)</td>
<td>.43</td>
<td>1.19</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>High</td>
<td>13 (2%)</td>
<td>.43</td>
<td>1.94</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Gesture only</td>
<td>4 (&lt;1%)</td>
<td>.13</td>
<td>.35</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note.* Percentages refer to the percent that each category represents out of all error codes.