Winter 2011

How “Struggling” Readers Engage in Literacy Events in Middle School Science: An Analysis of Interactions in Literacy Events

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HOW "STRUGGLING" READERS ENGAGE IN LITERACY EVENTS IN MIDDLE SCHOOL SCIENCE

AN ANALYSIS OF INTERACTIONS IN LITERACY EVENTS

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A Dissertation Submitted to the Faculty of
Old Dominion University in partial fulfillment for the
Requirement for the Degree of

DOCTOR OF PHILOSOPHY

EDUCATIONAL CURRICULUM AND INSTRUCTION

OLD DOMINION UNIVERSITY
December 2011

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ABSTRACT

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This study examined opportunities for participation and learning for "struggling" readers in a sixth grade science classroom. Literacy practices, language differences, activity structures, and the social and cultural identities and associated practices and everyday funds of knowledge of both "struggling" and nonstruggling readers in one sixth grade science classroom were documented and analyzed using a qualitative research design. Over sixteen hours of audio and video recordings as well as numerous student work samples were transcribed and analyzed. Analyses of the classroom interactions and artifacts documented in this study revealed several important affordances available in the context of this classroom related to opportunities for speaking and listening, some uses of print texts, and student agency in interactions. Student learning was found to be constrained by macrocontextual factors, text difficulty, and student history.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure

CHAPTER I

STUDY BACKGROUND

In the 1950s, literacy skills typically obtained by the end of third grade were sufficient for an adult to "lead a reasonably comfortable and successful lifestyle" (Biancarosa & Snow, 2004, p. 1). However, as Snow noted, such a lifestyle is no longer available to individuals who fail to develop adequate literacy skills to graduate from high school. Furthermore, the literacy skills needed by the average adult are growing more complex daily as a result of new technologies. Indeed, the rapid pace of technological change necessitates that the average adult adapt to ever-changing technology and have the capability to learn to use this technology to advantage in real time (Coiro, Knobel, Lankshear, & Leu, 2008). Moreover, the No Child Left Behind Act (No Child Left Behind, 2001) mandates that all children meet state standards in reading. However, results from the National Assessment of Educational Progress (NAEP) have failed to demonstrate a consistent increase in reading achievement among the nation's eighth graders (Lee, Grigg, & Donahue, 2007; Institute of Education Sciences, n.d.b). The results of the 2007 assessment of eighth graders, while significantly higher than the 1992 assessment, were actually up only three points. Furthermore, this score represents a decrease from the 2002 results (Institute of Education Sciences, n.d.a). The results of the 2011 were not significantly higher than the results of the 2002 assesssment (Institute of Education Sciences, 2011). Lower performing students scores in 2011 were not significantly different from their scores in 2002 (Institute of Education Sciences, 2011). Moreover, the gap between the scores of white students and Black and Hispanic students remains (Institute of Education

Sciences, 2011). Although lower income students did make gains on the 2011 assessment, it should also be noted that a significantly larger percentage of children with this designation were included in 2011(Institute of Education Sciences, 2011). Therefore, much interest and concern has been focused on strategies for increasing the literacy achievement of the nation's adolescents. A number of organizations, including the National Council of Teachers of English (NCTE, 2004), the National Association of Secondary School Principals (NASSP, 2005), the Alliance for Excellent Education (2007), the National Governor's Association (2005), and the International Reading Association (IRA, 1999) have called for reform in educational practices in an effort to increase the literacy achievement of adolescents. In addition, the federal government has funded the Striving Readers program which had as its orignial purpose increasing the literacy skills of students in the upper grades.

Background

Initially, standardized test results focused educators on the necessity of developing literacy skills in older students (Lee, Grigg, & Donahue, 2007). This focus was accompanied by a realization among most educators that teaching literacy in the upper grades would be most effective if it was done in the content areas (Moore, Readance, & Rickleman, 1983). Thus, content area literacy is at the center of many efforts of school reform at the secondary level. According to Jetton and Alexander (2004), "the very forms of text that students read, along with other central purposes, differ across domains" (p. 16). Each domain is characterized by unique lexicons and modes of inscription which necessitate specialized skills to understand and to interpret them. For example, Lemke (1990) has documented how learning science involves

"learning to use this specialized conceptual language in reading and writing" (p. 1). Furthermore, Shanahan (2004) has argued that in the content area of science not only do scientists need sophisticated reading and writing skills but also such skills are "required of anyone who wishes to be an informed consumer or an engaged citizen" (p. 75). Similarly, Duschl (2005) states scientific "language and discourse are perceived as tools for achieving, among other things, cultural capital and the construction, representation, and dissemination of knowledge claims" (p. x). However, despite the varied and increasingly difficult literacy demands placed on students as they progress through school, "academic supports for students in the forms of explicit reading instruction are diminishing" (Jetton & Alexander, p. 15).

In order to assess content learning, it is important to study cognitive processes as they are situated in classrooms. Gee (1996) asserts that in the past century cognitive science has become a "megadiscipline" combining, among other areas, "psychology, neuroscience, computer science, philosophy, [and] linguistics" (p. 391). At the same time, Moje (1996) has noted that the cognitive processes of both students and teachers take place in the social space of a classroom which is nested in school and out-of-school cultures and are, thus, sociocognitive in nature. Roth (2005) suggests that classroom discourse can be defined as "refer[ring] to what is communicable about some topic at a given time, place, or social, cultural, or institutional setting" (p. 45). Therefore, any conceptualization of adolescent literacy practices must include cognitive, cultural, and linguistic factors as situated in the social practices associated with a particular discipline or discourse community.

Research Problem

Although the literacy skills of adolescents are a subject of great concern to educators and policymakers, little consensus exists regarding which particular instructional strategies are most beneficial for developing literacy skills in content area classrooms (Moje, 2008). Furthermore, little research documents how students who perform poorly on standardized reading tests use literacy practices to learn in a content area (Dole, Nokes, & Drits, 2009); and, as Hinchman (2008) suggests, these scores “mask variability” (p. 16) in student literacy profiles. At the same time, it has been suggested content area teachers should be able to analyze the classroom context in order to select from a repertoire of instructional strategies to further the literacy skills of specific individuals or groups of adolescents (O'Brien, Stewart, & Moje, 1995). However, what features of adolescent readers identified as struggling or their content area classroom interactions would most inform teachers who wish to engage in such an analysis is unclear because little research of a multifaceted nature focusing specifically on these students has been conducted in the context of actual content area classrooms.

Research Question

What are the affordances and constraints in opportunities for participation and learning in literacy events for “struggling readers” in a sixth grade science classroom?

These areas were primarily examined by analysis of language in classroom interactions.

There were four foci for the study:

- How struggling readers **interact with the literacy practices** of this science classroom to participate and learn in the discourse of science;

- How **language differences** impact student participation and learning;
- How various **activity structures** impact student participation and learning; and
- How struggling readers use **their social and cultural identities and associated practices and everyday funds of knowledge** to participate and learn in the discourse of science.

Conceptual Framework

According to Dillon, O'Brien, and Heilman (2004), "problems need to be socially situated and identified to be legitimate foci of inquiry" (p. 1542). Furthermore, in order to understand problems fully, it is logical to consider them from within a number of different paradigms. Indeed, "the field of reading . . . is what Pearson and Stephens (1994) referred to as a transdisciplinary field" (Dillon, et al., p. 1536). Research in adolescent literacy is proceeding from many vantage points, psychological, pedagogical, sociological and anthropological; indeed, "notions that reading is cognitive, aesthetic, *or* sociocultural are set aside. Instead, all these forces are actively and interactively involved in reading development" (Alexander & Fox, 2004, p. 53).

The conceptual framework guiding this study is based on theories regarding not only cognitive but also social and cultural theories of learning. Although much of the current analysis of the social nature of learning has as its foundation the work of Vygotsky (1978; 1986), as Lewis, Enciso, and Moje (2007) point out, sociocultural theory incorporates theories from many disciplines including education, psychology, anthropology, sociology, and linguistics. Analysis of the influence of sociocultural factors on student learning was framed by Gee's (1989) definition of literacy studies and

Gee's (1992) Discourse theory. According to Gee, literacy studies blend cognitive psychology and sociocultural studies. The study of applied linguisitcs, language use within discourses, is contained with the study of Discourse. Gee (1992) defines Discourse as "characteristic ways of talking, acting, interacting, thinking, believing, and valuing, and sometimes characteristic ways of writing, reading, and/or interpreting" (p. 20). Furthermore, Discourses can be hybrids of other Discourses or can represent "borderlands" (Gee, 2005a, p. 31.) He differentiates the more broadly defined term Discourse from the narrower term discourse by the use of a capital letter D. According to Roth (2005), sociolinguists view discourse as that which is "communicable about some topic at a given time, place, or social, cutural, or institutional setting" (p. 45). Gee (2008) suggests a similar definition of discourse as "stretches of language which 'hang together' so as to make sense to some community of people such as a contribution to a conversation or a story" (p. 115). All language use occurs within a social context and must be studied as a part of that social context. Furthermore, familiarity with the language of any particular discourse develops within a social context or Discourse. Therefore, Gee (1989) defines "'literacy' as *the mastery of or fluent control over a secondary Discourse*" (p. 9). Furthermore, Gee (1989) asserts "literacy is always plural: literacies (there are many of them, since there are many secondary discourses, and we all have some and fail to have others)" (p. 9). According to Gee (2005b), science represents a particularly appropriate discourse to study as a basis for understanding the acquistion of academic language because it is emblematic of the sorts of language use that are necessary not only for academic achievement but also for "living in and thinking critically about modern societies" (p. 19).

Gee, Kelly, Roth, and Yerrick (2005) have analyzed the nature of language acquisition in science classrooms. Their analysis is undergirded by notions of language acquisition that build on the situated nature of learning and language development occurring in a particular context as part of a social practice. As such, language development is enhanced by access to more advanced users of language. Gee makes clear that it is not enough for students to understand scientific discourse. Rather he suggests it is necessary for students to become adept at using the language of the Discourse of science (Gee, et al.). Furthermore, Gee suggests that social practices and language use learned outside of the Discourse of science can, at times, actually interfere with the acquisition of the language of science. In Gee's extended analysis of a small group of discussion about a rusty bottle cap and a rusty plastic plate, he demonstrates how children fail to understand the difference between the origin of the rust on the two items because their "everyday language tends to obscure the details of causal, or other systematic, relationships among things in favor of rather general and vague relations, like 'all rusty' or 'put on' (Gee, 2005b, p. 33). This study examined the scientific and everyday language use of students identified as struggling readers in order to describe how they understand and use these languages in the context of a content area classroom.

In order to encompass cultural, social and cognitive analyses of student achievement, this study also employed Gavelek and Raphael's (1996) adaptation of Harre's (1984) model of psychological space as a theoretical lens to describe and analyze the sociocognitive processes employed by students as they encounter, internalize, and demonstate new science learning using literacy practices. This model describes "recursive cycles of appropriation, transformation, publication, and conventionalization" (Kong & Pearson, 2002, p. 2) learners enact as they are apprenticed to and participate in

the cultural practices of a specific context. Gavelek and Raphael's adapted model was used to understand and describe learning during literacy events centered around various texts which function as cultural tools in a science classsroom. Thus, what Bloome, Carter, Christian, Otto, and Shurat-Faris (2005) characterize as a "dialogic" approach between theoretical perspectives associated with both sociocultural theory and sociocognitive psychology was established. These researchers advocate this dialogic approach between theoretical perspectives as a method of solving specific problems in specific social contexts such as those which are the target of this study.

A focus in this study is the use of language or discourse to situate and construct the identities of the various participants in the classroom community. As Gee's conception of the various Discourses individuals encounter illustrates, student participation in a classroom community is impacted by how the influences of these various Discourses work to construct their identities in the space of a particular classroom. Moje and Lewis (2007) assert discourse communities are "not only face-to-face or actual in the moment groupings, but also ideational groupings across time and space" (p. 16). These influences are reflected in "how language gets recruited 'on site'" (Gee, 2005a, p. 1). Cole (2008) describes a model that can serve as a basis for examining the various levels at which cultural, linguistic, and cognitive factors interact in classroom contexts. These interactions range across classroom, school, community, and broader societal contexts. Moreover, these levels can be uncovered by an examination of texts, talk and interaction in classrooms (Rogers and Fuller, 2007).

Significance of Study

As Pressley (2004) has pointed out, adolescent literacy research has been understudied; therefore, it is necessary to learn more about "almost everything" (p. 429) regarding the achievement and development of literacy skills in adolescents. Moreover, adolescent literacy research has been underfunded. For example, according to the Alliance for Excellent Education (2007) the federal program for adolescent literacy, Striving Readers, provided only 13 cents per student in 2007 while the Reading First program for elementary school students furnished $72 per student. In addition, although funding levels for primary and secondary reading programs have not been commensurate in the past, new proposals in Congress attempt to set more equitable funding levels (Alliance for Excellent Education, 2009). If this money is to be spent in an effective manner, much more needs to be known about cultural, social and cognitive factors influencing classroom content area interactions.

At the same time, educators across the country are concerned with uncovering factors that will lead to increased achievement for students of all ages. States are under increasing pressure to make progress toward the goal of having every middle school student proficient in reading. As recently as April of 2008, Margaret Spellings, the former United States Secretary of Education, has advocated a uniform graduation rate calculation (Hoff, 2008). The increased focus on graduation rates will in turn pressure schools to ensure students possess adequate literacy skills prior to high school.

This study sought to contribute to the sparse research base concerning adolescent literacy in several ways. First, it documented the literacy practices of a group of struggling readers in the crucial period of beginning adolescence. This study also

identified and described current literacy demands or what Heath and Street (2008) call "everyday meanings and uses of literacy" (p. 103) of early adolescents in a specific domain. Moje (2008) has suggested little is known about "what texts get used, and when, how and why" (p. 79) in content area classrooms. Documentation of student literacy practices included a thorough description of texts and how they were used by these struggling students. Although many theories have been advanced concerning appropriate pedagogy in the content areas, it has also been suggested that schooling has changed little in the last 100 years (Gardner, 1999). In order to fully understand how to increase student achievement in the context of a content area, it is first necessary to fully describe current practices in school disciplines and how these practices interact with the cognitive, cultural, social and linguistic characteristics of students in the disciplines to promote or inhibit the literacy achievement of both successful and unsuccessful students. As Dillon (2005) suggested, a qualitative study can "identify and define the dimensions of problems" (p. 107) as a prelude to constructing experimental designs. This study contributed to more complete descriptions of the literacy practices of a specific population of students in the discipline of science. Central to this description was an investigation of the interaction between the out-of-school literacy practices of the students and classroom literacy practices, including practices involving the use or lack of use of current technology. Therefore, this study contributed to current descriptions of adolescent technology use both in and out of school.

Finally, this study advanced understanding of the relationship between cognitive, cultural, linguistic, and associated program and pedagogical factors influencing the success or failure of students with identified poor literacy skills in a specific domain. This

study described both the Discourse of the school and the primary Discourse of the students and the ways in which these Discourses interacted in a content area classroom context. Therefore, another outcome of this study was a richer description of how students' cultural backgrounds interact with classroom culture to either foster or impede school literacy achievement. It was the aim of this study to ground analysis in the actual activities and requirements experienced by adolescents who are participating in a present-day school Discourse in order to begin pointing toward practical solutions to the everyday problems experienced by teachers and students as they strive to meet demands in the current environment of state standards and federal legislation. It was not the aim of this study solely to critique current educational practices.

O'Brien, Stewart, and Moje (1995) pointed out the development of literacy strategies suggested for use in the content areas was largely the result of the work of cognitive scientists. However, as they noted, these cognitive strategies have not been widely infused into the curriculum in the various content areas because they were developed apart from the contexts of classrooms and, therefore, lack ecological validity. Moreover, they noted rather than "introducing into school settings a preconceived agenda in the form of a preferred strategy or instructional framework" (p. 458), researchers should study the strategies students and teachers actually use and attempt to determine why they use them from multiple theoretical perspectives. This study provided a thick description of the situated literacy practices of students identified as struggling readers in the context of a sixth grade science classroom with the intent of informing teacher educators, preservice teachers, and classroom teachers of contextual factors that impact how struggling readers engage in literacy practices. It has been suggested teachers should

be able to analyze classroom interactions in order to make appropriate pedagogical decisions (O'Brien, Stewart, & Moje, 1995). However, few, if any, studies have been conducted to determine which factors teachers in specific content areas should consider when conducting such an analysis. What social factors, for example, should inform the decisions science teachers make about appropriate pedagogy for struggling readers in science class?

Furthermore, Yore and Treagust (2006) have called for linking student assessment information from one domain (literacy) to another (science) in order to "clarify science literacy" (p. 306). This study provided just such a link and, in addition to providing a rich description of literacy practices in a science classroom, examined the relationship between these practices and assessments of the areas identified by the National Reading Panel Report as critical for literacy learning. Moreover, it is certainly the case that some students succeed despite being predicted to fail. This study examined this phenomenon by closely observing and comparing five focal students in a sixth grade science classroom. One goal of this study was the identification of cultural, cognitive, and linguistic affordances that could be harnessed in the future to raise the science achievement of those whose poor literacy skills have seemingly predisposed them to failure in science.

Overview of Methodology

Symbolic interactionism was employed in a microethnographic study in a sixth grade General Science classroom to document and describe current literacy practices and the differing cognitive, cultural, and linguistic factors influencing students' attempts to engage in these practices. A qualitative study was necessary both to fully document the literacy practices

confronting students in the transition to a middle school setting and to describe how these practices contribute to literacy achievement. Furthermore, a microanalysis of literacy events illuminated “how people use literacy . . . to accomplish knowledge construction” (Bloome, et al., 2005, p. 225). Analysis was informed by symbolic interactionism and social semiotics. The language employed by students and teachers during literacy events was analyzed using discourse analysis methods described by Gee (2005a), Bloome, et al. (2005), Bloome, et al. (2008) and researchers included in an edited volume (Cole & Zuengler, 2008).

Delimitations

While this study contributed to an understanding of current literacy practices in a sixth grade content classroom, it did not attempt to prescribe instructional strategies for literacy or science learning. Furthermore, it did evaluate the relative importance of individual influences or practices. It also did not contribute to specific knowledge of literacy or science practices in an urban setting. The documented lower literacy achievement of urban middle school students (NAEP Data Explorer) suggests that at least some fundamentally different factors influence the literacy achievement of urban students.

Definitions

Academic vocabulary.

The discourse of school exposes students to at least two categories of vocabulary they don’t normally experience in everyday conversation. General academic vocabulary refers to those words students are likely to encounter in print but unlikely to encounter in oral language. (See for example, *The Academic Word List*, Coxhead, 2000) In addition, a

number of researchers have documented unique academic vocabulary for the various content areas. (See for example, Marzano, 2004)

Context.

Context is multiple or nested (Cazden, 2001), therefore, numerous contexts act in the space of the classroom to shape student knowledge and perspectives. Language use reflects these intercontextual relationships (Bloome, et al., 2005). Macro-contexts are social and cultural structures whereas micro-contexts are specific events and situations (Bloome, et al., p. 45). Cole (2008) has suggested a model for the multiple contexts at play in classroom interactions. (See *Figure 1*. Macro and Micro Contextual Influences)

Cultural practice.

Literacy practices are one type of cultural practice. A cultural practice is "a shared abstraction (a cultural model) that is enacted in a series of events" (Bloome, et al., 2005, p. 50).

discourse.

According to Gee (2008), discourse is "stretches of language which 'hang together' so as to make sense to some community of people such as a contribution to a conversation or a story" (p. 115). A sociolinguistic analysis could encompass the discourse processes evident in students' home environments, the academic discourse of the school, and the blending of the two in the borderland of the classroom.

Discourse.

Gee (1992) defines Discourse as "characteristic ways of talking, acting, interacting, thinking, believing, and valuing, and sometimes characteristic ways of

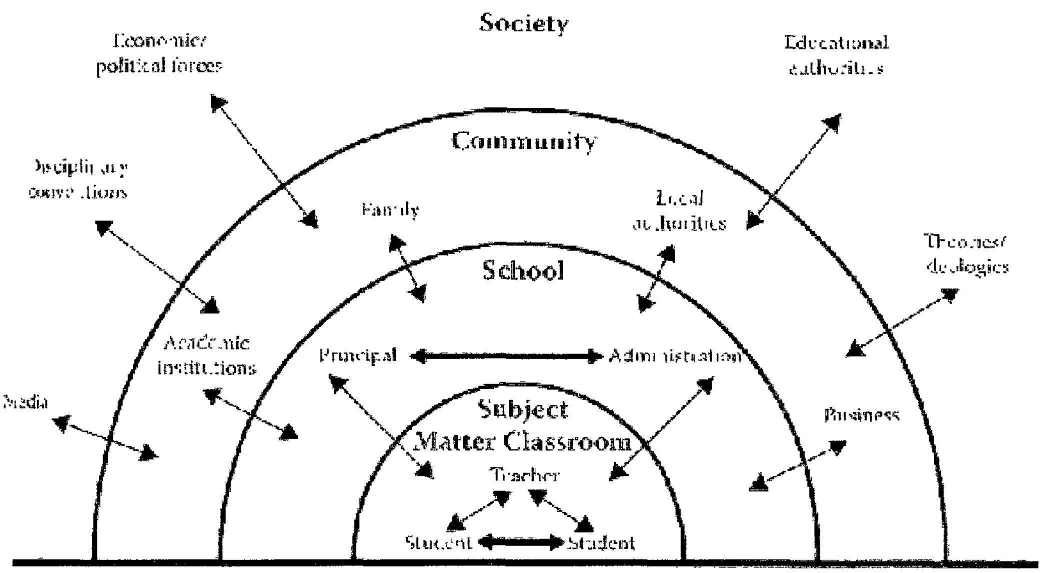

Figure 1. Macro and Micro Contextual Influences COLE, KIM MARIE © 2008 Reproduced with permission of TAYLOR & FRANCIS GROUP LLC-BOOKS.

writing, reading, and/or interpreting" (p. 20). Every individual has a primary Discourse, the one learned from their family at home. Every individual also develops secondary Discourses as a result of their situated interactions in the world. Furthermore, Discourses can be hybrids of other discourses or can represent "borderlands" (Gee, 2005a), p. 31.

Literacy.

Literacy consists of "a set of social and cultural practices embedded in and a part of broader, ongoing, and evolving social cultural and political processes" Bloome, et al., (2005, p. 234). Therefore, literacy is a context-specific construct.

Literacy achievement.

Literacy achievement is largely defined in terms of formal and informal assessment scores although achievement will also be evaluated using classroom artifacts and student and teacher assessments.

Literacy event.

A literacy event is "the bit observed from which social and cultural practices are inferred and conceptualized" (Bloome, et al., 2005, p. 5). A literacy event is analyzed by considering dimensions of setting, social and cultural history, the actions and "evolving social identities" (Bloome, et al., 2005, p. 120) contained in the event, the distinctive features of the event, and the significance the participants attach to the event (Bloome, et al., 2005). Therefore, any single literacy event has multiple contexts. (Bloome, Carter, Christian, Madrid, Otto, Shuart-Faris & Smith, 2008). Literacy events will be the unit of analysis for this study.

Literacy learning.

Because literacy is defined in terms of cultural and social practices, it follows that any particular individual's literacy learning can be observed by taking note of changes in how an individual participates in a particular literacy practice. For example, an individual who had previously ignored graphs included in print text and who subsequently begins to use them in constructing written explanations can be said to have learned to use a particular literacy tool. This learning is differentiated from achievement as measured on state assessments.

Literacy practice.

For the purposes of this study, literacy practices are broadly defined as any practices involving reading, writing, speaking or listening located within a social and cultural context. Moje (1996) characterizes literacy practices as cultural tools for making sense of the Discourse of the classroom. Literacy practices include more traditional school-based practices centered around school textbooks and paper and pencil writing tasks as well as practices involving the use of new literacies associated with digital media. (See *Figure 2.* Literacy Domains, Practices, and Events for an illustration of the relationship between literacy events and practices and the domains in which they occur.)

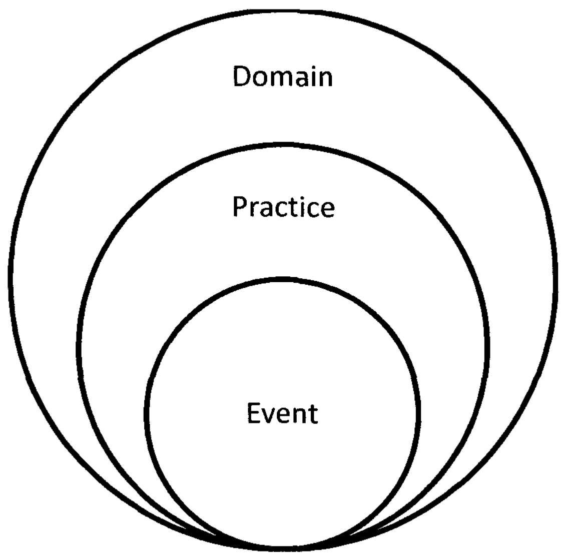

Figure 2. Literacy domains, practices, and events

Sociocognitive literacy processes.

Sociocognitive literacy processes are defined as the thought patterns and problem-solving capabilities students develop as a result of the social environment of the classroom (Bloome, 1987).

Sociocultural perspective.

Sociocultural perspective refers to both the culture or Discourse of the classroom and the culture students bring from home as manifested in their primary Discourse. According to Lankshear and Knobel (2007), "a sociocultural perspective means that reading and writing can only be understood in the contexts of social, cultural, political, economic, [and] historical practices to which they are integral, of which they are a part" (p. 1).

Symbolic Interactionism.

According to Moje, Dillon, & O'Brien (2000), "*symbolic interactionism* suggests that one defines situations and negotiates meanings on the basis of his or her interpretation of symbols while engaged in interactions with other human beings, and asserts, as its methodological imperative, that researchers study the lived world of human interaction" (p. 167). Patton (2002) states that "people create shared meanings through their interactions and those meanings become their reality" (p. 112) According to Patton, symbolic interactionism is significant because of "its distinct emphasis on the importance of symbols and the interpretive processes that undergird interactions as fundamental to understanding human behavior" (p. 113). This study is concerned with how individuals

interpret interactions using words and other symbols available to them in the space of the classroom.

Social semiotics.

This study is fundamentally concerned with how students use literacy practices to learn in the context of a Science classroom. Therefore, a major focus of this study is centered around what Lemke (1990) has described as one of the major questions addressed by the field of Social Semiotics: “How does the performance of any particular socially meaningful action make sense to the members of a community” (p. 186).

Text.

Texts are defined broadly as “anything from which we can construct meaning” (Lewis, Enciso, and Moje, 2007, p. xvii). Such a broad definition is necessary because as Hagood (2009) has noted, a definition of texts “includes a range of tools and media so broad that an unproblematic definition can no longer be apparent and assumed” (p. 40). Furthermore, as Hagood (2002) has suggested“from a postructuralist perspective, texts have no inherent meaning . . . The meanings attributed to texts are what readers make of them within various contexts” (p. 255).

Vygotsky Space Model.

This model describes how students appropriate what they have learned through social interactions in a classroom context and how they make this learning apparent in this context. As such, the model encompasses both the public and private (internal) dimensions of student learning in terms of how students appropriate, transform, publicize, and conventionalize knowledge and processes. Harré (1984) described what he termed a

"conceptual space for personal psychology" (p. 41) which serves as the basis for Gavelek and Raphael's (1996) iteration of the Vygotsky Space. (See *Figure 3*. Vygotsky Space Model) Harré locates knowledge on three dimensions: private/public, individual/collective, and active/passive. Gavelek and Raphael assert social settings are "the very means by which students come to acquire and construct new knowledge, new meanings, and new interpretations of text through interactive use of language" (p. 184). Their theoretical framework can be used to describe cyclical cognitive processes in classrooms in terms of both public and private cognitive activity.

According to Gavelek and Raphael (1996), public activity is apparent in classroom language whereas private cognitive activity involves personalization which they define as the "ongoing process within which the learning is evolving and changing over time and with experiences" (p. 187). The Vygotsky Space actually consists of two continuums, the public/private and the social/individual. The public/private dimension describes "the degree to which any cognitive activity is visible and thus available for observation" (p. 185). Student reasoning in a classroom discussion would be an example of public activity whereas a student reading silently would be an example of a private activity. A student-completed graphic organizer which exactly duplicates a teacher model would be an indication of the social dimension whereas an independently created graphic organizer constructed by a student in order to organize information from a text would be an example of the individual end of the continum as it would demonstrate the student had adapted an idea learned in social interaction to "his own purposes and needs" (p. 187). Together these two continuums define the four quadants of the Vygotsky Space.

Harré also described four means by which learning occurs, appropriation, transformation, publication, and conventionalization. When learners internalize procedures or strategies they were exposed to in the social realm, this is appropriation. According to Gavelek and Raphael (1996), transformation occurs after appropriation and is a process of "making those strategies their own" (p. 188). New learning, which can be either a process of appropriation or transformation, is then made public or visible. Because transformation occurs in the private dimension, it "can only be inferred from students' individual work once it is made public" (Gavalek & Raphael, p.188). The final

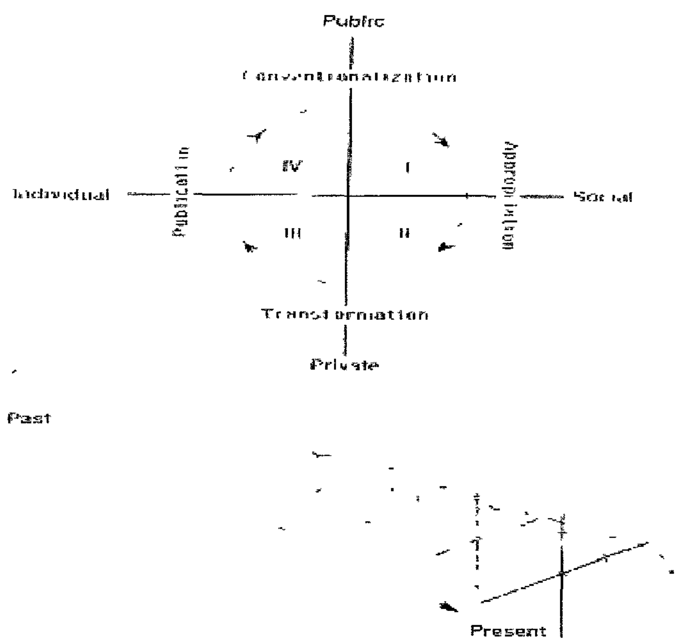

Figure 3 Vygotsky Space Model (Gavelek & Raphael, 1996, p. 186), Copyright 1996 by the National Council of Teachers of English. Reprinted with permission.

phase, conventionalization, occurs when this public knowledge becomes a part of the learning community of the classroom. Gavelek and Raphael assert Harré's model can be

used as a basis for understanding how students develop independent thinking related to text as a result of interactions. Kong and Pearson (2002) used this framework as the basis for an empirical study of the learning trajectory of students participating in classroom book clubs. They were able to trace the development of literacy skills in students across three distinct phases which they characterized as teaching by telling, teaching by modeling and scaffolding, and learning by doing. Furthermore, Gavelek and Raphael suggest this model demonstrates the importance of the social environment as it can affect students who could be positioned as less capable than their peers. Thus, this model can explain why students may fail to learn.

CHAPTER II

LITERATURE REVIEW

In order to fully describe a literacy event, one must fully describe the context of the event, the perspectives of the actors, and the content of the event. These imperatives can be thought of as mapping onto the domains of cultural studies, social psychology, and sociolinguistics. Therefore, this review will consider both theoretical and empirical literature associated with the fields of cultural studies in anthropology and sociology, social psychology, and sociolinguistics as well as literature concerned with technology and pedagogy as they relate to literacy events in a sixth grade science classroom. The theoretical literature will provide a rationale for the current study whereas the empirical literature will primarily be used to justify research methods and data analysis.

This review will describe both current and historical cultural, sociopsychological, and linguistic factors as they relate to classroom literacy events. Literature describing factors which are measured to assess achievement in literacy will be considered. In particular, the report of the National Reading Panel (2000) and NAEP will be reviewed as a basis for the identification of factors used to predict achievement as measured by a state assessment. Studies related to content area literacy in general and specific to the content area of science will be reviewed. This will include a review of literature related to the interplay of cognitive process and language, including the academic language unique to the study of science. In addition, the influence of new digital media on cultural and cognitive processes of adolescents will be discussed. Current research concerning pedagogies for literacy learning will also be reviewed. Research was located for inclusion

during successive cycles of reviewing related literature and locating additional sources from that literature.

Defining Adolescent Literacy

The national movement to hold schools accountable for student performance has increased the focus on older readers. In addition to federal mandates (No Child Left Behind, 2001), organizations such as the Commission on the Future of Higher Education have placed pressure on secondary schools in the United States. Their September 2007 report pointed out 40% of college freshmen enrolling in the fall of 2007 had to take remedial courses and only 69% of high school seniors who took the ACT in 2006 were able to demonstrate adequate composition skills for college (Pappano, 2007). Several national organizations including the International Reading Association, the National Council of Teachers of English, and the National Reading Conference have published position statements on adolescent literacy (International Reading Association, 1999; National Council of Teachers of English, 2004, Alvermann, 2001c). In addition, many organizations have published policy briefs addressing the issue of adolescent literacy (National Association of Secondary School Principals, 2005; National Association of Secondary School Principals, 2006; The James R. Squire Office for Policy Research, 2006; National Governor's Association Center for Best Practices, 2005; The Comprehensive School Reform Quality Center, 2005; Biancarosa & Snow, 2004; International Reading Association, 2006).

Although many researchers take an expansive view of literacy, a number of other researchers have taken a more narrow view of reading focused on basic skills and basic decoding processes. This view has also been supported by the medical profession,

primarily in studies involving neuroimaging. (See, for example, Shaywitz, 2003) However, for the most part, research in the field of adolescent literacy in the last decade has expanded from a focus on the content area reading and study strategies promoted by cognitive psychologists to analyses of adolescent literacy encompassing social and cultural pagadigms. One example of thinking about the current term 'adolescent literacy' can be viewed through a social constructivist lens as found in the work of Gee (1996, 2004a, 2004b) who has applied thinking about "New Times" (Gee, 1996, p. 386) to the field of education. He proposes the idea that a shift is occurring in which "old-style systems based on authoritarian hierarchy" are being replaced with "systems with 'non-authoritarian hierarcy'" which he calls "distributed systems" (Gee, 1996, p. 387). Distributed systems are an attempt to cope with the "exponential growth in *variety, variability,* and *diversity* of all sorts in all areas" (Gee, 1996, p. 387) in the modern world. In Gee's analysis, individuals are engaged in continuous construction of their identity based on their cultural context. Therefore, adolescents are "working to create a personally meaningful and socially valuable body of knowledge" (Alexander & Fox, 2004, p. 52) as a means to the formation of various identities necessary for success in the modern world.

Furthermore, new capitalist business models influence the organization of schools in that they require new outcomes from education. In the old capitalism with its authoritarian hierarchy, some workers were "hired from the neck down" (Gee, 1996, p. 391). In the new capitalism, workers are valued for their ability to work collaboratively and independently (Gee, 1996). For example, Yore, Florence, Pearson, & Weaver (2006) found that the scientists they studied worked in groups and that these "research groups were collections of diverse individuals whose expertise was distributed across the team

with context frequently determining which member was the current expert" (p. 125). Furthermore, as Hinchmann (2006) suggests, the ability to adapt rapidly to new conditions is a prerequisite for success. (See also Leu Jr., Kinzer, Coiro & Cammack, 2004) In addition, the speed at which change is occurring makes it an imperative that individuals possess the tools to adapt to continual change (Gee, 2006, p. 166). Gee calls individuals who possess such tools "*Shape-Shifting Portfolio People*" (Gee, 2006, p. 419; see also Moje, 2002, pp. 217-218).

Moreover, the rise of cognitive science as what Gee (1996) terms a "megadiscipline" combining, among other areas, "psychology, neuroscience, computer science, philosophy, [and] linguistics" (Gee, p. 391) and the alignment of cognitive science with the new capitalism, have also influenced conceptions of adolescent literacy practices. At the same time, researchers such as Moje (1996) view cognitive processes as situated and open to interpretation (p. 175). Further, Alvermann and Hagood (2000) suggest these situated processes have structures that can be studied (p. 199). Duschl (2005) points out that when cognitive processes are viewed through a sociological and an anthropological lens, they can be conceived of as tools (p. x), and texts can be analyzed both in terms of the mileu in which the text was composed and the setting in which it is being evaluated. For example, Gee specifically mentions Palinscar and Brown's (1984) method of reciprocal teaching as one in which discursive practices are made public. In this method, just as in the nonheirarchical workplace, teachers function more as coaches to students (Gee,1996, p. 400). Finally, it must be remembered that literacy skills developed in school are what Brandt (2001) calls "an economic resource" (p. 183).

From this standpoint, those concerned with the literacy education of adolescents have also had to consider in what ways the school Discourses should be moderated to better prepare students for the world they will face in adulthood. Alvermann and Hagood (2000) noted that schools often fail to incorporate the cultural and social experience students bring to the classroom from outside of school (p. 200). Therefore, notions of the multiple enactments of an individual's identity both in and out of school in relationship to the various contexts in which these enactments are situated have influenced current research related to adolescent literacy. For example, Alvermann and Hagood point out individuals encounter increasing diversity in media outside of school which necesitates a reassessment of school discourse (p. 201). Moje (2002) also notes the disparity between the varied literacy practices of youth outside of school settings and the conscripted literacy practices in schools noted in current ethnographic studies (p. 220).

These are among many reasons the literacy of adolescents has become a subject of much interest. Indeed, in the last decade, educators and literacy researchers have realized continued growth in literacy skills is crucial for adults as well as children and for all older students, not just for those who have been identified as likely to struggle with grade level demands (Alexander & Fox, 2004; Yore and Treagust, 2006). For example, the underlying principle guiding the Programme for International Student Assessment (PISA), an assessment of reading, mathematical, and scientific literacy, is that students should develop the prerequisite skills for lifelong learning. Furthermore, according to the New London Group, a great multiplicity of languages and what they term "communication patterns" are needed by adults (Sturtevant, et al., 2006, p. 16).

Sturtevant, et al. (2006) assert because more sophisticated literacy skills are needed for higher level learning, literacy instruction for older students is needed (p. 1).

Assessment

The National Reading Panel report, published in 2000, considered seven research questions related to the teaching of reading. The report was based on a meta-analysis of studies related to each of the seven research questions. This report has been influential not only in the formulation of current federal and state policies related to early literacy but also in the formulation of state reading assessments required by NCLB. The research questions of most relevance to the literacy skills of adolescents were related to reading fluency, vocabulary, and comprehension. The panel took the position that reading fluency was critically related to reading comprehension. Further, they noted that reading comprehension was dependent on vocabulary knowledge. Therefore, according to the report, comprehension, a cognitive process, is complex and is inextricably linked to fluency and vocabulary knowledge.

The National Assessment of Education Progress (NAEP) includes a national reading assessment given to students in eighth grade. This assessment is characteristic of many state assessments. According to the NAEP reading framework for Grade 8, students are assessed in the following contexts: reading for literary experience, reading for information, and reading to perform a task (National Center for Education Statistics, 2005). Students are expected to demonstrate the ability to interpret and evaluate text even at what is considered the "basic" level on the test. Readers are expected to form "a general understanding" and develop an interpretation of text, make connections between the reader's "knowledge and experience" and the text, and critically evaluate and

understand "the effect of different text features" (National Center for Education Statistics, p. 28). Taken together, the National Reading Panel Report and the NAEP assessment demonstrate which factors related to reading skills and complex cognitive activities are generally associated with the ability to perform acceptably on a state reading assessment.

However, as a study by Dennis (2009/2010) demonstrates, the assessment profiles of struggling adolescent readers can vary considerably. She was able to identify four different types of readers based on a number of assessments by using a cluster analysis technique. Interestingly, none of these students, all of whom failed a state reading assessment, demonstrated weaknesses in phonics or decoding skills. Furthermore, Conley, Freidhoff, Gritter, and Van Duinen (2008) point out even adolescents who have not been identified as struggling readers based on assessments, can struggle with literacy tasks in secondary classrooms. Moreover, adolescents who have been identified as struggling readers on assessments can "demonstrate moments of startlingly proficient literacy performance" (Conley, et al., p. 89).

History of Adolescent Literacy Research

The use of the term *adolescent literacy* to denote the study of both in- and out-of-school literacies is relatively new. Formerly, the terms *content area literacy* and *secondary literacy* were most associated with the study of adolescents. Luke and Elkins (1998) also note the terms "'functional literacy', 'consumer literacy', and 'workplace literacy' are all artifacts of early and mid-century reading research" (p. 5).

According to Moore, et al., (1983), three forces converged to bring about a focus on content area reading and instruction: humanism, developmentalism, and scientific determinism. First, educators influenced by humanist thought advocated for a focus on

individual learning and thinking (Moore, et al., p. 421). The Progressive movement, partially based in humanist thought, and most notably represented in the area of education by John Dewey, furthered the development of content area reading. Progressive educators came to view readers as active (Moore, et al., p. 422).

Second, educators were influenced by developmentalists to focus on individual needs (Moore, et al., p. 422). Developmental reading programs and content area instruction were advocated even at the high school level. (Moore, et al, p. 422). Third, scientific determinists' emphasis on empircal methods to determine effective approaches in education resulted in the rise of standardized testing formats in which students were required to read and independently construct meaning from previously unseen text (Moore, et al, p. 423). Ernest Horn who "emphasized wide reading in the subject areas", Paul McKee, "who presented a compelling rationale for the necessity of developing students' reading-to-learn abilities," Gerald Yoakam, "who published one of the first textbooks on the relations among reading, learning, and subject matter instruction," and Arthur Gates who "focused . . . on measuring and diagnosing reading achievement" (Moore, et al, p. 425) were among the prominent researchers in the area of content literacy. According to Stevens (2006), this research was focussed on facilitating student success in "school-sanctioned literacy practices" (Stevens, 2006, p. 300).

However, the 1950's was the beginning of a new era in reading instruction during which the literature focussed on how students learn (Alexander & Fox, 2004, p. 33). Due in part to the baby boom and a concurrent perception that more children were experiencing reading difficulty (Alexander & Fox, p. 34) and due in part to pressures associated with "the age of Sputnik," (Alexander & Fox, p. 34) research efforts were

concentrated on determining effective means of preventing and remediating reading difficulties. As a result of this pressure, in the middle of the twentieth century, "most basic research efforts turned to a reductionistic paradigm that focused on words in isolation" (Moore, et al, 1983, p. 423).

According to the 1983 report by Moore et al., five issues recurred throughout this time period:

- Locus of instruction
- Subject-area reading demands
- Study skills
- Reading materials
- Age focus.

Locus of instruction refers both to the location and type of instruction delivered to students. Instruction could be either located in a reading classroom and consist of isolated direct instruction in reading skills or located in a content area classroom and consist of instruction in skills most applicable to the content at hand. Researchers in the first half of the 20th century generally took the former view while Herber's landmark 1970 text took the latter view.

The issue of reading demands in various subjects is primarily related to the identification of vocabulary that is unique to the various content areas. As early as 1923, Pressey identified technical vocabulary unique to various subject areas (Moore, et al, p. 429). Reading achievement tests and observational data seemed to confirm that subject areas have distinct vocabularies. Likewise, the issue of study skills that are specific to reading dates to the early part of the 20th century. For example, F. P. Robinson

developed the Survey-Question-Read-Recite-Review (SQ3R) strategy in 1946 (Moore, et al.). The prominence of nonfiction in basal reading texts has varied over the past one hundred years and the relative importance of nonfiction reading in English classes has also influenced the amount of emphasis on reading in the content areas. Finally, as a result of the advent of standardized testing, educators focused on the necessity of developing reading skills in older students, and "those educators further realized that reading adequately in secondary schools actually meant being able to read in the content areas" (Moore, et al., p. 434).

Two factors were responsible for the reemergence of content area reading instruction in the 1970's, "the cognitive revolution in psychology and . . . the publication of Herber's (1970) text, *Teaching Reading in Content Areas*" (Moore, et al., 1983, p. 426). This text was the first to concentrate exclusively on content area reading practices. At the same time, a number of cognitive psychologists began to investigate general cognitive strategies used by readers to comprehend text (Alexander & Fox, 2004, p. 45). Instructional routines such as reciprocal teaching (Palinscar & Brown, 1989) incorporating these cognitive strategies were developed and applied across content areas. By the following decade, many states mandated content area reading courses for those preparing to be secondary educators (Moje, 1996, p. 172).

However, in the 1990's certain deficiencies in the content area reading approach were recognized. Moje, Young, Readence, and Moore (2000) noted that certain negative connotations had come to be associated with the old terms; specifically, "secondary reading carries with it the notions of a lab setting, in which students who have not learned to read are cloistered, working on individual sets of grade-leveled materials" (p. 401). In

addition, content area teachers rebelled against the idea that they were also expected to be reading teachers (Moje, 1996). Furthermore, in citing Paris, Wasik, and Turner's 1991 assessment, Alexander and Fox (2004) point out by the early 1990's assessments of the effetiveness of secondary reading programs failed to demonstrate improved achievement for many secondary students (p. 45). At the same time, it is important to note Allington and McGill-Frazen's (2009) assertion that this failure has usually been attributed to deficiences in students rather than to deficiences in reading programs (p. 556).

However, at the same time, a transition began to occur due to the influence of sociological and anthropological paradigms on the field of education. The definition of literacy was expanded to include "communicative competence in particular contexts" (Hinchman & Moje, 1998, p. 117). Furthermore, learning came to be viewed as "the creation of a mutual understanding arising in the social interaction of particular individuals in a particular context at a particular time" (Alexander & Fox, 2004, p. 46). However, as Hinchman & Moje noted, these broader definitions had a negative consequence in that researchers failed to focus on the development of more effective instructional strategies for struggling readers (p. 125). At the same time, the "domain-specificity of knowledge and learning" (Alexander & Fox, p. 48) was recognized as well as the fact that student interactions within any particular domain were dependent on the unique characteristics of the domain (Alexander & Fox, p. 49).

Just prior to the beginning of the 21st century, the term adolescent literacy became more prominent in the literature. Moje, Young, Readance and Moore (2000) distinguished the term adolescent literacy from the terms content area reading and secondary reading (p. 401). At the same time as views of literacy practices were

changing and becoming more specialized, Moore, Bean, Birdyshaw & Rycik (1999) noted the proliferation of literacy events meant these practices assumed greater importance. Researchers characterized this period as “New Times” (Gee, 1996; Luke and Elkins,1998, p. 5). Various researchers (Luke & Elkins; Moje, et al.; Stevens, 2002; Alverman, 2001) noted new technologies “set out the conditions for shifts in economic systems, cultural practices, and social institutions” (Luke & Elkins, p. 5). In fact, Luke & Elkins likened the task before educators at the turn of the century to “ the very task that John Dewey and his colleagues had to confront in the early 20th century and the task that William Gray and language planners faced in the postwar period” (p. 6). Unfortunately, just as these new concerns were coming into focus, Hinchman noted a decreased emphasis at both the federal and state level on adolescent literacy in response to an increased emphasis on beginning literacy instruction. (Hinchman & Moje, 1998, p. 125).

Social Cognitive Theory

It is the hope of schools and teachers that what transpires in the social space of the classroom will result in cognitive change. Bandura (1989) has noted that prior knowledge, observation, and experience are all incorporated in learning. A number of researchers (Guthrie, Wigfield, Metsala, & Cox, 1999) have advocated cognitive strategy instruction as a method of improving literacy skills and student efficacy. Allington (2002) suggests that teacher modeling is crucial to comprehension strategy instruction. A number of researchers (Gaskins, 1994; Brown and Campione, 1994; Scardamalia, Bereiter, and Lamon, 1994) have investigated applications of cognitive strategies in the classroom. Several researchers (Roth, 2005; Baker, 2004; Guthrie, et al., 2004) have suggested cognitive strategy instruction is a particularly beneficial literacy practice in

science due to its relatively difficult concepts. All of these researchers have connected learning to activities occurring in the social space of the classroom.

Harré (1984) described what he termed a "conceptual space for personal psychology" (p. 41) which serves as the basis for Gavelek and Raphael's (1996) iteration of the Vygotsky Space. Harré locates knowledge on three dimensions: private/public, individual/collective, and active/passive. Gavelek and Raphael assert social settings are "the very means by which students come to acquire and construct new knowledge, new meanings, and new interpretations of text through interactive use of language" (p. 184). Their theoretical framework can be used to describe cyclical cognitive processes in classrooms in terms of both public and private cognitive activity. According to Gavelek and Raphael, public activity is apparent in classroom language whereas private cognitive activity involves personalization which they define as the "ongoing process within which the learning is evolving and changing over time and with experiences" (p. 187). Kong and Pearson (2002) used this framework as the basis for an empirical study of the learning trajectory of students participating in classroom book clubs. They were able to trace the development of literacy skills in students across three distinct phases which they characterized as teaching by telling, teaching by modeling and scaffolding, and learning by doing.

Another important consideration in the literacy practices of students who are positioned as struggling is centered around differences in the use of language in students' primary Discourse and in classroom Discourse. Heath (1983, 2004) and Hart and Risley (1995) documented the difference in language use among families of differing socioeconomic status. In particular, the nature of academic language use in both a more

general and a subject-specific sense is either detrimental or facilitative for student learning. There can be more or less congruence between any particular student's receptive vocabulary and the classroom discourse. Furthermore, vocabulary can be simply understood or can be applied. Particularly problematic in the subject of science is vocabulary that indicates concepts that are unfamiliar to students. As the RAND Reading Study group (2002) pointed out, there is a difference between teaching students to recognize a word when they already understand the concept and teaching them to recognize a word representing a concept with which they are not familiar. Furthermore, Gee and Roth caution the acquisition of an academic language can also represent a loss of an old identity as well (Gee, 2004a; Gee, et al., 2005; Roth, 2005). However, as Vygotsky noted, language is the primary sign system used in the social context of school classrooms. Therefore, language mediates student learning.

Sociocultural Factors Affecting Adolescent Literacy Practices

The increased influence of the fields of sociology and anthropology on educational research has been associated with a number of researchers who have studied the impact of culture on learning. For example, Landson-Billings (1994) and Dyson (1997) studied teachers. Purcell-Gates (1994), Kaser and Short (1998), Compton-Lilly (2003), Gonzalez, Moll, & Amanti, (2005), and San Antonio (2004) have studied the sometimes detrimental impact of cultural differences on children's learning in school.

Furthermore, Alvermann (2001a) argues for an expansive rather than a narrow view of reading. She suggests that educators should not view "reading as a subject, rather . . . as a practice that is socially, culturally, and institutionally situated – one that is rarely

about just written language" (p. 686). According to the RAND Reading Study Group (2002):

> *Sociocultural factors* help us understand differences among readers in the way they define comprehension, the nature of opportunities that readers have to learn to comprehend, and the texts and comprehension activities that they value. For example, learners from some social groups experience a lack of congruence between their own definitions of literacy and those they encounter at school, whereas those from other social groups find the school-based texts and literacy activities familiar. (p. 75)

Academic disadvantages attributed to such factors as cultural differences and speaking nonstandard English have been well-documented (Hart & Risley, 1995; Snow, Burns, & Griffin, 1998; Newkirk, 2007). Gee (2006) found differences in the talk of students from lower and upper socioeconomic groups. "The working-class teens fashion themselves through language immersed in a social, affective, dialogic world of interaction and the upper-middle-class teens fashion themselves through language as immersed in a world of information, knowledge, argumentation, and achievements" (p. 170). While Gee (2004c) does not hold schools responsible for these differences, he does feel that the schools do nothing to lessen them. Snow, et al., (1998), make note of the increased likelihood of poor reading achievement for poor and minority children and those in urban schools (p. 27). The RAND Reading Study Group (2002) has noted minority students have historically scored significantly lower than White students on NAEP reading assessments (p. 80). Further, they cite a number of studies that document a narrowing of the curriculum for disadvantaged students. This focus on basic skills

instruction neglects to account for cultural background and funds of knowledge (Gonzalez, Moll, & Amaniti, 2005). Gee (2006) asserts schools should seek to eliminate this achievement gap (p. 166). "Poor kids – White and Black or anything else – are often left to trust the schools to give them them shape-shifting abilities and skills for their emerging portfolios. But, schools rarely give them these" (Gee, 2006, p. 168).

A number of researchers have described the ways in which these disparities affect students. For example, Hinchman & Moje (1998) point out that "because schools are often sites of marginalization for particular students, to study some young people only in school is to know them only as marginalized human beings" (p. 118). McDermott and Varenne (1995) attribute a "disability approach" for what they characterize as the erroneous view that "minority children [are] failing in school because of impoverished and impoverishing experiences in their homes" (p. 334) and a "difference approach" for the view that cultural differences between teachers and students can facilitate poor learning outcomes for minority children (p. 335). Indeed, according to Obidah and Marsh (2006), students are aware of the low expectations of the school staff, and this awareness becomes a self-fulfilling prophecy that appears to observers as individual failure. (See also RAND Reading Study Group, 2002).

In his earlier work, Gee (1989) suggests another rationale which helps to explain the intractablility of the current well-documented achievement gap between poor students and middle class students. Gee maintains all individuals are socialized into a primary Discourse at home and with their childhood peers. Gee asserts this Discourse serves as a "'foundation' for Discourses acquired later in life" (p. 8). Furthermore, Cazden (1988) and Heath (1983) have noted differences in home and school discourses

while Hinchman and Moje (1998) have pointed out that students "are confronted not only with the discourses of secondary schooling, but also with the discourses of disciplines" (p. 120).

In addition, much has been written about the specific literacy needs of males and the exclusion of those needs from contemporary academic settings (Brozo, 2002; Smith & Wilhelm, 2002). For example, Tatum (2006) notes that traditional school-based literacy practices appear unconnected from any long-term goals in the eyes of many African-American adolescent males. Researchers have also noted the influence of context on the literate behavior of adolescent males. For example, Tatum (2005) cautions that "black males living amid turmoil may be different culturally from black males who live free of turmoil [because] the culture of young black males may depart as a result of social class and other related experiences" (p. 72). Hinchman et al. (2002) suggest the literate identity of adolescent males in not unitary but rather varies in relationship to external factors (p. 236). As Hinchman et al. point out "boys construct themselves as masculine and literate *for specific times and places* [italics added]" (p. 237). Both researchers and teachers have to consider literacy practices and requirements of adolescent males from multiple perspectives and over time.

The influence of cultural factors on adolescent literacy learning is multidimensional. As Hinchmann et al. (2002) point out, "individuals have varying and partial awareness of the ways in which the social world informs their lives" (p. 232). Individuals are simultaneously involved in "identity production" (Hagood, 2002, p. 249) and identity perception. Therefore, in understanding these multiple influences it is necessary to consider the following dimensions:

- School/teacher theories of adolescent literacy practices
- School/teacher theories of literacy learning
- Adolescent theories of school/teacher literacy requirements
- Adolescent theories of significant literacy practices and their utility or lack of utility in connection to adolescent literacy.

Culture of the Classroom Space

Of particular interest here are the various theories of literacy practices and their enactments in the classroom space. Barton and Hamilton (2000) situate literacy practices in this space. Moje (1996) suggests while literacy practices function as tools for making meaning, these meanings are always dependent upon context. In fact, in her study of a chemistry teacher’s use of literacy strategies in her classroom, Moje found that a major factor in the teacher’s success in using these strategies was the social context of that classroom. Kaser and Short (1998) assert a mismatch between classroom culture and a student’s home culture can lead a student to disassociate from the classroom space (p. 191). Obidah (1998) used the term *literate currency* “to describe the multiple and interactive forms of literacy that students bring into the classroom” (as cited in Obidah & Marsh, 2006, p. 107). The term literate currency subsumes peer literacy, home and community literacy, school literacy and popular culture literacy because “students inculcate and combine sets of knowledge to form a continuum of literate currency” (Obidah & Marsh, p. 108). Furthermore, teachers must also be aware of how their own theories and their students’ theories influence their interactions with adolescents in such a dynamic situation. Moreover, in a negotiated curriculum “teachers and students work to learn from each other” (Hinchman & Moje, 1998, p. 120).

The use of an assessment tool can quantify student literacy achievement but it cannot effectively explain why students do or do not exhibit such achievement. In order to understand learning processes, naturalistic study of teachers, students and classrooms is necessary. When students move to middle school, they are affected by numerous changes ranging from the design of the school day to the compartmentalization of their instruction into a number of discrete classes, teachers, and subject areas. Barton and Hamilton (2000) explain literacy is not a unitary construct. Rather, individuals make use of multiple literacies which occur in different domains of activity. Barton and Hamilton identify various domains, one of which is school. Each domain has unique discourse communities. Students bring their primary Discourse (Gee, 1992) to the classroom.

A number of researchers (Alvermann & Hagood, 2000; Gee,1992; Moje, 1996) have noted that the classroom space forms a unique Discourse subject to the influence of the primary Discourses of both teachers and students. Furthermore, this space is nested within the space of the school and is influenced by the school Discourse. Thus, what counts as literate practice in any classroom is determined both by teachers and students and by their interactions. In essence, these individuals define and form a community of practice (Gee, 1996) or discourse community (Moje and Lewis, 2007) while at the same time they are defined and formed by classroom context (Moore & Cunningham, 2006). *Figure 2.* Literacy domains, practices and events on page 27 depicts the relationship of literacy domains, practices and events. According to the RAND Reading Study Group (2002), considering primary Discourses helps to delineate differences in literacy practices among students both in the way they define comprehension and in the comprehension activities they value.

Central to the topic of this review is the particular discourse of school, the language of students, teachers, and written text, and how and under what circumstances adolescents in the "subject position" (Alvermann & Hagood, 2000, p. 199) of student reject and embrace texts and, concurrently, the circumstances under which adolescents reject and embrace the subject position of student. Many somewhat complicated and competing perspectives are at play within the discourse of school including the teacher's theories about the roles of teacher, student, and text; the student's theories about the roles of student, teacher, and text; and the author's theories about the subject and the audience for the text. As Alvermann and Hagood suggest, it is particular the combinations of pedagogy, reading capabilities, reading practices and individual theories that determine specific classroom contexts for learning.

A number of researchers (Dyson, 1997; Newkirk, 2007; Alvermann & Hagood, 2000; Moje, 2002) have also noted the importance of including out-of-school literacy practices, including new technologies, as a part of the culture of the classroom. Leu, Jr. et al., (2004) assert out-of-school access to technology is limited for some students. O'Brien (2006) and Hand, et al. (2003) note that some students are more successful engaging in technological literacy practices than in more traditional ones. Clearly, a complete understanding of the dimensions of literacy achievement in a modern classroom must account for both access to and functions of digital media both inside and outside of the classroom context.

Alvermann & Hagood (2000) suggest that classrooms are spaces that can be studied. The literate practices of the classroom space can also be studied, and it is through these practices that the meaning of texts within the classroom space are defined by

individuals. Taken together, analysis of theoretical literature related to classroom culture suggests that a thorough description of literacy achievement in a classroom must encompass both the primary Discourse of individual members and the secondary school and classroom Discourses as well as the various members' theories regarding literacy practices and individual cognitive factors including reading stengths and weaknesses, motivation, and agency.

"Struggling" Readers

"We are foolish to not appreciate how much is known by others in their own terms" (McDermott & Varenne, 1995, p. 325).

A detailed understanding of the struggling adolescent reader is imperative in that the Alliance for Excellent Education (2007) has asserted that "only 30 percent of students entering high school read at grade level" (p. 1). Alvermann and Hagood (2000) and Kaser and Short (1998) note that the classroom context can be more or less faciliative for individual students. For some students, the secondary Discourse of school is congruent with their primary Discourse while for other students it is not. Furthermore, Yore and Treagust (2006) suggest that sociocultural, sociolinguistic and sociocognitive factors specifically influence student learning in science. Saul (2004) asserts that it is useful to understand how a student's primary discourse helps or hinders him in the science classroom. Therefore, as Alvermann (2004) suggests, differences in the cultural and linguistic backgrounds of students and teachers are particularly problematic in science classrooms and may result in lowered expectations on the part of teachers.

Alvermann (2001a) suggests that educators should seek to be "enablers of youth and their literacies" (p. 677). However, she points out the "potential for culture to act as a

disabler among adolescent readers (at least as far as school literacy is concerned)" (p. 678), for as McDermott and Varenne (1995) assert, institutional notions of cultural superiority can be problematic for students (p. 330). Furthermore, Allington (2007) maintains intervention classes will never close the achievement gap because they comprise only a fraction of struggling adolescent readers' days while these students spend "five hours a day sitting in classrooms with texts they cannot read, and that cannot contribute to *learning* to read, let alone contribute to the learning of science or social studies (p. 7). (See also Allington, 2002) In addition, the RAND Reading Study Group (2002) points out not only do struggling readers get fewer opportunities to practice reading but this also means they have few opportunites to learn content (p. 34).

In her article entitled *Reading adolescents reading identities: Looking back to see ahead,* Alvermann (2001a) applies McDermott and Varenne's (1995) framework to struggling readers. According to this framework, there are three approaches to disability: the Deprivation Approach, the Difference Approach, and the Culture-As-Disability Approach. The Deprivation Approach would position the struggling adolescent reader as one who failed to reach certain milestones such as "in being able to decode, comprehend, and summarize large chunks of informational texts" (p. 680). The problem with this approach, according to McDermott and Varenne is that the "explanation of what is wrong with their life makes things worse" (p. 330) because a label is attached to them. In fact, they characterize this approach as a "blame-the-victim" (1995, p. 330) approach and caution that "the ascription of disability [is] a constant event in the lives of an increasing number of persons" (p. 332).

In contrast, according to the Difference Approach "an arbitrary set of reading tasks deemed important by one group of people may have little or no relevance for another group" (Alvermann, 2001a, p. 682) because "the way people in different groups develop competencies as literate beings will vary according to the demands of their particular cultures" (Alvermann, p. 681). While this more nuanced view highlights strengths rather than disabilities, McDermott and Varenne (1995) maintain that "despite a liberal lament that variation is wonderful, those who cannot show the right skills at the right time in the right format are considered out of the race for the rewards of the wider culture" (p. 335).

The Culture-as-Disability Approach suggests "that schools actively arrange for some adolescents to take up, or inhabit, the position of struggling reader" (Alvermann, 2001a, p. 683). In fact, McDermott and Varenne maintain that cultures "actively organize ways for persons to be disabled" (p. 337). In particular, according to McDermott & Varenne, the dominant culture of the United States makes assumptions concerning literacy, for example, that it "is difficult to acquire . . . [and] should be transmitted to illiterates in classrooms" (p. 341). In this view, an individual struggling reader serves as a "display board for the problems of the system" (McDermott & Varenne, p. 341). Both Alvermann and McDermott and Varenne provide examples from their own work of situations in which, by neglecting to appreciate the disabling effects of their own particular stance, they were equally as responsible for the failure to achieve as were the individuals they were attempting to help.

In currrent discussions concerning reauthorization of NCLB (2001), various policymakers have focused on the effects the law has had on underperforming

adolescents. As the Alliance for Excellent Education (2007) points out, the law has done little to benefit struggling adolescent readers as is apparent when one considers the lack of secondary literacy programs and has, in some ways, been detrimental to adolescents. For example, although the average scores of eighth grade students on the 2007 NAEP were at the basic level (National Center for Education Statistics, 2007), the Alliance for Excellent Education noted in 2007 that the major adolescent literacy initiative of the federal government, the Striving Readers program, received less than two percent of the funding allotted to another major literacy initiative targeted at the early grades (p. 8). In addition, some researchers and policymakers have noted a tendency on the part of educators to neglect both the highest and lowest performing students in favor of students who fall just below the cut score and to concentrate on a multiple choice format (RAND Corporation, 2007; Viadero, 2007a; Viadero, 2007b). At the same time, the RAND Reading Study Group (2002) cites several strategies that show "specific instruction, for example, prereading, can improve poor comprehenders' understanding of a difficult text" (p. 35). In addition, writing activities (Rand Reading Study Group), prereading activities such as advance organizers (Idol-Maestas, 1985), and during reading strategies including text monitoring (Chan, Cole, & Barfetti, 1987) have been shown to increase reading comprehension for less well-achieving students.

Efficacy, Identity, Agency and Social Learning Theory

Sociocultural theorists have noted that individual identity is characterized by multiplicity and is influenced by society and culture. For example, Hagood (2002) notes that identity "is fragmented rather than holistic, changing across time and space, and multiple rather than singular and autonomous" (p. 250). Bloome, et al. (2005) define

identity as "social positions that people take up or are manuevered into by the actions of others" (p. xx) while Gee (2005a) defines individual identity in the plural as "different ways of participating in different sorts of social groups, cultures, and institutions" (p. 1). Holland and Lachicotte, Jr. (n.d.) suggest identities are ways of "inhabiting roles, positions and cultural imaginaries" (para. 5). Further, they assert these identities matter not only to others but also to the individuals themselves. They also point out symbolic interactionists suggest we "experience our own behavior as signs of who we are" (para. 18). Furthermore, they propose a "sociocultural approach to identity" (para. 19) considers identity to be symbolic, reflexive, and a source of motivation for action.

However, identity by itself cannot not explain individual performance on a specific task (Sturtevant, et al., 2006, p. 12). Rather, many researchers note the importance influence of self-efficacy on task performance. According to Schunk and Zimmerman (1997), "those who have a sense of efficacy for . . . performing well on a reading or writing task participate more readily, work harder, persist longer when they encounter difficulties, and achieve at a higher level" (p. 36). Conversely, those with a low sense of self-efficacy are reluctant to take on tasks and believe tasks are harder than they actually are (Morrison-Sadder, 2007). Furthermore, Guthrie, Wigfield, Metsala, and Cox (1999) found a significant correlation between reading comprehension and efficacy in a study they conducted with students in grades eight and ten. In addition, Shell, Colvin, and Bruning (1995) showed that text comprehension could be predicted from reading efficacy even among low achievers, and the prediction for all students increased between grades 4 and 7.

Schunk & Zimmerman (1997) suggest factors other than self efficacy such as "skills and knowledge, outcome expectations, and perceived value of learning" (p. 36), also influence achievement. According to Bandura's (1989) social learning theory, students form their "conceptions of actions . . .on the basis of knowledge gained through observational learning, inferences from exploratory experiences, information conveyed by verbal instruction, and innovative cognitive syntheses of preexisting knowledge" (Bandura, p. 1181). Bandura asserts goal setting, an influence on outcome expectations, can be linked to self efficacy (p. 1175). However, although Locke, et al., (1981) assert a strong link between past performance and goal setting (p. 144), Bandura (1989) points out that "expected outcomes contribute to motivation independently of self-efficacy beliefs *when outcomes are not completely controlled by the environment* [italics added]" (p. 1180). Therefore, classroom environments that function in an inclusive way and in which it is possible for students to be successful regardless of prior acheivement could have a powerful effect on students even if self efficacy is low. At the same time, Locke, et al., (1981) suggest goal difficulty is an important consideration in efforts to maximize student performance (p. 145). Evidently, self-efficacy beliefs can both affect achievement and be affected by it. For example, in their study of literacy and academic achievement, Snow, Tabors, Porche, and Harris (2007) found adolescents who scored even at the 30th percentile on literacy assessments who had gained admission to college. They determined these students were able to graduate from high school and attend college because they were highly motivated, goal-oriented and had the support of their families. Clearly, these students had developed an identity that was not wholly dependent on their

efficacy with text. Furthermore, this identity was developed as a result of their interactions with others both at home and at school.

Agency is the means by which "people can effect change in themselves and their situations through their own efforts" (Bandura, 1989, p. 1175). Moje and Lewis (2007) add to this that agency is both strategic and "embedded in power relations" (p. 18). Furthermore, Moje & Dillon (2006) point out that although adolescents are commonly conceived of as powerless "they often seize power through acts of resistance, especially in school settings" (p. 89). However, Moore and Cunningham (2006) assert, agency is limited because the environment or social situation in which individuals find themselves exerts an equally powerful influence on their actions (p. 135). At the same time, Moore and Cunningham suggest a purely structural or poststructural theory of student learning "shortchanges adolescents' purposeful thoughts and actions" (p. 132). Instead, they suggest "agency is present amid the internal dialogues of the mind" (p. 136) and, in fact, develops as a result of both internal and external dialogic relationships. Moreover, a number of researchers (Moje & Dillon, 2006; O'Brien, 2006; Moore and Cunningham, 2006) have suggested that student agency influences the degree to which adolescents engage in school and science literacy practices.

Furthermore, at times, adolescents are able to use identity fluidity to ameliorate negative factors. Holland and Lachicotte, Jr. (n.d.) point out although identity is constructed from the social and cultural world individuals inhabit, "they produce selves that inhabit these structures and imaginiaries in creative and variant, often oppositional ways" (para. 77). For example, Hagood (2002) noted that the adolescent male she studied engaged in identity shifting in order to avoid being categorized (p. 259). Hinchman,

Payne-Bourcy, Thomas, & Olcutt, (2002) found that a strategy one of the adolescents they studied used in an attempt to negate the effect of his background on the academic challenges he was facing was to question his teacher both for answers and confirmation of information. In fact, they found that this student "aligned himself with the teacher and not his peers in order to insure his ability to meet expectations successfully" (p. 237). Another of the students Hinchman, et al. studied, had to determine on his own how to use his literacy skills in an environment in which these skills were not valued by others (p. 237). This young man was able to fashion an identity acceptable to both his peers and school personnel (Hinchman, et al., p. 239). Gee (2005a) termed these "socially situated" identities. However, he also advanced the notion that each individual also posesses a "core identity" (p. 34). Ultimately however, as Orellana (2007) suggests, "contexts and people are mutually constituted" and individuals "bring their contexts with them, fundamentally altering the nature of the new spaces into which they move" (p. 126). As Bloome, et al. (2005) assert, the crucial factor is whether or not the identities assumed by students in the classroom provide them with the needed senses of agency and of self-efficacy to lead to productive learning.

Multimedia and Popular Culture

The rapid pace of technological innovation has necessitated changes on the part of educators everywhere. The key question for educators is one of the utility of the new technologies in the classroom setting. Unfortunately, these new literacies have yet to be fully described or defined (Leu Jr., et al., 2004, p. 157). Nevertheless, public law in the United States mandates that educators tackle the new literacies. As Leu Jr., et al., point out, "Title II, Section D, of the No Child Left Behind Act is devoted to technology with

the stated goal, 'To assist every student in crossing the digital divide by ensuring that every student is literate by the time the student finishes the eighth grade'" (p. 1582).

Despite the fact that email and instant messaging have been used in educational and quasi-educational settings for a number of years (Alvermann, 2001b, p. 11), it has been only recently that teachers have entered the work force who are familiar with newer technologies such as social networking sites. For example, Wittmeyer (2007) describes a teacher who attempts to incorporate MySpace as a teaching tool (p. 4). Indeed, Alvermann (2001a) suggests "that many . . . normative ways of reading are losing their usefulness (and validity) in the wake of new technologies and changing literacies" (p. 680). For example, hypertext places different demands on the reader than does traditional text.

Furthermore, it is evident that students often know far more about the new technologies than many educators do (Leu Jr.,et al., 2004, p. 1597). As Alexander and Fox (2004) point out "today's K-12 students in postindustrial societies have never experienced a world without computer-based technologies" (p. 54). According to Alvermann & Hagood (2000), "adolescents living in New Times . . . use the media and popular culture to break down the age-old distinctions between high and low culture" (p. 203). In working with a group of students in an after-school club, Alvermann (2001a) notes that she and a coworker had as much difficulty with these new literacies as the students they worked with had with their more traditional tasks (p. 687). Educators will have to understand these new literacies if they hope to make connections with the content and their students' ways of knowing about the world. Indeed, Leu, Jr., et al. assert that "effective learning experiences will be increasingly dependent on social learning

strategies and the ability of the teacher to orchestrate literacy learning opportunities between and among students who know different new literacies" (pp. 1597-1598).

Some researchers also suggest the benefit of new media for students who have difficulty mastering traditional literacy tasks. O'Brien (2006) found that who scored low on traditional tests were successful with tasks based on newer technologies (p. 31). However, Leu, Jr., et al. (2004) caution that in this new era traditional literacy is even more important although, by itself, not sufficient for success (p. 1591). Gee (2006) cites a study by Lam (2000) in which a bilingual student was able to learn both traditional school-related skills and other skills by using the internet (p. 167). Within the walls of the school building, however, this student was positioned as incompetent. Gee notes that this student "learn[ed] to shape-shift, to enact different social roles" (p. 168), a skill Gee considers crucial to success in the modern world. O'Brien also found that the students in his study of multimediating increased their scores on traditional assessments (p. 33) and further that males "contrary to gender and discourse studies that indicate how males have conversational goals that place ultimate value on maintaining status" (p. 34) were willing to accept advice from their peers.

Science Study and Literacy: Theoretical Perspectives and Investigations

Crucial to any attempt to understand the functions and uses of literacy in the science classroom is an understanding of the view of science that is being enacted. Yore (2004) describes a study he and others conducted of scientists' views of science and of their literacy practices (Yore, Hand, & Florence, 2004a). In this study, the authors described five views of science. According to Yore (2004), "the traditional view suggests that science knowledge is developed through observations, measurements, and

human reasoning" (p.75). In contrast, the absolutist view suggests that science "is a collection of truths about reality that are unchanging" (Yore, p. 75) while the postmodern view suggests "that scientists construct explanations in the context of their own personal beliefs" (Yore, p. 75). A scientist who adopts a "relativist view of science does not question, evaluate or judge sources of information and divergent interpretations or explanations because one source, interpretation or explanation cannot be judged as more valid than another" (Yore, p. 75). Finally, the evaluativist view suggests that science knowledge claims "are open to repeated evaluation against the available evidence from nature, but some well-established claims are unlikely to change"(Yore, pp. 74-75). (See also Yore et al., 2006; Wallace, Hand & Yang, 2004) Elsewhere, these views have been described in ontological and epistemological terms: "traditional (realist ontology, absolutist epistemology), modern (naïve realist ontology, evaluativist epistemology), and postmodern (idealist ontology, relativist epistemology)" (Yore, et al., 2006, p. 112). Although in reality it is possible individual scientists operate based on an amalgam of both expressed and tacit views, drawing from a number of different perspectives, clearly, theoretical stance influences not only how scientists pursue scientific knowledge but also how scientific knowledge is evaluated both by members of the scientific community and by nonscientists.

Moreover, these varying views of science necessitate varying literacy practices both in doing science and in reporting the results of scientific pursuits. For example, if an abosolutist view of science is being enacted, a scientist would need to be able to accurately document observations, perhaps in the form of a graph or chart. However, while an evaluativist would also engage in the documentation of observations, this

scientist would place equal or greater emphasis on taking a position and advancing an effective argument. In addition, nonscientists must often engage in literacy practices in order to learn about scientific phenomena. A layperson who has adopted a postmodern view of science would necessarily engage in different literacy practices than a layperson who has adopted a relativist view of science. Indeed, Wallace, et al. (2004) state the "one essential characteristic of scientific literacy is the ability to evaluate a scientific knowledge claim" (p. 355). Yore and Treagust (2006) also advocate a critical stance and suggest teachers should be guided by this notion when selecting activities for their classrooms.

On the other hand, the National Research Council (National Committee on Science Education Standards, 1996), has suggested that for laypeople "scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (p. 22). For this group, scientific literacy includes the capability to "ask, find, or determine the answers to questions" (National Committee on Science Education Standards, p. 22) as well as the capacity to read about and evaluate scientific information. According to PISA, scientific literacy is "the capacity to use scientific knowledge, to identify questions and draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity' (Measuring Student Knowledge and Assessment, 1999, p. 60). To Hand and Prain (2006) and the authors of the PISA assessment, literacy in science requires a critical stance and a move toward what Hand and Prain (2006) call "knowledge production" while for those members of the National Research Council (National Committee on

Science Education Standards) knowledge and understanding are the key requirements for scientific literacy.

Still others suggest because the process of scientific inquiry necessitates collaboration, it has a sociocultural scope (Yore, Florence, Pearson, & Weaver, 2006) which has only been expanded by technological advances. Alvermann (2004b) points out "a social constructionist theory of learning would argue that generating questions aimed at shifting away from a focus on 'facts' or 'truths' toward 'warranted justifications' of particular interpretations is what science learning should be about" (p. 235). Yore, et al., (2006) point out these justifications are then subject to evaluation by the scientific community (p. 111). Moje, et al. (2004) suggest content knowledge, interpretive competence, and knowledge of communcative conventions are all necessary for literacy in science.

Current researchers concerned with the relationship between literacy and science emphasize varying aspects of the intersection of literacy and science both in conducting scientific inquiry and in evaluating its results. Some approach learning about science from a sociocultural perspective while others are more influenced by the tenets of cognitive psychology. Furthermore, these varying emphases are beneficial because as Duschl (2005) explains, "psychological explanations and biological cognitive mechanisms . . . help us understand the individual as a thinker [and] anthropological explanations and cultural mechanisms . . . help us understand the individual in society" (p. x).

Schooled science and literacy learning: What should students know?

The study of science in schools and the literacy strategies necessary for such study have been influenced by the interaction of many theories of science and many theories of learning. Although Kamil and Berhardt (2004) noted the relationship between science learning and literacy learning was considered as early as 1990 by Rutherford and Ahlgren, they also suggest current pedagogy "deemphasizes reading and writing in order to emphasize performance-based activities that favor doing science rather than reading about it" (p. 132). However, Blank (2000) described the limited conceptual understandings of students who had engaged in a science activity and demonstrated how students' conceptual understandings could be restructured by reflective writing and discussion. At the same time, the current climate of accountability has caused a limiting of the scope both of the curriculum and of instruction. For example, the RAND Corporation (2007) reports in their survey of elementary and middle school science and math teachers, "many teachers reported narrowing curriculum to focus on tested topics and even certain styles of test questions" (p. 2). This narrowing of the curriculum presumably leads to a narrowing of literacy skills needed by students to function successfully in science classrooms. In such a climate, an absolutist view of science prevails and students are expected to memorize certain facts rather than to describe scientific processes or evaluate and justify claims.

Lederman (1999) conducted a year-long study of high school biology teachers in order to determine if their views of the nature of science influenced their classroom practices. His findings indicated only the two most experienced teachers in his study were able to align their classroom practices with their views of the nature of science.

Furthermore, although the evaluativist view is, according to a number of researchers, the one most frequently held by scientists, it does not necessarily follow that this is the view of scientific study most commonly held by science teachers. In fact, Tsai (2002) found that most teachers in his study held a traditional view of science. Akerson and Hanuscin (2007) found the teachers in their professional development project simultaneously held absolutist and evaluativist views of the nature of science at the outset; however, both the teachers and their students were able to moderate these views as the result of a professional development program.

Nevertheless, since the turn of the century, researchers have begun to consider the relationships and intersections of science and literacy practices and the ramifications of these for the educational community. For example, the RAND Reading Study Group (2002) suggested researchers must determine "the role of direct instruction in specific comprehension monitoring and comprehension-fostering strategies in an inquiry focused learning environment" (p. 46). In addition, W. E. Saul organized a conference in 2001 held on August 24-26 entitled "Crossing Borders: Connecting Science and Literacy" at the University of Maryland (Hand & Prain, 2006; Saul, 2004). Subsequently, a book was published to report the results, *Crossing Borders In Literacy and Science Instruction: Perspectives on Theory and Practice* (Hand & Prain, p. 102). In 2002 another conference was held on September 12-15 on Vancouver Island, British Columbia, Canada to extend the discussion begun at the first conference. This conference was entitled "Ontological, Epistemological, Linguistic and Pedagogical Considerations of Language and Science Literacy: Empowering research and informing instruction" (Hand & Prain, p. 102). The aim of the researchers involved in both conferences was to "build a framework" (Hand &

Prain, p. 102) to guide research in this area. While they acknowledged that literacy should be embedded in "authentic science inquiry" (Hand, et al., 2003, p. 614), they placed literacy at the center of the scientific domain. Their seven recommendations were as follows:

1. Although oral language is important to science literacy, the precision necessary for scientific thought and communication make print indispensable (Hand, et al, 2003, p. 612). (See also Norris & Phillips, 2003)
2. Reading involves "coping with both the expressed and unexpressed in the written word" (Hand,et al., p. 612).
3. Together both the text and the reader provide necessary interpretations of scientific knowledge (Hand,et al., p. 612).
4. Text is essential to the study of science (Hand,et al., p. 612).
5. Texts "invite and allow interpretation" (Hand,et al., p. 612). (See also Norris & Phillips)
6. Not all interpretations have equal validity (Hand,et al., p. 612). (See also Norris & Phillips)
7. "Science is the result of cumulative discourse . . . that . . . attaches to and depends on discourse that has gone before and can serve as an attachment for discourse that is to come" (Hand, et al., p. 612).

More recently, other researchers have also highlighted the role of language in learning about science. According to Yore and Treagust (2006), "this research comprises multiple subcultures interested in sociopolitical, sociolinguistic, sociocultural, and

sociocognitive aspects of language in doing science" (p. 292). For example, Yore, et al., (2004) state that "science is a process of inquiry conducted through the use of language" (p. 348). Roe, Alfred & Smith (1998) suggest scientific knowledge can be studied as a narrative. However, little research to date has been conducted with the specific aim of determining the validity of any of these claims in educational settings (Yore & Treagust). Furthermore, the limited number of research projects which have been conducted have largely documented failures to achieve meaningful scientific literacy. For example, some researchers have concluded a knowledge focus prevails in classrooms (Tsai, 2002; Ratcliffe & Millar, 2009). A number of researchers have suggested or shown how students who do not possess school-sanctioned literacy skills can potentially be marginalized in science classrooms (Moje, 1996; Hall, 2005, 2006). Moreover, Norris, et al. (2008), in their analysis of three Canadian basal reading series, found that although expository science passages were included in the texts, very few activities designed to teach students how to effectively analyze and interpret scientific texts were included in any of the selected programs.

How are schools to adapt to optimize the relationship between literacy and science in the classroom? The Island Group asserts that "science teachers must . . . view themselves . . . as teachers of science literacy" (Hand, et al., 2003, p. 613). Yore, et al., (2004b) argue that schools should foster "a culture that places strategic language activity, critical thought, and social relevance at the core of science learning" (p. 347). Unfortuately, according to the 2005 NAEP science assessment, 42.7 percent of eighth grade students scored at the "Below basic" level as did 48.2 percent of 12th grade students (Provasnik, KewalRamani, Coleman, Gilbertson, Herring, Xie, 2007). These dismal

results coupled with the pressures placed on schools by current federal education legislation have often situated educators in opposition to the suggestions of current researchers and toward a more reductive curriculum.

Language use as a social practice in science classrooms.

Gee (2004a) advocates a focus on literacy practices as unique and specific to social practices in various content areas. He emphasizes the importance of integrating language learning into content area study. Gee points out that "children need to be able to produce, not just consume, academic forms of language and, thus, must not just learn about them but acquire some degree of control over them, at least enough to write and speak them in school" (Gee, et al., 2005, p. 43). Indeed, the "degree of control" required for a student to be considered a competent language user in specific domains is a recurrent issue. Furthermore, Gee (2005b) asserts that "lifeworld language is problematic for science" (p. 30). He contends that everyday language can function as a barrier to understanding scientific discourse because of its "patterns and associations, repetitions and parallelism, what might loosely be called 'poetic devices'" (p. 32). Gee points out that scientific language is valued for the precision lacking in everyday language. Unfortunately, Brown (2006) found the minority high school students in his study reported more difficulty appropriating scientific language than learning scientific practices. Brown suggests this difficulty may serve as a "gatekeeper for students who attempt to assimilate into the culture of science" (p. 121) if it is not addressed in the classroom context.

The use of language has been characterized as both a means and an end in science.

> It is a means of doing science and constructing science claims . . . . [and] an end in that it is used to communicate the inquiries, procedures and science understandings to other people so that they can assess the validity of the knowledge claims, make critical decisions about the claims, and take informed action on related problems (Yore, et al., 2006, p. 113).

For example, Yore, et al., (2006) found that for scientists "making research results public was an intergral part of doing science . . . . The peer-review process helps monitor the quality of science claims" (p. 128). One of the scientists they studied remembered specific occasions on which he developed new ideas as a result of engaging in peer review and revising (p. 131).

Hand and Prain (2006) point out that language can either be viewed as a feature of a specific domain which requires study or as an epistomological tool that can be used to learn about a domain. Several researchers (Gee, 2004a; Hand & Prain, 2006; Yore, 2004b) have suggested that language is a tool for understanding science. For example, Yore, et al., (2006) characterize "scientific language [as] . . . a problem solving tool" (p. 110). However, Norris and Phillips (2003) caution against the idea that reading and writing function simply as tools in science. Rather, they suggest, scientific study is constituted by language use. Furthermore, even seemingly simple science literacy tasks can be more complicated than they appear. For example, according to Roth, "a standard interpretation or reading of a graph requires familiarity with (a) situations or phenomena that the graph might represent, (b) data collection and instrumentations that lead to suitable data, and (c) rules of transformation to get from the data to the graphical representation" (Gee, Roth, & Yerrick, 2005, p. 73). Wu and Krajcik (2006) showed

providing seventh grade students carefully scaffolded and sequenced tasks incorporated in an inquiry format could not only promote student knowledge but also production of representations of science knowledge.

Hand, et al. (2003) delineate the language practices they consider essential to the social practice of science.

> recording and preserving data; encoding accepted science for anybody's use, reviewing of ideas by scientists anywhere; (intertextuality); communicating ideas between those who have not met or lived at the same time; encoding variant positions; and focusing attention on a text for the purpose of interpretation, prediction, explanation, or test (p. 612).

However, Roth (2005) disputes the idea that students should adopt the formal language practices of scientists. He suggests it would be more useful for students "to be able to participate in creating an issue-oriented special purpose language" (p. 68). Roth contends that the development of scientific language requires greater involvement in a scientific Discourse community than is available to students in a science classroom (pp. 61-62). Yore and Treagust (2006) echo the idea that learning formal scientific discourse is akin to learning another language. "A three-language (home language, instructional language, science language) problem exists for most science language learners that parallels English language learning" (p. 296). In addition, Hand and Prain (2006) point out that students in essence have two tasks in science learning, both learning how scientific representations work and how they are used (p. 102). For example, not only do students have to learn the correct modes of language for writing a lab report, they also have to learn about the correct uses of a lab report.

Additionally, a number of researchers have addressed specific aspects of language use in classrooms. One primary consideration has been the use of various texts in content area classrooms. For example, Sturtevant, et al., (2006) point out the multiplicity of texts as well as the multiplicity of uses for these texts across the content areas (p. 17). Norris and Phillips (2003) assert the importance of a critical stance and a "mastery of literate thought" (p. 228) in the interpretation of content area texts. They contend that although "not all interpretations of a text are equally good, . . . usually there can be more than one good interpretation" (p. 228). Yore and Treagust (2006) assert both current international reforms as well as national science reforms support an emphasis on critical reading in addition to a knowledge emphasis (p. 293). Indeed, Baker (2004) draws a parallel between the inquiry focus of the National Science Education standards (National Committee on Science Education Standards, 1996) and teaching students to monitor their comprehension (p. 240). Kamil and Bernhardt (2004) assert specific types of knowledge and strategies are important to reading science. However, Norris and Phillips (2003) caution "science educators need to be concerned by the possibility that many students will bring to their science learning the simple view of reading" (p. 230) which is the view that one reads simply for the facts.They assert students must be able to engage in more sophisticated reading including evaluating statements and drawing conclusions (p. 235).

Other researchers have specifically addressed the functions of written texts in the study of science. For example, Kamil and Bernhardt (2004) argue for the importance of written language in science, citing the publication and peer review process (p. 124). Yore, et al. (2006) found that the scientists in their study felt they were able to evaluate and refine their findings through peer review (p. 109). Still others describe the functions of

writing in science classrooms. Yore, et al., (2004b) assert there are two perspectives for writing in science classrooms, "enculturation of learners into the discourse practices (genre perspective) and personal engagement of learners (diversification perspective)" (p. 349), and, in addition, they assert it is incumbent upon teachers to effectively communicate to students which purpose each writing assignment serves. Furthermore, both Yore, et al., (2004b) and Wallace, et al. (2004) promote writing as a means of supporting conceptual understanding.

In addition to student-produced texts, other forms of written text are important for student learning in many science classrooms. Heath and Street (2008) point out a number of challenges posed by science textbooks. They are multimodal; they "cross-reference other sources of information such as scientific report, newspaper, recipe book, or pamphlet from the family dentist" (p. 22). Illustrations and text labels can be used for different purposes on the same page or can be missing from the text entirely. Readers are expected to know how to make connections across modes and texts. Furthermore, they suggest texts make presuppositions about background knowledge and language socialization.

Moreover, science textbooks have a unique vocabulary. Although it is possible to understand an academic language as "largely as a set of verbal definitions" (Gee, 2004a, p. 18), Gee argues this limited understanding ultimately "is not useful when one has to engage in any activity using a specialist language" (p. 18). Instead, one must be able to make use of the situated meaning of a word which, according to cognitive psychologists, is "stored in the mind/brain not in terms of propositions or language, but in something

like dynamic images tied to perception" (Gee, 2005b, p. 25). Therefore, according to Gee (2005b)

> the crucial question becomes, *what sorts of experiences . . . – in terms of embodied practices and activities, including textual, conversational, and rhetorical ones – has this person had that can anchor the situated meanings of words and phrases of this social language?* (pp. 27-28).

Furthermore, according to the Island Group, "science language is a technology for solving problems" (Hand, et al., 2003, p. 610). They assert that although the dialects that students learn at home are important, if schools fail to impart academic vocabulary to some students, schools leave "some richer because they have effective tools for activities schools ask them to do, and some poorer because they are left without these tools" (Hand, et al., p. 611).

Brown and Ryoo (2008) investigated the influence of connecting the everyday discourse of students to learning about scientific phenomena on the learning of science vocabulary. They used computer simulations to give students experiences which could be understood in nonscientific language prior to teaching scientific vocabulary terms for the phenomena under investigation. These students scored significantly higher on a postest than a comparison group which encountered the simulations and the scientific vocabulary simultaneously. Barton and Tan (2009) were able to demonstrate how incorporating family, community, peer, and popular culture funds of knowledge and Discourse into a unit of study could improve the academic performance of sixth grade science students. The students in their study not only earned higher grades on this particular unit of study than on any other throughout the course of the school year but

also were able to demonstrate their learning by completing several literacy-related tasks including completing a comprehensive nutrition guide, making a poster, and providing written explanations. Reveles and Brown (2008) described how two teachers were able to scaffold scientific discourse for elementary school students in such a fashion that the students were able to adopt scientific discourse practices.

In addition, the influences of popular culture and new technologies on science learning and on learners cannot be overlooked. Hand and Prain (2006) suggest " the issue of how students' everyday representational resources (talk, reading, writing, multimodal representations, multiple representations) can be used" (p. 102) should be evaluated. Similarly, the Island Group asserts the context and cultural practices associated with the uses of specific texts must not be overlooked (Hand, et al., 2003, p. 609). Other researchers (Gutiérrez, 2008; Moje, et al., 2004) have investigated the concept of a "third space" which can be created as a result of classroom interactions. Such investigations acknowledge the potential influence of students' social and cultural worlds on not only interactions but also on student learning. However, although Moje and her colleagues were able to document a number of different funds of knowledge (González, Moll, & Amanti, 2005), including popular culture, available to the middle school students they studied, they also found these students did not often share this knowledge in their science classrooms even when it was directly relevant to what was being studied.

Another important consideration in any analysis of the intersection of science and literacy is of the various text types, most especially in relationship to technological innovation, available today. Alvermann (2004b) explains how these new literacies can

support student learning in concert with inquiry activities (p. 226). Yore and Treagust (2006) assert that educators have not yet mastered the full extent of these potentialities (p. 308). Moje and Dillon (2006), enumerate what they see as the goals for literacy educators. They assert educators should aspire to move

> the vast majority of young people . . . from “basic literate proficiency (e.g., extracting a main idea from a single, short passage) to sophisticated textual and intertextual processing and practices . . .includ[ing] literate acts such as reading across multiple print texts; integrating ideas from print with visual, oral, and performed texts; synthesizing and communicating findings or ideas in written, oral, pictorial, iconic, and performed forms; and critiquing, expanding, or reconstructing ideas garnered from multiple sources.
>
> (p. 105)

Furthermore, Gee (2004a) asserts that “students need to have ‘reading lessons’ on such expanded texts” (p. 31) which are characterized by modeling and explicit discussions about language and genre as well as content. Still, the Island Group cautions students should also be well-versed in the uses of more traditional science literacies (Hand, et al., 2003, pp. 613-614). Hand and Prain (2006) argue that it is important for educators to find “linkages across . . . modes - [reading, writing] talking, listening, representing, viewing, interpreting, and so on” (p. 102). Roth (2007) asserts it is students themselves who are finding these linkages. In his analysis of case studies of students in middle school science classrooms, he suggests current views of scientific literacy overlook both the innovations of these students and the collective nature of these literacies. Further, he

suggests scientific literacy should be defined based on the capacity to create rather than on any set of received knowledge or skills.

Sociocultural and cognitive emphases in the study of scientific literacy practices.

The various aspects and modes of both understanding and representing scientific inquiry have been considered by researchers from a number of different disciplines and theoretical perspectives. Cognitive psychologists have emphasized the important role of critical thinking in science learning. For example, Yore, et al., (2004b) suggest the following cognitive processes are utilized to comprehend science text: "activating prior knowledge of the specific topic, genre, and rules of evidence; analyzing and synthesizing the new information; evaluating the new information with respect to criteria for scientific evidence; and integrating the text-based message with prior conceptions" (pp. 348-349). Yore and Treagust (2006) discussed the role of declarative knowledge in learning science. "Declarative knowledge refers to the knowledge one has about oneself as a learner and the factors that affect performance" (p. 307). According to Yore and Treagust, metacognition builds on declarative knowledge but incorporates both procedural knowledge, (knowledge about strategy use), and conditional knowledge, (knowledge about strategy implementation) (Yore & Treagust, p. 307).
Similarly, Baker (2004) has called the monitoring phase of executive control evaluating (p. 239). For example, Yore, et al. (2006) assert "executive control of science writing involves setting purpose, establishing a heuristic, accessing available information, selecting strategies, generating ideas, evaluating ideas, translating ideas into text, monitoring effects, reflecting, adjusting actions, revising, and assessing internal

consistency" (p. 116). In a study comparing good and poor writers, Ferrari, Bouffard, & Rainville (1998) uncovered both qualitative and quantitative differences in the writers' executive control of task performances.

Driver, Asoko, Leach, Mortimer, & Scott (1994) made visible how metacognitive processes are an important aspect of conceptual change for elementary school students. Koch (2001) developed a series of metacognitive tasks which she had students complete while reading an introductory physics text. She found these students performed better on a post test than a similar group of students who read the text without completing the metacognitive tasks. Wallace, et al. (2004) report that one student who used their science writing heuristic, a process "that increases their. . . cognitive and metacognitive engagement" (Baker, 2004, p. 240), commented "not only did we learn, but we found out how to learn" (p. 362). Blank (2000) found that seventh grade students who were taught an ecology unit incorporating a metacognitive routine showed more evidence of meaningful learning six months after the end of the unit than did a control group. Collins, Palincsar, & Magnusson (2005) showed how an instructional framework which included revoicing could promote metacognition in fifth grade students engaged in an inquiry framework to investigate a natural phenomenon.

Other researchers have focused on social and situational factors affecting science learning. For example according to Gee (2005b), "more children fail in school . . . because they cannot cope with 'academic language' than because they cannot decode print" (p. 20). Gee contends that academic scientific language is but one of many social languages that compose the English language. In addition, Gee asserts modeling and coaching are both necessary for novice users to fully adapt to the practices of any

particular social language (Gee, Kelly, Roth, & Yerrick, 2005). Furthermore, Roth (2005) suggests, "At the individual level, new forms of language also *emerge* rather than being the result of conscious design . . . But emergence also means that outcomes cannot be predicted or forced to occur with any precision." (Roth, 2005, p. 49).

Indeed, the influence of sociocultural factors on student science learning has been discussed most often in relation to struggling readers. Gee (2005b) points out, *"Language acqusition crucially involves access to and simulations of the perspectivies of more advanced users of the language in the midst of practice"* (p. 28). Alvermann (2004b) makes the point that as a result of their minimal reading experience, poor readers also lack background knowledge and vocabulary and have often failed to acquire the important comprehension skills needed to grapple with scientific text (p. 230). (See also Stanovich, 1986). Alvermann contends that the lack of literacy skills possessed by some students may cause their science teachers to "expect less of low-achieving readers in exchange for the students' good will and reasonable effort in completing their assignments, which typically require little, if any, reading" (pp. 230-231).

Gee (2004a) cautions acquisition of a new language can be problematic for an individual (p. 15). This is because, according to Roth (2005) "my acquisition of another language, whether cultural or discipline-specific, not only involve[s] the addition of another code but also change[s] who I am in relation to others and how I understand myself" (p. 46). In order for students to understand and aspire to the social and cultural groups which use the language, both Gee (2004a) and Kelly (Gee, Kelly, Roth, & Yerrick, 2005, p.40) explain they must first understand the "socially situated identities and activities that use the social language" (Gee, 20041, p. 17). Gee further describes the

difficulty acquisition of academic language presents for some students because this acquisition results in “a disassociation from, and even opposition to, their lifeworlds because their lifeworlds are not the type of middle-class ones that have historically built up a sense of shared interests and values with some academic specialist domains” (2004a, p. 18). Gee (2005b) suggests that “the crucial question in science education ought to be: *What would make someone see acquiring a scientific social language as a gain?*” (p. 23). This should be a significant consideration for any educator who hopes to build academic language capacity in struggling readers, who are often also students whose economic and cultural circumstances are not middle class. Gee asserts to see gain from social language acquisition learners must:

> (a) believe they can now or will in the future be able to function with this social language to accomplish worthwhile goals of their own (even if this is just getting into college), (b) be able to make (and be helped to make) bridges between other identities and forms of language they bring to the classroom and the new social language, (c) trust that the discourses associated with the new social language will not denigrate them or oppress people “like them”, and (d) see themselves as becoming an accepted and valued member of a group of people who use and value the social language (Gee, Kelly, Roth, & Yerrick, p. 41)

On the other hand, the Island Group contends that “youths who struggle with reading and writing in school often demonstrate a range of literate behaviors in less formal learning contexts” (Hand, et al., 2003, p. 610). For example, Alverman (2001a) described the literate behaviors of one student in an afterschool club. O’Brien (2006) suggests the potential of multimediating at school to change the perceptions struggling readers have of themselves within the school discourse because their familiarity with the

semiotic modes and associated grammars of various multimedia forms will generate confidence (p.38). However, in some respects these less formal approaches can be problematic, especially in terms of the acquisition of language. According to Gee (2005b), while less formal approaches make afford those who have already acquired a specialized academic vocabulary the opportunity for additional practice, students who do not possess such a vocabulary may be in danger of failing to understand or, worse, misinterpreting information (p. 36). In order to circumvent this difficulty, Gee (2005b) suggests "mono-dialogical discussions" . . . . where children are asked to take longer turns, expand their language, and make clear their reasoning and its connections to what others have said" (p. 36).

Moje and Dillon (2006) provide a list of questions teachers should consider as a result of their examination of how two students enact their particular identitites in one science classroom. Specifically, among other considerations, Moje and Dillion examined how these students' identities both assisted and impeded their learning of science and how their identities were mediated by their relationships with the teacher and the other students in the class. They made three classroom recommendations at the conclusion of their study:

- Teachers should be thoughtful about what identities they are expecting their students to enact and what literacy demands those identities entail.
- Teachers should be thoughtful about the identities they are enacting.
- Teachers should be thoughtful about the appropriateness of the participant structures in their classroom and the identities and literacy activities those structures provoke.

Instructional strategies.

A number of instructional strategies, incorporating both oral and written language, have been advocated for science classrooms. Yore and Treagust (2006) emphasize the importance of "embedding of explicit language tasks and instruction into science inquiry" (p. 296) in order to assist students in mastering the language demands of science. Wallace, et al. (2004) found that engaging students in writing their own questions, group discussions and writing about their learning increased learning in science. In addition, the use of these strategies promoted the use of metacognitive strategies among the students that they studied. Baker (2004) also suggests writing enables students to be metacognitive in addition to enabling students to "state their content knowledge" (p. 253).

Several researchers have emphasized critical thinking and argument. Yore, et al., (2004b) highlight the importance of argument to the advancement of scientific thought and suggest that "argument can be incorporated by structuring lessons to consider plural theoretical accounts of science" (p. 348). They suggest the use of argument results in "cognitive gains in students' understanding as well as a change in the nature of the traditional discourse pattern that dominates science classrooms" (p. 348). Bell (2008) and Akerson and Hanuscin (2007) emphasize the importance of challenging students' absolutist views of the nature of science. Bell advocates a process skills approach to teaching the nature of science. This approach emphasizes the tentative and creative nature of scientific inquiry and the function of background knowledge while acknowledging the role of empirical evidence in the formation of valid scientific theories. Such an approach, requiring critical thinking skills such as inferring, predicting, classifying, analyzing, and hypothesizing, is heavily dependent on students' language skills. According to Hand and

Prain (2006) if language in science is viewed as a tool (see also Yore, et al., 2004b), the emphasis should be on "the use of focused discussion, argumentation, explicit science reading instruction, and diversified types of writing" (p. 104). Furthermore, they assert that "the critical stance developed during text production should be transferred to reading science text and judging oral and written arguments about science, technology, society and the environment issues" (p. 106).

Gee (2004a) speaks to the role of the teacher in modeling and scaffolding instruction when he asserts that in order for students to internalize academic language necessary for science they "must [have] access to and simulations of the perspectives of more advanced users of the language as these are used in practice" (p. 22), similar to the way children learn language in infancy. (See also Yore, et al., 2004b). Blank (2000) found students who engaged in a learning cycle including metacognitive strategies retained conceptual understandings six months after the completion of the learning cycle. Hand and Prain argue that it is important to find "linkages across . . . modes - [reading, writing] talking, listening, representing, viewing, interpreting, and so on" (p. 102) that build on one another and suggest the "sequence of representational tasks [could] be structured to maximize learning" (p. 102). (See also Yore & Treagust, 2006).

Furthermore, many math and science teachers report difficulty making pedagogical decisions that are effective for struggling students (RAND Corporation, 2007, p. 2). At the same time, other researchers have described the difficulty poor readers have when confronted with content area texts. For example, while Shanahan (2004b) found students believed they needed to read their science textbooks, she also cites a number of problems students have when reading them (p. 371). One suggestion has been

to provide multiple texts to better meet the needs of all learners. Ivey (2006) cautions "it is highly improbable that anyone will devise a new strategy that will help struggling readers access materials that are too far beyond their reach . . . alternative materials spanning the gamut of difficulty levels and genres must become the centerpiece of instruction and learning" (p. 56).

One framework which includes specific literacy practices with the study of scientific concepts is Concept-Oriented Reading Instruction (CORI). CORI is an approach that incorporates writing and comprehension strategy instruction into engagement in scientific inquiry (Deshler, Palinscar, Biancarosa, & Nair, 2007, p. 147). Gutherie et al. (2004) found a group of third grade students who were taught cognitive strategies and given motivation support in the form instructional strategies such as text choice and the use of collaboration performed better on all measures of reading science text than students who received traditional instruction or only cognitive strategy instruction. Roth (2005) suggests the use of "collective concept mapping for allowing students to talk science" (p. 52). Baker (2004) also argues that science instruction should incorporate cognitive strategies and develop skills in context, encourage metacognition and a critical stance, and use the same lesson organization being used to teach reading. However, Saul (2004) asserts these instructional strategies are not commonly used in schools today (p. 5)..

Furthermore, Yore and Treagust (2006) assert many language tasks in elementary and secondary school science programs are poorly implemented. Although they note "the increased popularity of science programmes (Full Options Science System, Science and Technology for Children, etc.) and requirements by states, such as Florida, for science

materials [to] . . . include or require language considerations" (p. 292), they point out these materials are not properly used in classrooms and further note most practitioner journal articles on this subject contain "numerous suggested applications for classroom practice with little or no theoretical or evidential base to justify their claims" (p. 292). Yore and Treagust (2006) suggest some criteria for evaluating language activities in science.

- "Do the language tasks reflect or result in authentic science discourse, literacy for citizenship, and participation in the public debate about STSE [science, technology, society, and environment] issues?" (Yore & Treagust, 2006, p. 303)
- "How do the language tasks relate to models of learning underlying research or instructional practice?" (Yore & Treagust, p. 303)
- "Do the enhancements to the fundamental sense of science literacy produce associated enhancements in the derived sense of science literacy?" (Yore & Treagust, p. 304)
- "Do the language tasks enhance or utilize specific pedagogical assumptions involved in effective science instruction?" (Yore & Treagust, p. 304)

The current climate of accountability in education has necessitated a focus on the literacy skills of elementary school students since the implementation of the No Child Left Behind Act in 2001. Recently, the focus has shifted to the middle and secondary school levels because of a recognition that many students are unable to demonstrate the literacy skills necessary to succeed in college or the workplace. According to Gee (1996),

the modern world is characterized by increased *variety, variability,* and *diversity.* Effective functioning in these "New Times" requires more complex skills. Indeed, according to O'Brien's (2006) cyborg theory, physical changes are occurring in the human brain in response to these increasing demands. Although many factors impact the success or failure of adolescents to achieve adequate literacy skills during the years they spend in individual classrooms, these factors are not confined to these classrooms. Therefore, it is necessary to attempt to understand adolescent literacy achievement from within historical, sociocultural, psychological, and pedagogical paradigms if there is to be a possibility of effecting change to benefit adolescents. Furthermore, the presence of these influences in individual classroom discourse, including science classrooms, has both more general social and more specific individual cognitive impacts and consequences, the implications of which have been infrequently examined and are poorly understood.

CHAPTER III

METHODOLOGY

This study examined how students who perform poorly on standardized reading tests and have been positioned as “struggling readers” use literacy practices to learn in a content area. The research question addressed in the study is as follows: What are the affordances and constraints in opportunities for participation and learning in literacy events for “struggling readers” in a sixth grade science classroom?

These areas will primarily be examined by analysis of language in classroom interactions. There are four foci for the study:

- How struggling readers **interact with the literacy practices** of this science classroom to participate and learn in the discourse of science;
- How **language differences** impact student participation and learning;
- How various **participant structures** impact student participation and learning; and
- How struggling readers use **their social and cultural identities and associated practices and everyday funds of knowledge** to participate and learn in the discourse of science.

The research question was addressed in a microethnographic study describing classroom factors that facilitate or hinder literacy achievement in science. An ethnographic study is an appropriate method for uncovering the historical and contextual factors related to literacy events because any understanding of affordances and constraints for literacy learning for a particular group of students necessitates a thorough

understanding of classroom culture. Furthermore, such an understanding requires in-depth observations of interactions in a specified setting (Heath & Street, 2008). Student learning will be described based on a model delineated by Gavelek and Raphael (1996). Gee’s (2005a) Discourse analysis methods as well as methods suggested by Bloome, et al. (2005), Bloome, et al. (2008), along with those from an edited volume (Cole & Zuengler, 2008) were used for describing cultural and linguistic factors impacting student achievement in literacy.

Theoretical Framework

Two different schools of thought, arising at approximately the same time, emphasized the social nature of learning and serve as the framework for this study. Vygotsky advanced cultural historical theory while Mead developed symbolic interactionism. Vygotsky’s cultural historical theory encompasses three themes (Gavalek and Bresnahan, 2009; Wertsch, 1985). These themes are the social origin of mental processes, the importance of signs and tools, and the origins and development of psychological functions. Vygotsky believed the intrapsychological state developed primarily as a result of interactions in the social world. According to Vygotsky (1978), internalization occurs when “an interpersonal process is transformed into an intrapersonal one” (p. 57).

Furthermore, according to Wertsch (1985), Vygotsky’s “notion of social interaction and its relation to higher mental processes is heavily dependent of the forms of mediation (such as a language) involved” (p. 15). Holland and Lachicotte, Jr. (n.d.), explain when meaning is associated with an object or a behavior such as a gesture, a facial expression, or an utterance, the object or behavior becomes a mediating device.

Vygotsky (1986) labeled mediating devices such as words, sounds, and number systems as signs. He believed signs were important both in the external social world and to the internal mental processes of individuals. In fact, he asserted "understanding between minds is impossible without some mediating expression" (p. 7). He further suggested signs are important to internal mental processes; for example to "mental operations involving the use of signs such as counting and mnemonic memorizing" (p. 86). Vygotsky was primarily concerned with language as a sign system that culminated in abstract thinking. Gavalek & Bresnahan, (2009) assert Vygotsky believed "the abilities to read and write enabled individuals to use language as a first order system thus enabling the beginnings of the ability to think abstractly" (p. 144). On the other hand, Vygotsky cautioned in the external social realm "direct communication between minds is impossible, not only physically but psychologically. Communication can be achieved only in a roundabout way. Thought must first pass through meanings and only then through words" (Vygotsky, 1986, p. 252). Therefore, Vygotsky believed signs had the ability to foment development through their use in social interactions.

Interestingly, Vygotsky's theories were developed in response to some of the same educational concerns prevalent in American society today. According to Wertsch (1985), Vygotsky was responding to illiteracy, cultural differences, and the lack of special services for the disabled. As a result of these concerns, Vygotsky was primarily concerned with the internal mental processes of individuals that result in learning. This lead to his theorizing the zone of proximal development, ". . . the difference between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or

in collaboration with more capable peers" (Vygotsky, 1978, p. 86). According to Vygotsky, "the only 'good learning' is that which is in advance of development" (p. 89). Therefore, Vygotsky "viewed instruction as an aspect of the social" (Werstch, 1985, p. 71-72).

Mead was a sociologist who concerned himself primarily with the content of social interactions. His theories resulted in the branch of sociological social psychology known as symbolic interactionism which served as the basis for the later theories of Goffman. According to Charon (2010), "symbolic interactionism focuses on the activities that take place between and among actors" (p. 28). These "activities" are interactions. The major tenets of this theoretical perspective are in many ways similar to the perspective of Vygotsky. According to Charon, these tenets are as follows:

1. Human actions are the result of social interactions.
2. Interaction occurs both externally in the social world and internally within individuals.
3. Humans define their environment.
4. Human actions are the result of their present context.
5. Humans are active in their environment.

Therefore, according to Charon, symbolic interactionists believe "*to understand human action, we must focus on social interaction, human thinking, definition of the situation, the present, and the active nature of the human being*" (p. 29).

Both Wertsch (1985) and Holland and Lachicotte, Jr. (n.d.) suggest a similarity between Vygotsky and Mead in the ways they conceptualize the formation of the mind and identity via interaction with the social world. While Mead was primarily interested in

what Wertsch terms the "social act" (p. 59), Vygotsky "emphasized how the mind and personality, as sociogenetic products, *developed*" (Holland and Lachicotte, Jr., p. 2). Both Mead and Vygotsky felt this social process distinguishes humans from animals (Vygotsky, 1978; Charon, 2010). A blending of these two perspectives as a theoretical framework for understanding classroom literacy events has the potential to illuminate both the social features of classroom interactions during literacy events and how these features work to influence the intrapsychological processes of individuals.

Setting

This study was conducted during the spring of 2010 in a middle school in Virginia in a sixth grade science classroom. At that time, 30% of the teaching staff at Hillsdale Middle School[1] had obtained their Master's Degree. Approximately three-quarters of the staff members had been teaching more than ten years. The middle school was comprised of 350-400 students and is located in a small town. Approximately 30% of the school's students had identified as minority and 30% were identified as economically disadvantaged.

The students in this class stayed together throughout the day as they traveled in a group from teacher to teacher. Ms. Sand, the science teacher, was also their homeroom teacher and their English teacher. Their English class occurred daily during Core 1, the first class period after homeroom. The 70 minute Science class met daily after lunch during the fourth core period of the day. This was the last core period for the sixth grade students as it occurred just prior to the daily exploratory period.

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[1] All site, teacher and student names are pseudonyms.

Students met for homeroom, English, and Science in Ms. Sand's classroom. The classroom was the next-to-last room on the sixth grade wing of the building. The desks were arranged in rows which were two deep around three sides of the room. One wall of the classroom has a row of windows spanning the length of that side of the room. These windows are on the back side of the building. Just outside the windows is a large field which is bordered by a chain link fence. On the other side of the fence is a two-lane highway that serves as the main east/west route for the county. Cars and tractor trailer trucks can be seen traveling this route, but seldom is more than one vehicle visible on the road at a time. A small building housing the school system's alternative education program and the school bus parking lot are also visible outside the window.

Most of the students in the class sat on the side of the room with the windows, and students generally sat in the same seat daily. Ms. Sand's desk was located at the front of the room in front of the whiteboard on the side of the room closest to the windows. (See Appendix A Seating Chart for the usual classroom seating arrangement.) The remainder of the furniture in the room consisted of a long table located under the windows at the back of the room, file cabinets, a large freestanding storage closet, three small bookcases, and a large wooden lectern at the front of the room. At the beginning of the study, science projects, models of the solar system, were displayed on the long table. In addition, a moveable bulletin board was located at the back of the room to block off an area for storage. The area above the windows was decorated with inspirational posters, a chart of the periodic table of elements, and a writing rubric poster, and the bulletin board depicted a male figure dressed as a scientist. Two small microscopes were on top of a

bookcase containing dictionaries. (See Appendix B Room photographs for photographs of the various sections of the room.)

Subjects

A purposeful sample was used to provide insight into literacy practices in a sixth grade science classroom. The teacher and the students enrolled in a sixth grade general science class were the subjects of the study. The specific class included in the study was chosen based on the availability of subjects who have been previously identified as "struggling" readers and who fit the profiles to serve as key informants for the study. Although the researcher primarily focused on a subset of students, those who had been identified as likely to experience difficulty with sixth grade literacy practices, these students could not be studied apart from the context of the entire classroom. Furthermore, a thorough description of how these students interact with classroom literacy practices would need to include comparison with the interactions of students who have not been predicted to experience difficulty with sixth grade literacy practices.

Typically, a large amount of quantitative data is collected during the elementary school years in order to describe student strengths and weakness in various dimensions of literacy learning. A number of factors have been well-described as contributing to the overall literacy learning of students (National Reading Panel, 2000). Among these are such indicators as the number of words a student is able to read in a minute, vocabulary knowledge, how well a student comprehends passages at a particular text level, performance on classroom reading tests, and state assessment test results. Furthermore, basal readers are commonly used for elementary reading instruction and such instruction tends to be proscribed and invariant. Based on a review of current literature related to

both reading skills and current reading assessments the following eight variables were selected to identify students for this study: fifth grade reading Virginia Standards of Learning test score, Gates-MacGinitie Reading Test Vocabulary subtest NCE score, Gates-MacGinitie Reading Test Comprehension subtest NCE score, a fluency score, words read per minute, fifth grade third quarter reading/writing test score, fifth grade fourth quarter reading/writing test score, an instructional reading level score, and a fifth grade teacher ranking of instructional reading level. Data were collected by individual classroom teachers over the course of the fifth grade year. These data are entered on spreadsheets and submitted to the county administration at the end of the fifth grade year. The exceptions to this procedure are the fifth and sixth grade Virginia Standards of Learning tests which are taken by students in May of the fifth and sixth grade year. The results of these tests are reported directly to the county administrative test coordinator electronically between June and August of each year. When available, attendance data was also incorporated in order to assess the influence of poor school attendance as a factor in literacy achievement for this particular population. Ultimately, seven students, Alice, Clyde, Jack, Javon, Lloyd, Niah, and Sierra, were identified as "struggling" readers.

Two specific students, Niah and Lloyd, both of whom were identified as "struggling readers", were originally identified as key informants. One student, Niah, was selected because she was earning passing grades in the science classroom while the other, Lloyd, was a student who was failing science. A third "struggling" reader, Jack, was identified as a key informant during the course of the study. Furthermore, two additional students, one male and one female nonstruggling reader, Tara and Sam, were

identified as key informants. These were students who had not been predicted to experience difficulty with sixth grade literacy practices, and they were selected to serve as key informants for purposes of comparison. They were selected on the basis of their current science grades. Although the original goal was to select one student who was passing science and one who had a failing grade average, none of the nonstruggling readers had a failing average in the class.

The researcher functioned as a participant observer in the classroom, fulfilling the duties of a reading specialist. According to Patton (2002), a participant observer must seek to uncover insider views of the situation while at the same time remaining aware of his outsider status. Heath and Street (2008) suggest "an *etic* or *constant-comparative* perspective enables us to understand underlying actions and their co-occurring patterns and textual features" (pp. 43-44). This information can then be used to inform analyses of data gathered from an emic perspective. There was no cost associated with the project. Permissions were obtained from the school system, the principal, the teacher, and the parents or guardians of the students who served as key informants. Additional permissions for video documentation were obtained from each student's parent or guardian. IRB approval (200902088) was obtained. Observations were conducted during the spring semester of the 2009/2010 school year.

Instrumentation

Formal interviews were conducted with the teacher and four of the focal students at the beginning, middle, and end of the study. The fifth student, Jack, was asked the three sets of interview questions at the end of the study. The interview questions are available in Appendix C *Interview Protocols*. The purpose of the first teacher and student

interviews was to uncover the thinking of these individuals about learning, science, literacy, and the classroom culture. In addition, the first student interviews also included questions designed to lead to the development of a background description of the primary Discourse of the students. The purpose of the second interview with the teacher was to develop a background description of the primary Discourse of the teacher. These life histories and background descriptions served as a frame for understanding classroom observations. Gee's (1989) definition of Discourse as "ways of talking, acting, interacting, thinking, believing, and valuing, and sometimes characteristic ways of writing, reading, and/or interpreting" (p. 20) was used to develop interview questions that sought to assess this primary Discourse as it stood in relation to the classroom discourse. The second interviews with the students were for the purpose of obtaining specific information concerning their attitudes and perspectives about the science class itself. The purpose of the concluding interviews was to further probe the intersection of participants' primary Discourse and the secondary Discourse of the classroom. In addition, an observation protocol was used to focus classroom observations. The observation protocol is available in Appendix D *Observation Protocol.*

Data Collection Procedures

Data were collected over the course of twenty school days in May and June of 2010. (See Appendix E Observation Calendar) Science class was cancelled for three of those days due to state testing. Student interviews were conducted on those days. The teacher, Ms. Sand, and four focal students (Sam, a nonstruggling reader, Tara, a nonstruggling reader, Niah, a struggling reader, and Lloyd, a struggling reader) were each interviewed three times over the course of the study. In addition, a fifth focal student

who was a "struggling" reader, Jack, was added during the study. Jack was not initially identified as an interview subject because he was not enrolled in the class at the beginning of the year. However, because he appeared to be experiencing significant difficulty in the class and because he was involved in a number of key incidents during the observations, I decided to conduct an interview with him in order to elicit his perspective. All three sets of interview questions were asked of this student in one session at the end of the study.

Data were collected using an interview protocol, a researcher's journal, and audio and video recordings of classroom interactions. Transcripts of the audio and video recordings were typed for analysis. Daily informal conversations were also documented in researcher notes. In addition, 16 formal interviews were conducted. The teacher and four of the key informants were each interviewed three times. The fifth student informant was interviewed once. These interviews were conducted at Hillsdale Middle School at a time and place agreed to by each interview subject. All but one of these interviews was conducted at the beginning, midpoint, and end of the fieldwork phase of the study. The sixteenth interview was conducted at the end of the study. The purpose of the first interviews was to determine the interviewee's conceptual model for his or her role in the classroom. The purpose of the second and third interviews was to collect reflections on the culture of the classroom and uncover how these have been shaped by the histories of the interview subjects.

The remaining 17 days of direct observation were documented using audio and video recordings. On most days, data were collected using either two audio recording devices or an audio recording device and a small video camera. All recordings were

transcribed and compiled into one master transcript for each day of observation. Major class activities were also documented on an observation protocol, and field notes were written on a laptop computer daily during and directly after the observation. Although I most often took on the role of an observer, especially when working with the video camera, students also asked me for help with their work and Ms. Sand included me in the class discussion at times. Artifacts including student work, classroom texts, field notes, photographs, and lesson plans were collected. Student work was collected daily, copied, and returned to the students. Each student in the study was assigned a pseudonym and a corresponding number. All copied work was numbered to ensure student anonymity. Students were asked to bring all study materials to class on the unit testing day, June 2. These were copied and returned to the students the next day. Student workbooks published as an accompaniment to the Science textbook were collected at the end of the year. Ms. Sand also made copies of her weekly lesson plans available for analysis.

The use of field notes, lesson transcriptions, and artifacts permitted triangulation of data. Classroom observations and analysis of artifacts was focused with reference to the Vygotsky Space model as articulated by Gavelek and Raphael (1996). Therefore, the scope of observations included interactions centered around appropriation, transformation, publication, and conventionalization of literacy practices in the classroom context. Transcriptions of classroom interactions and interviews were anaylzed drawing on discourse analysis methods outlined in works by Gee (2005a), Bloome, et al. (2005), Bloome, et al. (2008), and an edited volume (Cole & Zuengler, 2008). According to Gee (2005a) one purpose of discourse analysis is to illuminate "in terms of understanding and intervention, important issues and problems in some 'applied' area (e. g. education)" (p.

8). Gee contends individuals use language to indicate significance; enact activities, identities, and relationships; distribute social goods; make connections; and privilege ways of speaking, knowing, and believing. Furthermore, he contends all instances of language use can be analyzed with reference to how the language is being used to construct these things. Gee suggests these constructions can be analyzed by examination of the social languages, Discourses, intertextuality, and the “themes, debates, and motifs” important to the social group in which they occur. Bloome, et al. (2005) echo these concerns but in a more general fashion. They contend literacy events should be analyzed with regard to their location in time and space, their history and the unique histories of the individuals involved, what happens in the event, and the meanings assigned to the event by the participants.

A major concern of this research project is the socially situated identities of students who have been predicted to experience difficulty with literacy demands in sixth grade and how these identities work to promote or inhibit learning in the context of literacy events in a science classroom. Individuals have multiple identities – indeed, these can be evident in an individual literacy event; therefore, analyses must uncover how individuals work to construct their identities over time in specific contexts. Gee contends individuals construct situated meanings in the moment based on their prior experiences and their understandings of the context. Therefore, an analysis of the language in interactions has the potential to reveal how individuals construct identity and meaning during the interaction. Furthermore, these analyses have the potential to reveal instances of intrapsychological construction of meaning when a number of such interactions are examined over time.

Data Analysis

All audio and video data were transcribed. When multiple recordings were made simultaneously, the resulting data transcriptions were then melded into one transcript of the day’s lesson. Transcription conventions are available in the Appendices. (See Appendix F Transcription Conventions). Data were coded on an ongoing basis using a method of constant comparative analysis which evolved through open coding to identify concepts, axial coding to relate categories to subcategories (Patton, 2002), and selective coding to determine core categories and relationships. For example, the initial code, participant structures, was refined based on the preponderance of four specific participant structures: individual seatwork, group work, triadic dialogue, and media event. These categories were further refined at the end of the study when the transcripts were closely examined for evidence of less common participant structures.

Particular attention was paid to incidences of “co-occurrence” and patterns of occurrence that “take place similarly again and again” (Heath and Street, 2008, p. 38). Results of this coding were used to focus subsequent observations. As I analyzed the results of the Chapter 18 test, data were coded by whether each student had orally answered each question in class the day before the test or the day of the test when Ms. Sand read each question and its four answer choices aloud. Then an investigation was conducted to locate other encounters each student had with the information for each test question. The goal was to determine the "opportunities for learning" for each student for the test items to see how he or she came to know or not to know the answer to the questions. These data were coded by individual case. Later, this process was expanded to include the results of the final exam. Finally, this analysis was expanded when individual student classroom interactions were

coded by participant structure and crosschecked with both the results of the Chapter 18 test and the final exam.

In addition, an expert analyst, a doctoral student in a literacy program, was used to crosscheck the coding of the data. A Cohen's kappa of .93 was computed demonstrating an acceptable degree of interrater reliability. This was particularly important because the researcher, as a reading specialist, has a certain bias regarding the most effective literacy practices for a science classroom. It was possible the researcher may have failed to note literacy practices that do not fit traditional best practice in the field of content literacy.

The language of the students and teachers documented in the transcripts was also analyzed according to Gee's (2005a) framework for discourse analysis. Gee concedes he has blended a number of theories in his framework; however, all have their basis in the social nature of learning. Bloome, et al. (2005), Bloome, et al. (2008), and Cole and Zuengler (2008) will also be consulted as a basis for analysis as these volumes are also concerned with social and cultural factors in literacy events as a basis for analysis of classroom interactions.

Analysis of all collected data was conducted with reference to symbolic interactionism as a method of analyzing classroom Discourse and situating the classroom discourse with a primary Discourse and Social Semiotics in order to assess the effects of language and language differences on student literacy achievement. According to Bloome, et al. (2005) research on classroom literacy events should "create a dialectical relationship among three sets of theories" (p. xviii). These sets of theories are "theories in the field about the classroom language and literacy events being studied" (p. xviii), the

theories behind the approach being taken towards analyzing the discourse, and the theories, often implicit, embedded in the event, including those held by the participants.

This study design can be considered reliable for several reasons. This study was conducted over a long period of time during which daily observations were conducted. Data were triangulated by the use of interviews, observations, and several secondary data sources. Furthermore, data were analyzed with reference to multiple theoretical perspectives; most notably, those of symbolic interactionism, the sociocultural and sociolinguistic theory of Gee (2005a), and Harré's (1984) concept of psychological space. Validity was enhanced by the use of member checks and multiple coders. The researcher conducted informal interviews with all members of the observed class and conducted similar observations in other sixth grade science classes in the school in order to enhance the internal validity of the study's design by limiting reactivity effects.

CHAPTER IV

FINDINGS

The purpose of this study was to closely examine how adolescents who have been identified as "struggling" readers use literacy practices to learn in a content area classroom. Specifically, this study sought to determine the affordances and constraints in opportunities for participation and learning for students designated as "struggling" readers in a sixth grade general Science classroom. There were four foci for the study:

- How struggling readers **interact with the literacy practices** of this science classroom to participate and learn in the discourse of science;
- How **language differences** impact student participation and learning;
- How various **activity structures** impact student participation and learning; and
- How struggling readers use **their social and cultural identities and associated practices and everyday funds of knowledge** to participate and learn in the discourse of science.

Each of the four foci will be examined in depth following an overview of the classroom context.

Observations were conducted during the last unit of study for the year, space exploration, and during the review period prior to the final exam. Just before the beginning of the observation period, students had conducted an experiment in order to learn about rocket propulsion. Although students engaged in some small group work, watched two movies, and used laptop computers to learn about and view rocket launches, much of the focus of classroom instruction was centered around learning the information

needed to answer the multiple choice questions asked on the unit test and final exam. For example, students spent part of one class period using iPod touch devices to access multiple choice practice questions in order to review sixth grade science standards. Several times whole class discussions began in response to student queries; however, these discussions were usually cut short in order to continue with test review or going over material. The observations conducted for this study confirm the findings of a RAND corporation study (2007) in which "many teachers reported narrowing curriculum to focus on tested topics and even certain styles of test questions" (p. 2). Furthermore, an absolutist view of science prevailed as the overarching focus was on knowing the facts in order to be successful on the tests.

The culture of this classroom community was centered around Ms. Sand who planned all of the instruction. She characterized her teaching style as *no nonsense* and stated that she could be flexible but only *after I get structured.* Ms. Sand was considered the ultimate authority in the classroom. For example, on Day 6 of the observation period, Ms. Sand and the students were going over the answers to questions in the science workbook. Students were occasionally uncertain if the answer they had written was correct. Ms. Sand asked the students,

Does anyone else have one they want me ***to rule*** *on?*

Although Ms. Sand and the students viewed the textbook as authoritative and at times attempted to consult it to locate answers to questions, a conversation during an exam review on Day 17 illustrates Ms. Sand's position as the ultimate authority. Students had been asked to name three features of the moon. When no one named highlands, the following conversation ensued:

Ms. Sand: highlands, put it down if you don't have it

Daniel: I put plateaus.

Ms. Sand: craters, highlands, and maria

Daniel: That's what it says in the book.

Ms. Sand: ***No, I'm tellin' you.***

Daniel: okay, okay

Here Daniel is attempting to defend his answer as legitimate because of his claim that the textbook states plateaus are a feature of the moon. However, Ms. Sand insists that he must list highlands rather than plateau as the third feature because she claims this as the correct answer. Her authority overrides that of the textbook.

Ultimately, Ms. Sand's major concern was that the students know the information for the final exam as this was the metric for judging her as an instructor. The exam was viewed by both Ms. Sand and the students as imposed on them by outside forces. In fact, Ms. Sand had little input in the construction of the final exam because it was written by a teacher at another school. Ms. Sand referred to the makers of the test as somewhat mysterious "others" during class discussions. For example, the following exchange with Adam occurred on June 17 just prior to the exam. Ms. Sand had just asked Javon to identify which scientist advocated the heliocentric model from among several choices, and Javon had correctly identified Galileo.

Adam: Galileo and Copernicus right?

Ms. Sand: Right, exactly, but Copernicus wasn't one of your options at that juncture. Now ***they*** *may take out Galileo and put in Copernicus and you would be right, okay.*

Ms. Sand had confidence in her teaching ability and believed her students were capable of doing well on these tests. In my first interview with her, she mentioned two teaching experiences when her students had done well. At her previous school she commented,

> *myself and my teammates given the low children and our children scored just like teachers who had the top*

Moreover, although Ms. Sand recognized that some of her current students were "low", she also felt that some of these same "low" students were actually some of her stronger students because *anything you talk about they have some knowledge of it.* She also asserted *anything oral or hands on you couldn't ask for better.*

In addition, Ms. Sand considered her students to have good reasoning skills and vocabulary knowledge. She also remarked that their test scores had improved over the course of the year. On the other hand, after class on June 10, Ms. Sand observed that it was very difficult to get the students to remember things. Furthermore, when asked what skills she believed her students needed to learn science she gave the following response:

> *They will have to be a pretty good reader and* ***a good listener*** *- although* ***they may not read. A lot of them can hear you say things and they will never forget it.***

Her belief that this particular class learned best by listening coupled with her concern about their ability to remember content most likely were the impetus for the large proportion of class time devoted to oral review of information. In fact, when asked in a student interview to explain how she thought Ms. Sand usually went about teaching science class, Tara explained that Ms. Sand went

over and over it so it can get stuck in our heads so we will remember it on the test

Moreover, Ms. Sand acknowledged there were *some very poor readers in here* and commented *if they were stronger readers they would be top notch.* In the student interviews, Niah and Lloyd expressed difficulty with reading in general and in particular with reading in this science class. For example, Niah explained that she did not like to read because she sometimes had difficulty understanding what she read. She attributed this difficulty to the fact that she *reads too fast*. Although Jack did not express a specific difficulty with reading he observed *I just don't get science*. At the same time he noted some difficulty with reading in science when he remarked *it's a lot of big words and you have to understand what most of it is saying*. The nonstruggling readers did not express a similar difficulty. In fact, Tara felt that reading was one of the easiest parts of science for her.

Furthermore, the "struggling" readers did not necessarily connect success in science to reading. Although Niah did not consider herself a good reader, she also felt this science class was easier than her other classes because *we don't do a lot of reading words*. Although Lloyd felt there was a lot of reading in science, he also twice mentioned that in order to be successful in science, it was most important to listen. Interestingly, listening was the very strength Ms. Sand recognized in this class. Jack was the only "struggling" reader who did not deemphasize reading, and of these three "struggling" readers, he was also the only one who did not have a passing average at the beginning of the study. Despite the fact that Niah and Lloyd did not appear to value reading as an important literacy practice for success in science, it would not be accurate to assume that

reading was an infrequent practice in this science class. In fact, the nonstruggling readers noted the importance of reading to learn in their class. When asked how science was different this year, Sam noted he *had to read more in sixth grade out of the textbook.* He also said one of Ms. Sand's most frequent instructional strategies was to *tell us to take out our textbooks and read* and that he often had to *read paragraphs and do our worksheets.*

Literacy Practices

The purpose of this study was to identify the affordances and constraints in opportunities for participation and learning for "struggling" readers in a sixth grade science classroom. Accordingly, the first of the four foci of the study was to uncover how struggling readers **interact with the literacy practices** of this science classroom to participate and learn in the discourse of science.

In order to determine how students interact with specific literacy practices, it is first necessary to identify the literacy practices with which they are expected to engage. For the purposes of this study, literacy practices were broadly defined as any practices involving reading, writing, speaking or listening located within a social and cultural context. Moje (1996) characterizes literacy practices as cultural tools for making sense of the Discourse of the classroom. Literacy practices in this science class included more traditional school-based practices centered around school textbooks and paper and pencil writing tasks as well as practices involving the use of new literacies associated with digital media.

Literacy practices are embedded in literacy events. A literacy event was defined as "the bit observed from which social and cultural practices are inferred and

conceptualized" (Bloome, et al., 2005, p. 5). A literacy event is analyzed by considering not only its structure but also dimensions of its setting and social and cultural history as well as the actions and "evolving social identities" (Bloome, et al., 2005, p. 120) contained in the event, the distinctive features of the event, and the significance the participants attach to the event (Bloome, et al., 2005). Therefore, any single literacy event has multiple contexts. (Bloome, Carter, Christian, Madrid, Otto, Shuart-Faris & Smith, 2008). Literacy events were the unit of analysis for this study. (See *Figure 2.* Literacy Domains, Practices, and Events on page 19 for an illustration of the relationship between literacy events and practices and the domains in which they occur, in this case, the domain of science.) A discussion of the types of literacy practices uncovered in this classroom and of how students used these practices as tools for learning follows. The literacy events and activity structures in which these practices are embedded are discussed in more detail in **Activity Structures** beginning on page 142.

Reading.

As Sam noted, all of the students in this science class were expected to read and interpret both text and images during the course of this study. Students spent relatively less time interacting with photographs, moving images, and graphics and much more time working with written text. However, the dimensions of their engagement with these texts varied across types of text and literacy event.

Reading photographs, moving images, and graphics.

Students were expected to read moving images on three occasions. On the first day of the study, students used laptop computers to view video footage of rocket launchings. The students interacted very little with each other and instead silently

perused their individual computer screens. Furthermore, over the course of this study, Ms. Sand showed the class two movies related to their study of space exploration, *One Giant Leap* (Carey, G., 1994) and *October Sky* (Johnston, J, 1999). *One Giant Leap* is a documentary which tells the story of the Apollo project though interviews and video footage. *October Sky* tells the fictional story of young men in West Virginia who won a national science fair by building their own rocket. According to my field notes, students appeared more engaged in the fictional movie than in the documentary. This is most likely due both to their ability to identify with characters close to their age in *October Sky* and to their limited background knowledge concerning events associated with the Apollo project since it took place before they were born. However, although some students were frequently inattentive, these same students did engage with parts of *One Giant Leap* with which they could make a connection. For example, Cam was engaged by one particular segment. He exclaimed *oh, Martin Luther King* when a clip of the famous civil rights leader appeared on the screen. This was the first time Cam had been engaged in the video, and he went back to talking to a neighbor when the segment ended.

In addition, the science textbook the class was using contained many photographs, and a number of charts, graphs, and diagrams. However, on the two occasions when the class read aloud from the textbook in a round robin fashion, there was little discussion and no reference to any of the graphics accompanying the text. Ms. Sand became quite concerned about the students' ability to interpret charts, graphs, and diagrams after she was given a copy of the final exam. She commented that there were many more graphics on the exam than had been covered in class. For example, she said they *just talked about* rotation and revolution rather than looking at graphics.

Because of this concern, Ms. Sand subsequently called the students' attention to several drawings on the whiteboard so they would recognize these items on the exam. For example, a specific symbol was used to depict a comet on the exam, and Ms. Sand showed the students a similar symbol on the whiteboard. (See Appendix G Information on the Board G1 Comet drawing) She also referred the students to several diagrams in the textbook during her exam review, for example, a diagram of the phases of the moon that was similar to a diagram on the final exam. This strategy apparently was useful for Niah because she commented in my third interview with her that one of the things that most helped her to understand in science was *when she draws on the board.*

In order to complete two assignments, students also had to read parts of several graphic organizers in the workbooks that accompanied the science textbook. For example, students had to complete a graphic organizer to show the progression of theories about the origin of the moon. In order to successfully complete the organizer, students had to read a graphic in their science textbook. Because the textbook graphic was not read aloud or discussed during the round robin reading of that textbook section, students had to read and interpret this graphic independently. There were also charts and graphs on some of the study guides and practice tests the students had to read. For example, on Day 7 when the students had to read practice test questions on an iPod touch device, Jack encountered a graph. When I saw he had correctly answered the question associated with the graph, I asked how he knew that was the right answer. He said, *because the line goes up and this is the only answer that goes up.* On the other hand, Lloyd missed two questions during the same activity that involved reading charts. It was

not possible to view an entire chart at once on the small iPod touch screen, likely making it much more difficult for Lloyd to understand the chart.

Reading written text.

Students were also expected to read a number of different types of written text, including text visible in the classroom, electronic texts, the science textbook and its accompanying workbook, and various study guides. For example, students were directed to a particular website on Day 7 by a web address written on the board. In addition, Ms. Sand wrote the objectives for the coming week on the whiteboard at the front of the classroom each Friday. (See Appendix G Information on the Board G2 Weekly Objectives.) The objectives, the web address written on the board on Day 7, and the labels on the charts, graphs, and diagrams that were drawn on the board were the only texts visible on the walls of the classroom to which students' attention was directed during the course of this study.

On two occasions all students were expected to obtain information by reading electronic texts. On the first day of the study, students had to use an internet search engine to locate video and other information about rocket launches. According to my field notes, Ms. Jones, the aide, circulated around the room and assisted the students in navigating to various videos. On Day 7 of the study, each student was given an iPod touch device that they used to locate a particular website. They then had to read and answer multiple choice questions related to sixth grade science content. On the final day of the study, Ms. Sand sent both Daniel and Lloyd to the computer lab to locate information. This was because all classroom texts had been collected and packed away

for the summer. Both boys returned to the classroom and reported their findings to the class.

Reading text took the form of oral reading on two days during the study when two new topics associated with space exploration were introduced, the moon on Day 2 and moon missions on Day 4. Both were introduced by directing the students’ attention to a particular section of the textbook. Students then took turns reading segments aloud in a round robin manner. There were a total of 11 turns to read during these two events. Seven students who read were nonstruggling readers, two of whom, Daniel and Pam, had two opportunities to read. Niah and Clyde were the only “struggling” readers selected to read during the two events. Furthermore, the “struggling” readers in the class did not follow along in the textbook during these events. For example, in my field notes for Day 2, I noted that each of the “struggling” readers appeared inattentive while other students were reading. While it is certainly possible these students were listening to the information, they were clearly not interacting with the printed text. Moreover, when Clyde read on Day 2, Pam was the only other student in the class who directed her attention to the textbook. In addition to oral reading of textbook sections, all students had to read aloud from completed workbook pages and study guides when the class was going over answers.

Students were often expected to read their textbooks independently to locate information when completing workbook pages and study guides. The workbook accompanying the science textbook was labeled according to the headings and subheadings in the textbook. Each label also contained particular page numbers in the text where the information could be located to answer the questions in that section.

Nevertheless, "struggling" readers often had difficulty locating answers. In my second interview with her, Niah explained that she found homework the most difficult part of the class *because you have to keep looking and can't find the answer*.

On Day 2 of the study, students were assigned the *Looking at the Moon from Earth* ("Prentice Hall Science . . . Workbook," n.d., p. 209-210) section in the workbook for homework. Alice's answer to question six is indicative of the difficulty "struggling" readers had locating relevant portions of text. This question asked, *What are craters on the moon caused by?* The relevant sentence in that section of the textbook states, "But about fifty years ago, scientists concluded that the craters on the moon were *caused by the impacts of meteoroids, rocks from space* [italics added]" ("*Prentice Hall Science*," 2004, p. 585). Thus it is possible to locate the phrase beginning with the words *caused by* and copy the remainder of the phrase to correctly answer the question. Alice's response, *features on the moon's surface*, was incorrect. She had incorrectly copied part of the bold sentence on this same page, apparently because it had the word craters in it: "Features on the moon's surface include craters, highlands and maria" ("*Prentice Hall Science*," 2004, p. 585).

Students who were not identified as "struggling" readers often appeared to have significantly less difficulty reading and locating information to complete these workbook pages. For example, on Day 4 of the study, I noted Javon, Lloyd, Alice, Sierra, and Clyde took much longer than others locating answers in text even after the textbook section had been read aloud. The remainder of the students quickly finished their work and began talking and joking with each other while waiting for these students to finish so the class could go over the answers. Moreover, in my third interview with

her, Tara gave an example that illustrated her ability to read to learn information. When asked what materials helped her to learn science, she cited the science textbook, remarking,

> *when I had trouble about the lunar eclipse I went back into it and found the answer.*

All students found reading to locate information somewhat more difficult when they had to locate the information without the assistance of the page numbers in the workbook. For example, on Day 7, Jack and Daniel were attempting to read the textbook to locate the strength of the pull of gravity on the surface of the moon. Daniel read and considered several section headings, *Phases of the Moon, Motions of the Moon,* and the heading for a section on tides. He skimmed the accompanying text before finally commenting, *I'm gonna random guess.* In fact, students often avoided using the textbook. For example, on Day 11, I noted although Pam had her textbook on her desk under her paper, she never opened it. Moreover, no other students could be seen referring to the text during that event although Ms. Sand told them at least twice that they could use their textbook or any other resources to find the answers.

Students identified as "struggling" readers often appeared the most reluctant to use written text in these situations. On Day 11 of the study, Lloyd asked me for help with a question. When I suggested we look for the answer in the textbook, he said, *I am trying to do this without using the book.* On Day16 of the study, a dispute arose between Lloyd and Ms. Sand about the date of the moon landing because of Lloyd's contention that *the book said nineteen sixty four.* Ms. Sand then sent him to the back of the room to get a textbook *and see cause I wanna be right.* After he got the textbook, Lloyd walked

to the front of the room to give it to Ms. Sand, but she insisted he locate the answer himself. Lloyd began leafing through the pages until he apparently reached the section about the moon landing near the back of the book. This section has several large photographs of astronauts on the moon that would make the topic obvious. He then looked over several pages, but when Ms. Sand asked him if he needed help, he said that he did. Although she sent Adam to his desk to help him, Lloyd was finally able to locate the information before Adam got there.

Although it was apparent Ms. Sand encouraged students to use their textbook, it was equally apparent the teachers as well as the students found this a frustrating strategy at times. For example on Day 11 of the study, the students, Ms. Jones, and Ms. Sand were attempting to use the textbook to determine the density of the moon. When Daniel volunteered an answer, Ms. Sand requested he show her *documentation.* Josh, Ashley, Daniel, Niah, Ms. Sand, and Ms. Jones begin to search the textbook for the information. For the most part, this searching consisted of leafing through the pages of the book and pausing briefly to examine text that seemed likely to contain the answer. Niah commented, *I saw density but I didn't find the moon's density.* A little later, after having no luck locating the information herself, Ms. Sand asked the class, *find anything yet?* Finally, Ms. Sand announced she and Josh had located the information. The following exchange then took place between Ms. Sand and Niah:

Niah : Ya'll found it?

Ms. Sand: Yeah we did. and if you had been lookin' like we been lookin' you'd a found it.

In addition, students very rarely consulted their textbook, workbook, or study guides for information during whole class discussions. For example, on Day 8, the class played a "quiz bowl" game in order to review for the next day's unit test. Ms. Sand divided the class into two teams, boys and girls, and then asked them the questions from the next day's test. According to field notes, students very rarely consulted any of their available notes to answer any of the questions during the Quiz Bowl game. They appeared to be listening to Ms. Sand read the questions and answering from memory. At times, they guessed answers until they hit upon the right answer rather than attempting to consult the available text for the information.

Writing.

Although Ms. Sand felt that good science students did *not necessarily have to be good writers*, many of her assignments included writing. Students were expected to write summaries of both movies they watched during the course of this study. Students also wrote paragraphs describing what they saw when they viewed video of rocket launches and made a list of things they would take to the moon. Ms. Sand stated that they sometimes wrote paragraphs detailing the results of experiments. Students completed a solar system project prior to the beginning of the study and at least one "struggling" reader, Sierra, chose to write a report to accompany her project. (See Appendix H Sierra's science project.) Her report consisted of a list of the planets and facts about each one. When I asked where she got the information, she replied *from my notes*. In fact, an examination of the vocabulary and syntax in the report revealed it was likely this information had been copied from a text. For example, she stated, "Jupiter is the largest planet in the solar system, has four large moons and a number of small

moons." The students in this class also appeared to value writing as indicative of academic success. During the viewing of the movie *October Sky,* the girls in the class often held their papers up to be admired by the other girls sitting nearby. Their purpose was to show off the length of their written summaries.

Students frequently had to write answers on the workbook pages and study guides they were given. The workbook items were a mixture of short answer questions and multiple choice questions. There were also occasional graphic organizers to be completed. Many of the short answer questions in the workbook could be answered by writing a word or short phrase. These questions could also be answered by locating the relevant sentence in the textbook and copying a part of it. Although "struggling" readers sometimes had difficulty locating the relevant section in the text, this was a strategy they often resorted to even if it required they seek assistance from a teacher or another student in order to locate the right phrase. The word choice and flawless spelling in these workbook answers made this strategy apparent. The other writing of these "struggling" readers often revealed spelling or grammatical errors. For example, in order to answer the question, "What are craters on the moon caused by?" (Prentice Hall, n.d., p. 210), Javon exactly copied the phrase *the impacts of meteoroids, rocks from space* ("*Prentice Hall Science*," 2004, p. 585) from the textbook. (See *Figure 4.* Javon's answer to question six Day 2.) Lloyd, the "struggling" reader who valued listening over reading apparently answered this same question from memory. His answer is clear although the two major words in the answer are misspelled. Note that he has also not included the final phrase, rocks from space, which appears in Javon's answer. (See *Figure 5*. Lloyd's answer to question six Day 2.) In answering the same question, the nonstruggling

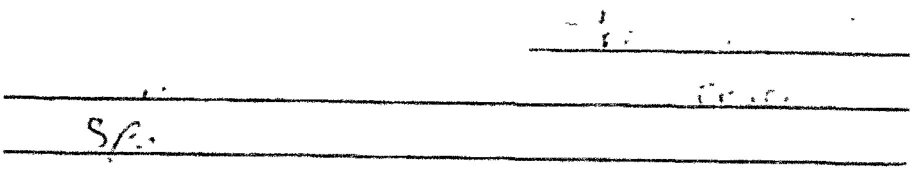

Figure 4. Javon's answer to question six Day 2

Figure 5. *Lloyd's answer to question six Day 2*

readers in the class showed a greater capacity to paraphrase the information. For example, in Josh's answer (*Figure 6.* Josh's answer to question six Day 2) he rephrased the information using the word *striking* without changing the meaning.

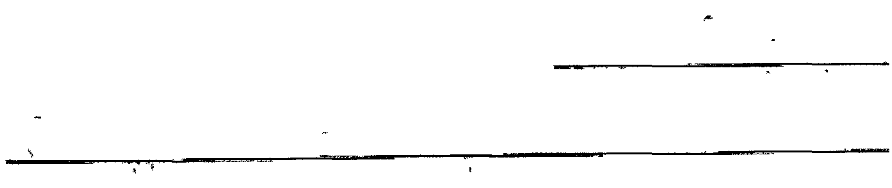

Figure 6. Josh's answer to question six Day 2

Students also engaged in some note taking. Although this was not organized as a formal activity, occasionally when the class was going over material Ms. Sand would direct them to make notes on their papers. For example, on Day 14 of the study as the class was going over one of the exam reviews, Ms. Sand asked the students to label the asteroid belt on a diagram on the study guide, list the characteristics of Jupiter from their oral discussion, write *a comet has tails on it* and later add that the tails point away from the sun, note the sun is at the center of the solar system, and note that rotation causes day and night. She also asked them to draw a diagram and write pages numbers on their paper. Jack managed to make one of these notes on the first page of his study guide while Pam was able to write them all. (See Appendix I Exam Review Notes I1 Jack's exam review notes and I2 Pam's exam review notes to compare the two pages.) In addition, spelling could also be a hindrance for "struggling" readers when it came to note taking. For example, on Day 15 of the study, Ms. Sand directed students to write *chunks of ice* next to the question, "What are comets?" ("*Prentice Hall Science . . . Workbook,*" p. 224) in their science workbook. Alice's misspelling of *ice* as *us* certainly had the potential to be confusing to her later. (See *Figure 7.* Alice's note Day 15.)

See *Figure 7.* Alice's note Day 15

Aside from constructing their own models of the solar system for their science projects prior to the beginning of the study, there was only one occasion when students were asked to represent information by creating their own images. This occurred on Day 14, the day that students made notes on the first page of the exam study guide. Ms. Sand told the students to draw *a little diagram put the sun in the middle and a orbit ring around it*. Then she asked the students to put the Earth *on that orbit*. She then inquired about the direction of the Earth's rotation as it was orbiting. Later in this discussion, she told the students to write down counterclockwise. Many students had difficulty following her directions for this task, and their efforts revealed a number of misconceptions. (See *Figure 8*. Daniels' drawing, *Figure 9*. Pam's drawing, *Figure 10*. Jack's drawing, *Figure 11*. Sam's drawing, and *Figure 12*. Lloyd's drawing for photographs of student drawings of Earth's orbit.) For example, Daniel, Jack, and Pam put more than one celestial body on one orbit. In fact, Daniel and Pam each put at least nine circles on one orbit. Jack put both the Earth and the moon on one orbit, however, he did attempt to write the direction of orbit by noting "clockwhise" on his paper. Lloyd's drawing was quite artistic, however, he failed to indicate a clear direction for rotation. Sam, on the other hand, followed Ms. Sand's directions exactly.

Speaking and listening.

Ms. Sand did not often require total silence in her classroom. Even when she asked the students to complete work individually, she rarely told them that they could not talk to each other. The only sustained period of silence occurred on Day 9 as the class was taking a test on Chapter 18 of their textbook. Students engaged in talk about science

Figure 8. Daniel’s drawing

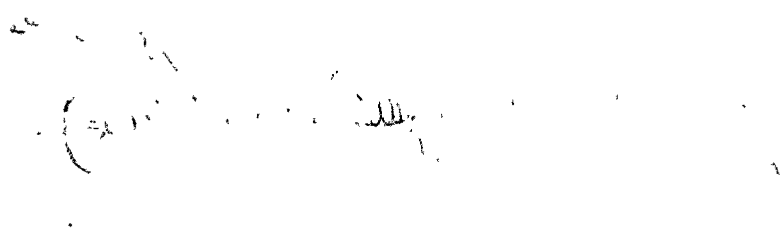

Figure 9. Pam’s drawing

in front of the whole class, when they worked together, and when they were ostensibly working individually. They spoke to tell facts, give explanations, describe, and give reasons for their answers. They asked questions of Ms. Sand, Ms. Jones and each other. Ms. Sand valued formats that allowed her students to listen to information because

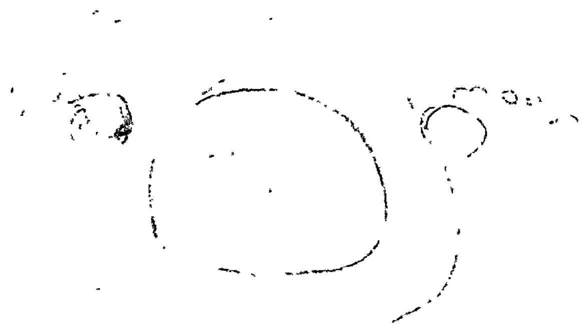

Figure 10. Jack's drawing

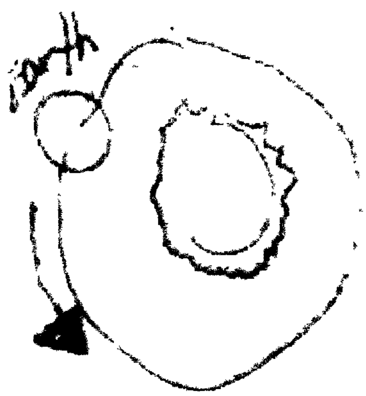

Figure 11. Sam's drawing

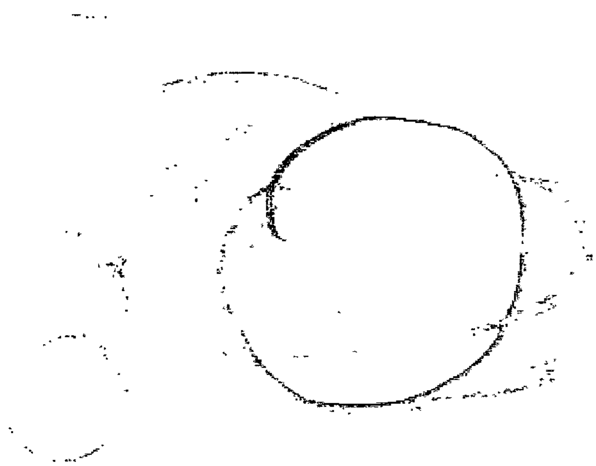

Figure 12. Lloyd's drawing

she felt this was an effective avenue for learning for this particular group of students. Students listened to each other, to Ms. Sand, to Ms. Jones, and to the soundtracks of two movies over the course of this study. They listened to Ms. Sand and to other students reading information from a variety of sources. They listened in small groups, in conversations, and in whole class formats. Indeed, the speaking and listening the students in this class did over the course of this study are the basis of the theoretical framework guiding this study. For this reason, it is not enough to simply consider how the "struggling" readers in this study managed each of these classroom literacy practices.

Each of these literacy practices, reading, writing, speaking, and listening, occurred as a part of a literacy event and each event was organized by a particular activity structure. The language used in classroom talk, spoken and heard by the students, was a major mediating device (Holland and Lachicotte, Jr., n.d.), determining not only how students understood the activity structures and science content of this classroom but also

how they attempted to construct themselves as science learners in this classroom. The language of classroom texts is examined in the section that follows. Over 16 hours of interactions were transcribed and examined in order to analyze how the students and teachers in this classroom used language to mediate their interactions. These interactions, constructed through language use, are examined in more detail through the lens of the activity structure in which they occurred. (Please see **Activity Structures** beginning on page 142 for this discussion.)

Language Differences

Gee, et al. (2005) note students must develop some degree of competency with the forms of language used in school in order to suceed (p. 43). Certainly in this study, language was integral to the literacy practices, literacy events, and activity structures of this science classroom. Indeed, the literacy practices with which the students in this study engaged were essentially practices of language use. Each literacy event included student engagement in speaking, reading, writing, or listening to language. Furthermore, these events were situated within an activity structure which was constructed by the teachers and students through language and other signs. As Holland and Lachicotte, Jr. (n.d.) suggested, language, as the primary sign system in this classroom, mediated student learning.

Moreover, the language of schooling is not unitary. In fact, as Yore and Treagust (2006) suggest, if students are to be successful in science, they must actually develop a degree of competency with at least three language types, " home" language, academic language, and scientific language (p. 296). In addition, different activity structures and literacy practices require different receptive and expressive language competencies.

Although the majority of students, (certainly the students included in this study) are competent users of their home languge by the time they reach sixth grade, the degree of similarity of this language to the academic and scientific language they encounter in science classrooms can be instrumental in determining whether they can successfully engage with the available literacy practices and activity structure of any particular literacy event. Therefore, in order to understand the affordance and constraints in opportunities for learning for the students in this science classroom, one must examine language differences.

The general academic language students encounter in school can be familiar or unfamiliar to students depending on the degree of similarity between this language and their home language. Coxhead (2000) has developed a cross-disciplinary academic word list from a variety of types of written academic texts. The resulting Academic Word List (AWL) is composed of 570 word families and organized into ten lists, from the most frequently to the least frequently occurring. A comparison of the words in texts in this science classroom with the AWL revealed these texts contained much challenging academic vocabulary. For the purposes of this study, texts are defined broadly as "anything from which we can construct meaning" (Lewis, Enciso, and Moje, 2007, p. xvii). Although the words in the AWL were developed from written texts, their use is not exclusive to written texts. In fact, Ms. Sand used academic vocabulary when speaking to the class. For example, she made the following comment when evaluating a student composed text:

> *So you were able to* ***transfer*** *what you read,* ***when you got on the computer, you were able to see what you learned in class****.*

In this case, Ms. Sand appears to be aware the word *transfer,* a word that appears on the AWL, may be challenging for some of her students because she follows the use of the word with an explanation of its meaning in the context of her statement. During this same class period, she also used a number of other words listed on the AWL in speaking to the class, including *incorporate, infer, focus, research, hypothesize, equip, structure, assignment,* and *summary.* These words also occurred in written text these students used, sometimes even in student directions. For example, the directions to students for the true/false section on a unit test the students completed asked students to *indicate* an answer ("*Prentice Hall Science. . . Workbook,*" n.d, p. 207).

Furthermore, students in science classrooms are also expected to understand and use scientific terms signifying both simple and sophisticated scientific concepts. Moreover, as the RAND Reading Study group (2002) suggests, there is a difference between teaching students to recognize a word when they already understand the underlying concept and teaching them to recognize a word representing a concept with which they are not familiar. Gee (2005b) points out the crucial role experiences play in the development of these underlying concepts. At the same time, students' familiarity with the everyday meaning of a word can make understanding its use as a scientific term challenging. For example, a word such as *property* has a specific meaning in science that differs from its meaning in everyday usage. In addition, students can be expected to develop more sophisticated vocabulary and be capable of more detailed conceptual understandings as they grow older. A number of organizations have produced standards documents with graduated expectations (Marzano, 2004, p. 134). Marzano (2004) used five of these as sources for a graded list of scientific terms which can be used as a basis

for understanding the appropriateness of various scientific terms for students in sixth grade.

Interactions with science vocabulary.

Ms. Sand considered science vocabulary important for understanding science. She also felt at least some of her students had a good command of the vocabulary of science. In my first interview with her she called their vocabulary *for science right up there*, but in the second interview she was more circumspect in her comments, stating only that *some have good ones*. Certainly at least one struggling reader was aware of his own difficulty with the vocabulary used in this classroom. Jack attributed his problems reading science specifically to the words.

> *It's a lot of big words and you have to understand what most of what it saying.*

Students were confronted with both general academic and scientific vocabulary in virtually all of the written materials they used during the course of this study. For example, on Day 4 of the study, Sam, Tara, Niah, Pam, and Ashley took turns reading pages 586 and 587 of the science textbook aloud to the class. These two pages of text contain six academic vocabulary words appearing on the AWL, *enormous, research, impact, concluded, device,* and *detect.* These two pages also include at least 18 scientific terms, among them, words such as *solid, molten, and meteoroid* which appear on Marzano's Level 3 (Grades 6-8) list and one, *seismometer* which appears on Marzano's Level 4 list (Grades 9-12).

An incident on Day 11 of the study illustrates the challenges both the teachers and students faced with both written and oral texts containing several of these words. Ms.

Jones initiated this interaction by telling the students, who were engaged in a seatwork activity, to *read number one carefully*. Then she asked them to listen and began to read aloud from the worksheet.

> *"A student is planning an* ***investigation*** *on the* ***properties*** *of different types of* ***matter****. What is the best" answer? "find the* ***volume*** *of an irregularly shaped object such as a rock" ("Benchmark Test A," n.d.)*

This passage contains two words that appear on the AWL and could also be considered science content words, *volume* and *investigation*. Furthermore, both the words *property* and *matter* may be familiar to some students only in their more common everyday meanings. In order to decrease the density of such terms in her oral reading, Ms. Jones has substituted the word *answer* for the word *method* which appears in the written text and which appears on the AWL. She has also chosen to omit reading the answer choices which contain eight additional words appearing on either the AWL or Marzano list, *graduated, cylinder, balance, mass, similar, data, magnification, and microscope.* In fact, a complete understanding of the concept of *volume* and, specifically, of finding the volume, cannot be easily gleaned simply from reading a definition, and for students who do not understand even some of the academic and scientific meanings of the other ten words in this problem, it may be very a difficult task to determine the answer. Sensing this, Ms. Jones picked up a pencil cup from Ms. Sand's desk and demonstrated as she spoke the following words:

> *Here, watch this, if I take this cup and I put four ounces of water and I drop a rock and it goes up eight, how do you know what the volume is?*

Her explanation contains no words from the AWL and only one scientific term, *volume*.

Moreover, her accompanying demonstration constitutes the type of experience that "can anchor the situated meanings of words and phrases of this social language" (Gee, 2005b, pp. 27-28).

As this incident illustrates, the density of academic and scientific vocabulary in the written texts the students used rendered it extremely difficult for the teachers in this classroom to adequately provide the experiences students would need to develop well articulated mental concepts for all such words the students encountered. For this reason, Ms Sand, at times, concentrated her efforts on teaching students to remember several key phrases associated with with key concepts. For example, one of the terms the students had to know from their study of the solar system was *comet.* The two pages about comets in the textbook explain in detail the formation of each of the three parts of a comet as well as how they move in the solar system. The bold statement, presumably containing the key idea for this section states, **"Comets are chunks of ice and dust whose orbits are usually very long, narrow ellipses"** (*"Prentice Hall Science",* 2004 p. 624). However, Ms. Sand was also aware the students would only be asked to identify a comet in a graphic on the final exam. For this reason, she chose to focus on the appearance of a comet, specifically the comet's tail and the direction of its tail, on the four occasions comets were a topic of conversation during this study. On Day 13, she began the discussion with a question,

> *Ms. Sand:* ***Why does a comet's tail point away from the sun?***
>
> *Unidentified students: cause a comet*
>
> *Ms. Sand: it's something about a solar wind what does solar wind do?*

Unidentified students: push it push away

Ms. Sand: ***push or blows it away from the what?***

Daniel: ***sun***

Ms.Sand: Sun, very good.

The following day, her emphasis was the same, but this time she has added a drawing to the board.

Ms. Sand: Who said comet? Very good. It's a comet. Now Ms. Sand, her and her bad drawing, but look on the board. The way you can tell a comet from, uh, asteroid or sun spots, ***a comet has tails on it****, so you need to write that down somewhere on your paper, comet. You wanna,* ***you can tell a comet because it has a tails on it*** *and just wh- just what 'bout the tails?*

Daniel: It's always facing away from the sun

Ms. Sand: ***away from the sun.*** *Good, good answer, good, uh, write that down, you don't know it, write it down.* ***A comet has tails on it and the tails always point from the sun.*** *Jack do you have that written down? Jack, we're talkin' 'bout comets. See number seven* ***over here by the sun those are the tails*** *that's how you know that's a comet okay?*

Two days later, Ms. Sand emphasizes this information again.

Ms. Sand: If I was to show you a picture of outer space, ***how would you know the comet?***

Josh: the comet

Ms. Sand: ***What does it have?***

Josh: It has a tail.

Ms. Sand: Very good. ***You can tell by the tail****. Now, which way would the tail be facing, Josh, do you remember?*

Josh: away from the sun

Ms. Sand: Alright, ya'll got that? ***Alright the comet's tail point away from the sun.*** *Why is that, ya'll know?*

Daniel: Oh, I know, the, uh, the local winds.

Ms. Sand: the solar winds

Finally, the next day, as the class was reviewing a workbook page, they come to the following question: "How does a comet's tail form?" ("*Prentice Hall Science. . . Workbook*," n.d., p. 225)

Ms. Sand: ***What are comets****?*

Daniel: rocks

Pam: They have tails.

Ms. Sand: ***They have tails****, they have*

Pam: They point away from the sun.

Ms. Sand: So write it down.

[Ms. Sand repeats some of the previous information, and they discuss the logistics of writing the information down.]

Ms. Sand: What comets are, are chunks of ice and dust.

Unidentified student: I thought they were fire.

Ms. Sand: ***How does a comet's tail form? Where the comet tail come from?***

Daniel: solar

Ms. Sand: ***Come from what? Solar what?***

Unidentified student: wind

Ms. Sand: ***Wind,*** *that's number three, put that down.*

Daniel: What's number two?

Ms. Sand: the nucleus, coma, tail

Daniel: nucleus, coma

Ms. Sand: Coma, c-o-m-a and ***the tail.*** *Pam, do you have that?*

Unidentified students: XXXX

Daniel: solar winds

Ms. Sand: ***solar wind pushes the gas away from the sun***

Unidentified student: What are the three parts of a comet?

Ms. Sand: nucleus, coma, ***tail****, and what causes a comet tail to form, solar winds* ***pushin' it away from the, what, sun****. Gas and dust form* ***the comet's tail.***

In this case, the question that began this discussion, *how does a comet's tail form,* was never actually addressed. When Ms. Sand asked her original question, *what are comets,* she did not take up Daniel's response, *rocks,* but instead responded to Pam who had volunteered, *they have tails.* Even when Ms. Sand later asked, *how does a comet's tail form,* she immediately asked another question, *where the comet tail come from* in order to orient the discussion towards the direction the tail points. This focus was of benefit to the majority of the students in the class when they took the final exam as they correctly identified the object in the diagram as a comet. However, Josh, Jack,

and Lloyd missed the question. Jack apparently thought the object was a moon, a logical error if one is not aware a comet travels in an orbit, information not mentioned in the class discussion. Lloyd thought the figure was a meteoroid, also an understandable error if one’s concept of a comet is not sufficiently differentiated from other objects in space, and Josh selected planet, a possible label for all the other numbered objects in the picture. The limited information she emphasized was not enough to sufficiently elaborate the concept so that these three students could differentiate a comet from a planet, a meteoroid, or a moon. Moreover, although Ms. Sand’s strategy was apparently effective for most students in the class, it was only effective at the level of identification.

Academic vocabulary words, even when they occurred without being surrounded by scientific vocabulary, could sometimes pose difficulties for the “struggling” readers that these words did not pose for the other students in the class. For example, on the final exam a question included the word *unique. Unique* appears on List 7 of the AWL. All seven of the students identified as “struggling” readers and the only English language learner in the class missed this question. All seven of the other students in the class answered it correctly.

Although strategies designed to limit the academic and scientific vocabulary included in classroom discourse may be effective for helping students score well on teacher-made tests, such strategies did not help these students when they were confronted with worksheets and tests produced by the textbook publisher. Furthermore, when students are learning new concepts, such strategies place limitations on depth of conceptual understanding that, at times, resulted in misunderstandings and wrong

answers. As Gee et al., 2005 suggest, students in science classrooms need to not only understand academic and specialized science vocabulary, they also need to be able to produce it (p. 43).

Student production of academic language.

Both groups of students, "struggling" and nonstruggling readers, used some academic vocabulary in their writing. For example, on Day 6 of the study Adam wrote *brought data* in explaining what the Apollo missions accomplished. The word *data,* which does appear on the AWL, did not appear in the text the students were completing at the time. Likewise, on this same day, Clyde, used the word *locations* in writing his explanation of the uses of satellites. This word, also from the AWL, also did not appear in the text.

Most often, the density of academic language in most of the written materials students used made it difficult to determine if students who incorporated these words into the answers to questions on the short answer questions on worksheets actually understood their meaning. However, an examination of the paragraphs students wrote summarizing the movies they viewed is informative. These summaries were produced independently by these students without the use of any teacher or publisher produced text. For example, a few students, "struggling" readers and nonstruggling readers, used words that can be found on the AWL in their summaries of the movie *October Sky.* Lloyd, the only struggling reader who used any of these words, used the word *injured.* Pam used both *finally* and *designed,,* and Sam used four words from the AWL, *finally, injured, temporary,* and *removed.* Many of the central events of the movie are centered around the attempts of the three boys to *design* and successfully launch a rocket. Therefore, an

examination of the words and phrases the other students in this class used to describe these events and indicate the sequence of the events in the story is helpful in describing how the "struggling" and nonstruggling readers in this class use language. All but one of the students included the rocket in their summary. Alice was the only student who did not mention it. (Daniel and Jack were absent.) Table 1. *Building the rocket* contains the phrases the "struggling" and nonstruggling readers in this class used in relating this idea. Words from the AWL are in bold.

An examination of this table reveals qualitative differences in the vocabulary these students used to described this event. Only one of the "struggling" readers group, Lloyd, used a form of the word *build* to describe what the boys in the movie were attempting to do. Javon used the word *make* while Clyde and Niah used the word *fix.* Sierra omitted the idea of construction entirely and instead wrote *had this toy rocket thing.* In contrast, three students in the other group, Ashley, Cam, and Sam used a form of the word *build.* Pam used the word *designed* from the AWL while Josh and Tara elaborated the idea of building by adding words associated with scientific writing, *model* and *experimental.*

Individual student interactions with scientific language.

It was evident in the many forms of classroom talk that the "struggling" readers in this science class encountered difficulty understanding and using scientific language. For example, some of the "struggling" readers in this classroom had difficulty decoding many of the scientific vocabulary terms they encountered due to a more global difficulty decoding multisyllabic words. This deficit, at times, could cause confusion

Table 1. *Building the rocket*

"Struggling" Readers		Nonstruggling Readers	
Name	Phrase	Name	Phrase
Clyde	fix a rocket	Ashley	build a rocket
Javon	make a rocket	Cam	build a rocket
Lloyd	build rockets	Josh	making small model rockets
Niah	fix an rocket	Pam	**designed** a rocket
Sierra	had this toy rocket thing	Sam	built rockets
		Tara	experimenting …so it would make their rocket launch

for them as they attempted to read science text. For instance, Alice became confused as she was attempting to silently read text while she was working on science questions with Pam.

> *Alice: What was number, uh, dang, what was the astronaut that what? Pam, what was the astronaut that what?*
>
> *Pam: That not astronaut, that's astro belt.*
>
> *Alice: Oh, astro belt.*

Alice had apparently neglected to read the end of the word *asteroid* and mistook it for the word *astronaut*, which is similar at the beginning but differs from *asteroid* in its

ending. Moreover, some of the "struggling" readers in this class confused science vocabulary words with similar looking or sounding technical words they knew from experiences outside of school. When the class was completing one of the review worksheets before the final exam, Ms. Jones asked Javon, *what is a turbine?* Javon immediately confidently but incorrectly responded, *a turbine is something you start a a car with.*

Conversely, some of the"struggling" readers in this science classroom were successfully able to associate specific information with scientific terms in order to manage classroom interactions and in order to read and answer some questions on mulitple choice tests. For example, in the following exchange between Daniel and Niah, she correctly remembers a proposition while he does not.

Daniel: The sun produces energy by

Niah: fusion

Daniel: wrong

Niah: What is it?

Daniel: solar energy

Niah: ***It's nuclear fusion.***

In this exchange, Niah refuses to accept Daniel's assertion that she is wrong. Instead, she confidently repeats her answer. However, later during this same review session, Niah had difficulty making Daniel understand a question she was attempting to compose and then ask because she could not produce the correct scientific term, *asteroid belt.*

Niah: ***the bubbles*** *around the XXXX what they called ?*

Daniel: comets

Niah: ***the bubble things***

Daniel: what bubble things, XXXX inner planets, who knows

However, being able to successfully decode particular science terms, associate them with particular propositions, or remember them when trying to mentally compose and then produce a question is not the entirety of what is required to function effectively even in this science classroom. For example, as Ms. Sand was conducting a review for the final exam, she asked Sierra a question that necessitated she apply existing information to produce a definition. In doing so, Sierra reveals the limits of her own conceptual model of revolution.

Ms. Sand: the helliocentric model you heard that (.4) Stop calling Clyde. Do you remember that, that model? 'Member we had two models in here, one where everything revolved around Earth, and then we had one where everything was revolving rou- round the sun.

Sierra: ***I know 'bout it XXXX and I heard of it.***

Ms. Sand: Okay, who answered me about, just answered me about the geocentric? Who was that? XXXX Lloyd, tell her the geocentric one. Tell her again what you said. Wait a minute, hey come on, uh, uh tell her Lloyd.

Lloyd: The geocentric one is where, uh, everything ***revolves*** *around Earth.*

Ms. Sand: Earth. Earth and it's all about Earth. Now Sierra, look at Ms. Sand. I want you to tell me about the hellio centric model, so what model would that be?

Sierra: ***the sun***

Ms. Sand: What about the sun sweetie?

Sierra: that it, that ***when it goes around the Earth***

Ms. Sand: huh?

Sierra: ***when it goes around the Earth***

Although Sierra asserts she both *knows about* and has *heard of* the heliocentric model, she apparently has a poor underlying conceptual model for the revolution of the Earth. Even though Lloyd uses the word *revolves* in his explanation, Sierra does not incorporate it in her own explanation, choosing to use *goes around* instead. She then twice repeats that the sun *goes around the Earth.* Although most certainly a knowledge of the meanings of the Greek root helio, of the Latin root centr, and of the affix –ic could also have been helpful to her in determining the word's meaning, such knowledge will do little good if she is operating with an erroneous underlying conceptual model. Furthermore, it is equally possible Sierra actually has a grasp of the underlying concept but that the cognitive demands inherent in the process of processing several statements containing a number of scientific terms, *revolves, geocentric, and model,* and applying this information in order to produce a new definition were such that she actually became confused. Moreover, although Ms. Sand went on to provide a clarification for her, Sierra ultimately missed the question on the final exam asking her to identify the motion of the Earth around the sun.

“Struggling” readers also had difficulty with scientific terms they encountered that were not specifically related to the topic they were studying. For example, Jack was supposed to correct the following false statement on a worksheet: “The moon’s average density is greater than the density of Earth’s outer layers” (*“Prentice Hall Science . . Workbook,”* n.d., p. 207. Underneath the sentence, he wrote, “the moon's density as nothin everything on it is dead & so no gravity.” Jack apparently understands *density* as having to do with the surface of an object and possibly somehow related to gravity.

Sometimes the substitution of one term of this type for another was enough to cause confusion to some students. For example, the study guide for the Chapter 18 test, also a multiple choice test produced by the textbook publisher, referred to *hot gas* being *expelled* from the rear of a rocket. The same question was asked on the actual test, however, with one difference in wording. On the actual test hot gas was *propelled* rather than *expelled* from the rear of the rocket. Despite answering this question correctly on the study guide, both Niah and Jack missed it when they took the actual test.

An examination of the written work produced by “struggling” readers reveals similarly flawed understandings. Most often students were able to copy short phrases directly from the text to answer questions about scientific concepts. On Day 13 of the study, students completed questions about the solar system (*“The Solar System,”* 2006). The questions were organized in groups, each group corresponding to one paragraph of the accompanying text. Alice had to answer the following question associated with the first paragraph, “What is the most important similarity between the Earth and the moon?” (*“The Solar System,”* 2006) The second sentence of the first paragraph states, “The most important similarity between the Earth and the moon is the way in which

they move through the heavens" ("*The Solar System,"* 2006). Alice read the sentence in the text, noticed the similarity in wording, and then in answer to the question wrote, *the way in which they move through the heavens.* However, this strategy did not always work well. For example, when she moved on to the second paragraph, Alice was confronted with the following question: "Why doesn't the moon produce its own light?" According to the text,

> Unlike our sun, which is a huge ball of hot gases that gives off light and heat energy, our moon is nothing more than a gray ball of rock. By itself the moon does not shine. It only shines because it is illuminated by the sun. As the sun's light hits the moon, it bounces or reflects off the moon's surface. ("*The Solar System,"* 2006, Part 5)

The sentence containing the answer to the question, in addition to being a complex sentence, contains three scientific terms, *hot gases, heat energy* and *light energy*. Alice chose to overlook this sentence and instead wrote, "because it bounces off the, off the moon surface." Her response indicates a limited grasp of the underlying concepts concerning light production implicit in this passage. Students also indicated an incomplete grasp of concepts and even of facts in the writing they produced on their own. For example, Niah, in her summary of the movie *One Giant Leap*, wrote that the astronauts *are floating **around** gravity.*

Nevertheless, although the "struggling" readers in this classroom had developed tactics for answering questions correctly even when they did not understand the information, they also demonstrated what they knew and what they were learning about scientific language when they produced their own writing without the assistance of

external written texts. Students wrote paragraphs about the rocket launches they viewed on the first day of the study, and they produced summaries of facts from the movie *One Giant Leap*. Although Niah's comment that the astronauts were *floating around* gravity was slightly inaccurate, she also included two other content terms from the unit under study, *lunar vehicle* and *craters* in her summary. Clyde wrote that *Russia sent spunic into **orbit*** and added that *NASA has great **technologies***. Jack mentioned that a rocket exploded *like an **atomic bomb***. It was also apparent from his approximation of the word *multistage*, "multilunches", that he was beginning to understand how multistage rockets worked.

However, the transition from what Sierra called *having heard of* a scientific term to having a detailed understanding of the concept or to the having ability to apply the concept to new learning requires multiple interactions. In order to investigate and characterize both the number and type of interactions "struggling" readers had with scientific terms over the course of this study, I analyzed interactions around two related terms that were frequently used in classroom discussions. For students to fully understand many of the concepts important to the study of the solar system, the students needed to understand both the concept of *revolution* and the concept of *rotation*, including the difference between the two. Therefore, these terms were used frequently in the textbook and other written texts and in classroom talk. Furthermore, eight of the 30 questions on the final exam included one or both of these terms. Several of the worksheets and practice tests Ms. Sand used as a basis for many of the classroom reviews also contained questions in which these terms were used. A query for the words *revolution ,revolves, revolving, revolve, rotates, rotate, rotating,* and *rotation*

allowed me to locate each instance of their use in the transcripts of all seventeen days of the study as well as in transcriptions of all student writing. I next examined the data to locate instances when the “struggling” readers in this class had a personal encounter with the word. I defined a personal encounter as an incident which personally involved the student in an interaction around the use of the word. This interaction could take the form of reading aloud, asking or answering a question, or writing the word.

An examination of the data located by this method revealed that all of the “struggling” readers in this study had more than one personal encounter with at least one of these two terms. Most of these personal encounters occurred during whole class review when Ms. Sand posed a question that the student answered. For example, the students were expected to know day and night were caused by the rotation of the earth on its axis. At times Ms. Sand would read a multiple choice or short answer question to the student and then read answer choices. The student would then indicate the correct answer. Other times, Ms. Sand might pose an open-ended question such as *what causes day and night* or *what does the rotation of the Earth cause*? All “struggling” readers answered at least one of these questions, although not all of them answered correctly. These students also encountered these questions during group work activities. Again, these encounters involved reading classroom texts aloud, most often multiple choice questions and answers. All of these personal encounters with these words were centered around being able to remember and associate short phrases such as *day and night = rotation of Earth on its axis.*

However, the text query revealed two other types of student encounters with these words. Javon, Alice, and Sierra had all used a form of the word *rotation* in either their

paragraph about watching the rocket launch or their factual summary of the movie *One Giant Leap*. In addition, Ms. Sand asked Clyde, Sierra, and Javon to make an explanation involving the use of one of these two terms during whole class activities. Sierra's attempt to explain the heliocentric model of the universe is one such example. (See page 135 for the transcript of this interaction.) An incident on Day 17 of the study also illustrates the difficulty the "struggling" readers had providing even limited explanations for these terms. The class was going over a question in the science workbook ("*Prentice Hall Science . . . Workbook*", page 202).

Ms. Sand: Javon, do you have that one, number ten, " why does the Earth have seasons?"

Javon: ***the way the axis is***

Ms. Sand: hmmm

Javon: ***the way the axis is***

Ms. Sand: What you mean by the way the axis is? What about it? You're right, you got it, it really does have somethin' to do with the axis. What about it?

Javon: ***why it rotates***

Ms. Sand: rotates around what?

Javon: sun

Ms. Sand: There you go, the way it rotates on its axis around the sun, very good.

In this case, Ms. Sand asks Javon to explain his first statement, *the way the axis is* because by itself, this statement does not provide an actual explanation for the

seasons. Javon is only able to make a connection between the word *axis* and the word *rotates*. Ms. Sand then supplies the remainder of the link to him by asking, *rotates around what?* I was not able to identify any instances of lengthier essentially correct oral or written explanations for these two scientific terms for any of the "struggling" readers in this study.

Although all of the literacy practices and literacy events the students engaged in over the course of this study involved the use of oral or written language, few of the practices or events required deep engagement with the concepts represented by the scientific vocabulary they encountered in the classroom. Because many of the texts the students encountered were dense with both academic and scientific vocabulary, Ms. Sand and Ms. Jones had developed strategies to overcome the difficulties this might pose for these students. Students infrequently used these terms independently in speaking or writing and when they did use them, they most often associated them with short phrases containing the information Ms. Sand wanted them to remember.

Activity Structures

The activity structure of any literacy event is a key aspect of its context and can, therefore, influence how an individual interacts with a particular literacy practice. For example, a student may engage differently with the literacy practice of reading aloud when engaged in a group work activity structure in which he is reading to a small number of other students than this same student might engage in oral reading in an external text dialogue format occurring in front of the entire class. Nevertheless, a description of the activity structure of a literacy event cannot completely describe the event. Bloome, et al.

(2005) argue for analyses of literacy events to include not just structure but substance (p. 55).

Accordingly, the following discussion of the various activity structures associated with the literacy events observed in the course of this study weaves together discussion of the activity structures of these events, a key aspect of context, with discussion of the substance of these events and of the substance of specific individual interactions within these events. Therefore, this discussion will describe not only the activity structures observed in the course of this study but also how the "struggling" readers who are the focus of this study interacted with the literacy practices at play within each literacy event and its associated activity structure. This will yield information about how these particular students used the available resources of both the activity structure and the literacy practices in the event to participate and learn. In addition, analyses by activity structure types can be used to compare student learning across structures. The method of analysis will of necessity vary depending on the variables of each particular activity structure. However, because language is a key sign available to individuals in any interaction, analysis of the substance of the literacy events associated with each activity structure will primarily focus on analysis of the language used by the actors.

To focus data analysis of the substance of the literacy events examined across activity structures, the following nine questions were developed based on the work of Gee (2005a), Bloome, et al. (2005), Bloome, et al. (2008) and researchers included in an edited volume (Cole & Zuengler, 2008).

1. How do students participate/act in the social practices of each of these activity structures? What is their **role?**

2. How do students learn using the social practices of each of these activity structures?
3. How do participants define this event/structure?
4. What meanings do participants attach to signs (objects and behaviors, utterances, gestures, facial expressions) in this literacy event?
5. Does a mismatch between social practices students are attempting to use and the social practices of the activity structure interfere with their participation and learning?
6. How do various discourses and macro-contexts and histories work to construct the identities of students in each literacy event/activity structure?
7. Do students have a sense of agency (sense they can effect change in themselves and their situations through their own efforts) in this event/structure? Who has the power?
8. What significance do the participants attach to the event? Do they believe they will be successful?
9. What tools for literacy practices are available to the participants?

Activity structure types.

As Lemke (1990) notes, "people are not slaves to the activity structures of their communities" (p. 9). Within the recognized boundaries of any activity structure, individuals use the resources of the structure to assist them in realizing their goals. They also choose how closely they adhere to the format of the structure. Therefore, according to Lemke, while a particular activity structure provides the boundaries for possible moves, it should not be seen as a rigid prescription for talk or action. Lemke (1990) has

identified 17 Main Lesson Activities in Science classrooms. According to Lemke, each activity structure has its own unique structure or "socially recognizable sequence of actions" (p. 198). Ten of these activity structures, triadic dialogue, external text dialogue, student questioning dialogue, teacher student debate, true dialogue, cross discussion, media presentation, seatwork, group work, and testing occurred during the course of the observations conducted for this study. Lemke defines triadic dialogue as teacher questioning, student response, and teacher evaluation. External text dialogue varies from triadic dialogue only in that either the question or answer is read from a written text. Although these two activity structures were identified separately for this study, it is important to note that these designations are somewhat arbitrary. Ms. Sand and the students often alternated in any one event between using completed work as a basis for teacher questioning and answering questions about content from memory.

In student questioning dialogue, the student initiates a question which is then answered by the teacher. In teacher-student debate, the student challenges the teacher on a point. In true dialogue, teacher and students talk with each other in a normal conversational exchange. In cross-discussion, students talk with each other about the subject matter and the teacher participates as an equal. Lemke included media presentation as an activity structure; however, this designation has been somewhat amended for this study. In the present study, the teacher presented media to the class as a whole in the form of film (media presentation), but she also directed students to media which students interacted with individually on laptop computers and iPod touch devices at the same time as they interacted with the teacher and with each other. The latter type of media interaction is actually a form of seatwork. Seatwork is individual work on an

assignment generated by the teacher. Group work is similar to seatwork except that students work together to complete a task assigned by the teacher. The border between seatwork and group work is permeable. Rarely were students completely silent during times of seatwork. Therefore, it is quite likely that answers were shared among students who were ostensibly working independently. Testing is similar to seatwork but is "evaluated individually and independently" (p. Lemke, 218).

Appendix J *Frequency of Activity Structures* documents the activities structures observed in this particular classroom and the amount of time students spent engaged in each structure over the course of the study. As is apparent in the table, the class spent the most time engaged in triadic dialogue, external text dialogue, seatwork, and group work. Student questions, teacher-student dialogue, true dialogue and cross discussion arose spontaneously for the most part during periods of triadic dialogue or extended text dialogue, although they were calculated separately. Altogether these four activity structures comprised less than a quarter of an hour of time. The largest segments of time were devoted to external text dialogue (3:01:54) and group work (2:45:55). The third largest segment of time was devoted to seatwork (2:27:45). Furthermore, at times it was not possible to precisely calculate the amount of time spent in an activity because all students did not begin or end at the same time. Therefore, these figures provide only estimates that can be used to note large differences in time between activity structures.

Seatwork.

Lemke (1990) defines seatwork as "an activity in which students work independently on tasks specified by the teacher" (p. 217). During the course of this study, in many cases, seatwork was followed by what Lemke calls "going over

seatwork" in external text dialogue formatted literacy events. Students spent over two hours (2:27:35) engaged in seatwork during the course of this study. Altogether eight seatwork events ranging from three minutes to nearly an hour in length were identified and analyzed.

For the purposes of this study, two literacy events involving the use of digital technologies were included as seatwork. On the first day of the study, students used laptop computers to view shuttle launchings. Many students required some assistance with the text in the search engine so Ms. Jones assisted them in navigating to an appropriate site on the World Wide Web. On Day 7 of the study, each student spent a few minutes towards the end of the class using an iPod touch device to navigate to a specific website in order to access practice multiple choice questions. Both the text and the mechanics of navigation on the device presented difficulties to some of the "struggling" readers. For example, when he used the iPod touch device, Jack did not understand at first that he must scroll down to see the all of the text, including the choices after each question.

Structure of seatwork.

Almost all of the time students were engaged in seatwork they were allowed to talk with each other and to both teachers. At times, two or more students would work together and then separate and work individually. Sometimes, Ms. Sand or Ms. Jones would begin helping one student and an informal group would form composed of students who all wanted assistance with a particular question. Therefore, what was a period of seatwork for some students may also have been a period of group work for others. For this reason, the somewhat arbitrary distinction between seatwork and group

work should be taken as a general one which mainly exists for the purpose of focusing discussion.

On Day 15 of the study, a typical literacy event structured as seatwork occurred toward the end of the class. This event illustrates the informal nature of this activity structure. Students were working to finish answering the questions on the various exam preparation study guides Ms. Sand had distributed. At the beginning of class, Ms. Sand explained to the students that they would have the opportunity to finish an English project during this period if they had not already done so. She then went on to explain what the students who were finished with the project should do. *Uh, the rest of us we're just we're gonna be working with our partner again.* After about 40 minutes had elapsed, everyone except for Javon appeared to be finished with the poetry project. Moreover, although many of them had begun the class period working with a partner or in a small group, a number of these groups had gradually drifted apart. A review of a few minutes of the video beginning at 57:22 reveals the following activity in the classroom:

> Ms. Sand calls Ashley's name and says, "*open up your book, we trying to find 'bout the moon's density XXXX*" Someone calls out, "*What page*?" *Force of friction* is mentioned, perhaps by Josh, and others can be heard wondering what page. Students on the right side of the room, Niah, Daniel, and Daisy, have or are in the process of getting their textbooks out, presumably in preparation for going over the questions. Niah is looking for the moon's density in the textbook. Ms. Jones is sitting with Alice. Lloyd is sitting at his desk with papers out but no textbook. Adam and Javon are

> discussing a paper, apparently related to the English assignment. Javon is still working on the laptop, an indication he has not finished the English project. Adam comments about the poetry assignment and a poem is visible on the paper he is examining. Ms. Sand is working with Josh at his seat. Jack and Clyde are out of the room.

As can be seen from this vignette, Ms. Sand did not always present herself to the students in the class as the ultimate authority during periods of seatwork. When she moved from her desk to give individual assistance to students, she nearly always sat with Josh, and she did not come prepared with a teachers' guide with the answers. If the two of them had difficulty determining an answer, she would involve the other students in the class by asking them to search for the answer too. In this case, although she has specifically addressed Ashley for assistance in locating the information, Niah has joined in the search as well. Niah's behavior here is but one example of many in which she resisted being positioned as a "struggling" reader. Although Niah was very forthcoming in her interview about her perception that she was not a good reader and mentioned having difficulty locating information in the textbook, her behavior here demonstrates how she seeks to align herself with the students in the class who are viewed as capable of locating information in the textbook. She does not hesitate to pull out her book and begin to search for the information along with Ashley despite the fact that Ms. Sand has not addressed the request to her. Meanwhile, Lloyd is working alone to answer questions, apparently without the assistance of his textbook. It appears he is relying on what he remembers from class discussions and read alouds. Javon is not working on any study

guides but rather is still trying to finish his English assignment. Ms. Jones has pulled a chair up to Alice's desk in order to give her individual assistance.

Substance of literacy events with seatwork format.

Although the literacy events with a seatwork format in this classroom were always centered around a writing task, they infrequently required only writing. The students did spend a small part of one class finishing a paragraph and during one class period when quite a few students were out of the room working with another teacher, the remaining students made a list of items they would take to the moon. However, the rest of the seatwork the class completed required that they read as well as write. The reading on the worksheets and study guides the students did included reading multiple choice questions, short answer questions, and two graphic organizers. In addition, most often these questions were most easily answered if students were skilled at reading to locate information. Furthermore, Ms. Sand and Ms. Jones also suggested to students that they refer to the textbook when they answered questions incorrectly. At times, some of these students chose to ignore these suggestions to engage with the textbook. For example, on Day 12, after Ms. Sand has found one of Jack's answers to be incorrect she suggested "*you better go back and look, get your book out*." In this particular case, Jack chose to ignore her comment. He did begin rewriting his answer, however, he did not get his book out.

Moreover, Jack's avoidance often took the form of disengaging from the seatwork activity entirely. For example, according to the transcript of the literacy event on Day 11, after Ms. Sand gave directions, Jack approached her for clarification. He did not bring a pencil to her desk with him, so she sent him to get one. Then, a few minutes after

returning to his desk, he spent 2 minutes and 29 seconds staring into space and tapping his pencil on his desk before he began writing again. At that point, Jack turned around in his seat and started reaching his arm towards Cam and talking to him. When he finished, he turned back around and stared into space for a minute and a half. When Ms. Jones sat down to help Josh, who was seated directly behind Jack, Jack turned around and watched her for a minute. Next, Jack got up and went to Ms. Sand's desk. Jack then went back to his seat. However, he did not go back to work. A few minutes later, Ms. Jones explained one of the questions to the whole class both verbally and with the use of gestures. Jack was looking at his lap, but the rest of the students who were visible in the video were paying attention to her. Ten minutes later, Jack left the room. Several of the other "struggling" readers were also noted to engage in avoidance strategies. For example, both Lloyd and Clyde were observed going to the pencil sharpener multiple times before beginning assignments.

Another strategy the "struggling" readers in this study used to cope with literacy demands during seatwork was to seek help from Ms. Sand or Ms. Jones. Four of these "struggling" readers, Javon, Clyde, Alice, and Sierra were classified as special education students. Ms. Jones was assigned to this classroom specifically to give assistance to these the special education students. For this reason, when a literacy event structured as seatwork began, Ms. Jones often walked to each of these students' desks to check in with them about the assignment. Her interactions with these students included reading questions aloud, eliminating answer choices, and suggesting strategies for determining the correct answer. The following example from an interaction with Alice

demonstrates both how Ms. Sand read the text to these students and how she eliminated answer choices for Alice as she reasoned through the question.

> *Number four. According to the modern model of atoms [she gestures with her hand to indicate an atom is small] an atom . . .* ***cannot be broken down into smaller pieces, no, consists of a positively charged sphere in which negatively charged electrons are embedded like raisins in, no,*** *consists of a nucleus of a negative charge, consists of a nucleus containing protons neutrons. So an atom has protons and neutrons XXXX and inside that, XXXX,* ***so J****.*

In this incident, after Ms. Jones reads the question stem, she begins reading the answer choices one by one. She eliminates the first two choices before reading the subsequent choices. In fact, she does not completely read the text of the second choice but stops before coming to the end of the phrase to comment, "*no*" indicating she has eliminated this as a choice. She briefly states a reason why *j* is the correct answer, "*so an atom has protons and neutrons XXXX and inside that, XXXX*" before stating, "*so j*" indicating this as the correct answer.

At other times, as this comment from Day 12 illustrates, Ms. Jones gave less direct assistance by helping the students think through the question or by mentioning strategies the students might use to locate the answer.

> *First of all what's the XXXX So what do I have to say? What's the* ***key word****? XXXX So what kind XXXX* ***what kinda power are they talking about****? So it's what?*

Here Ms. Jones suggests a strategy, (*What's the **key word**?)* She also asks a question designed to elicit an inference, (***what kinda power are they talking about****?)* In order to fully describe the types of assistance both Ms. Sand and Ms. Jones gave to "struggling" readers during seatwork, several key incidents illustrating important aspects of literacy practices in seatwork are described below.

Incident one

Not all of the difficulty "struggling" readers experienced locating information in the text was simply because they failed to read to locate a specific phrase that could be copied to answer a question. At times, the textbook questions required students to use more sophisticated literacy skills such as making inferences. Many of the students in the class experienced difficulty with these questions. As Tara commented in the second interview she experienced difficulty when she didn't *know what the questions were asking*. At times, it was also difficult for the teachers to understand the inference required. For example, on Day 4 of the study, students had to answer the following questions, labeled with the phrase: *Thinking Critically Inferring* from the *Section 4 Review* in the science textbook:

> *Why did scientists once think there were volcanoes on the moon? What evidence from the Apollo landings makes this unlikely?* (*"Prentice Hall Science*," p. 588)

As I was circulating among the students observing them complete this assignment, Clyde requested my help with this question, and the following conversation ensued.

Ms. Palmer: Okay, so what does the last one say?

Clyde: "Why did scientists once think there were volcanoes on the moon (.4) What evidence from the Apollo landings makes makes this unlikely?"

Ms. Palmer: Okay, so why did scientists think there were volcanoes on the moon? Do you remember what it says?

Clyde: It says XXXX, it says that the craters of the moon had been made by volcanoes.

Although Clyde read the question in its entirety prior to considering the answer to my question, he does not appear to have understood the implication of the words *once think* in the first question or of the phrase *makes this unlikely* in the second question. His comment instead indicates he erroneously believes volcanoes did make the craters on the moon. I then attempted to refocus his thinking on the phrase *once think.*

Ms. Palmer: So, why do you think they ***thought*** *that?*

Clyde: because, I don't know.

Ms. Palmer: You don't know that. Can you make a guess? Cause ***it says infer so that means like to make an educated guess.***

Clyde: cause there were shuttles up there?

Ms. Palmer: Okay, that sounds like a good answer to me.

Clyde: XXXX

Ms. Palmer: So the question said "why did scientists once think there were volcanoes on the moon?"

Clyde: because the craters were

Ms. Palmer: ***because and then there's a sec- there's a part two to*** *this right here* ***so what does that say?***

Clyde: ***advice***

Ms. Palmer: What's that word?

Clyde: ***Say what advice from, what (.2) evidence*** *from the Apollo landings makes this unlikely.*

Ms. Palmer: ***Okay, so what does evidence mean?***

Clyde: (.6) they saw round pits, wait, it was covered, moon's sur- the moon's surface was covered with round pits and they thought it was craters .

Ms. Palmer: Who was they?

Clyde: the XXXX

Ms. Palmer: Okay, go back and read your question again .

Clyde: What evidence

Ms. Palmer: from

Clyde: ***Oh, oh my goodness XXXX***

Ms. Palmer: Yeah, there you go.

Clyde: ***evidence XXXX ,OHHH XXXX***

Ms. Palmer: Well, I, uh, read this section then see if you can figure out.

Clyde: "Astronauts brought back 382 kilograms of moon rocks, about half of the mass of a small car. Much of what scientists have learned about the moon came from detailed study of the moon rocks gathered by astronauts .

Ms. Palmer: ***So what does the word evidence mean?***

Clyde: ***what they see***

Ms. Palmer: ***What they see so what evidence do they have?***

Clyde: ***detailed study of the moon rocks***

Ms. Palmer: And what does it tell you about the moon rock ?

Clyde: It's about half the mass of a small car.

Ms. Palmer: Okay, that's how much moon rocks they brought back. What about this part? What does that part say about the

Clyde: "Almost all the rocks were formed by cooling of molten material so the moon's surface must once have been very hot. Some of the rocks showed that they had been broken apart by impacts and then reformed so scientists concluded that meteoroids had bombarded the moon's surface. The astronauts brought measuring instruments to the moon to record some of the me- meteoroids' impacts. One type of device known as a (.4) known as a XXXX is, is used to detect earthquakes on earth (.4) moon, oh, on the moon it detected extended weak moonquakes the result of changes deep under the moon's surface. [heavy sigh]

Ms. Palmer: So, your question asks you to

Clyde: Ohhhh

Ms. Palmer: make an inference, like, to make an educated guess about what evidence made it unlikely that there were volcanoes on the moon. So you just read the evidence, so what is your educated guess?

Clyde: Oh my gosh

Ms. Palmer: Whatdaya think?

Clyde: ***(.7) I'm trying to think think. (.9) think, think, think***

Ms. Palmer: You still thinkin'?

Clyde: Um hum.

Ms. Palmer: Okay, well

Clyde: OH, oh (.9)

Ms. Palmer: It's your educated guess what you think.

Clyde: (.21) They thought it was (.6) it was they XXXX it was

I initially attempted to focus Clyde's attention on his misunderstanding of the question because his response, *I don't know*, indicated he may not have realized this question required him to make an inference. I then attempted to explain this task to him. I accepted his response that space shuttles could be included in the answer to this question, but when I asked him to think further about this, he returned to the word *craters* without connecting it to the space shuttle. I then decided to point out the second part of the question to him. He misread the word *evidence* as *advice* on his first attempt at reading the passage, but managed to self-correct when he reread. However, when I attempted to get him to explain the meaning of the word *evidence*, he avoided my question by reading more of the text. He continued to avoid a direct definition for the word by making two unfinished explanations. Then he apparently intended to imply he had figured out the answer (*Oh, oh my goodness XXXX ; evidence XXXX ,OHHH.* However, these actually may be attempts to divert attention from his having neglected to define the word. At this point, I asked him to reread the segment of text that indicated the evidence. This appeared to help him articulate a definition for the term because when I asked the question, *What does evidence mean*, again after he finished reading, he

responded, *what they see.* At this point, he was able to answer the first question by repeating a phrase from the text to me.

However, when we went on to the second question he again instituted the same avoidance behavior by making comments such as, *I'm trying to think, think. (.9) think, think, think.* When I tried to refocus him another difficulty with the text became apparent.

Ms. Palmer: Who thought there were volcanoes?

Clyde: astronauts

Ms. Palmer: Did the astronauts –

Clyde: Oh, no never mind, Galileo

Ms. Palmer: And so, when did all that happen?

Clyde: (.7) during the

Ms. Palmer: ***Did Galileo and the astronauts live at the same time?***

Clyde: ***uhhh, they didn't live at XXXX time let's see (.7) yeah, yeah***

Ms. Palmer: Did Galileo go to the moon?

Clyde: Nooo

Ms. Palmer: ***So the people who thought that there were volcanoes, where were they? They weren't on the moon?***

Clyde: Uh, ***they were probably in a rocket*** *or something.*

Ms.Palmer: Hmmm, (.3) see that date right there?

Clyde: Oh, telescopes.

Ms. Palmer: So that was when?

Clyde: 1609

Ms. Palmer: And, and they looked at the moon with telescopes didn't they?

Clyde: yeah

Ms. Palmer: And ***where were they standing when they did that?*** *(.4) On a rocket or on the earth do ya think?*

Clyde: ***on a rocket***

Ms. Palmer: I think they were probably on the earth

Clyde: On Earth, yeah

Ms. Palmer: I don't think they had a rocket back then, do you? So, they were lookin' at it from pretty far away, right?

Clyde: Um hum

Ms. Palmer: And they had those telescopes. Now, that was in 1609 and do you remember when this happened?

Clyde: 1969

It appeared Clyde had several misconceptions about the sequence of these events. For example, he was unsure when Galileo lived in relation to when the astronauts lived and to the time period when space exploration began. Given these significant misunderstandings and his initial difficulties understanding what the question was asking and what the term *evidence* meant, he was ultimately unable to determine an answer to this question.

Ms. Palmer: I can't wait to see the inference you make.

Clyde: YES. (.4) Ohhhhh (1.26) Oh my gosh, I just lost it.

Ms. Palmer: It's what?

Clyde: I said I just lost it.

At this point, Clyde completely gives up on my ability to assist him in answering this question and announces that he is going to ask Ms. Jones to help him. According to the teachers' guide, the answer for this question is as follows:

> Scientists once thought that some of the moon's craters were formed by volcanoes because they resembled volcanic craters. The Apollo astronauts measured the heat flow beneath the moon's surface and found that the moon has cooled almost completely since it was formed, so the presence of volcanoes seems unlikely. (*"Prentice Hall Science,"* 2004)

As is apparent from their interaction, Ms. Jones has checked the teacher's guide and determined the sentence in the book that the authors of the text suggest indicates the correct answer, a sentence Clyde and I had yet to consider.

Clyde: Mrs.Jones? What is your inference? . . . inference, I need a inference, I need

Ms. Jones: for . . . number 4?

Clyde: yes

Ms. Jones: Well, ***do we even start with the word because****?*

Clyde: on it, I'm gonna just mark it out there and then I'll make that

Ms. Jones: ***a capital c***

Clyde: yeah

Ms. Jones: K, let me see what you wrote (.3) K, the craters were shaped like volcanoes. Okay, well ***you need to start with a complete sentence****. The scientists*

Clyde: Oh my gosh.

Ms. Jones: thought that the craters were formed because they looked like volcano craters. Now the second part says what evidence from the Apollo landing make this likely?

Clyde: I need to know your answer. Do you have a inference like I need to know it like

At this point in the exchange, Ms. Jones ignores Clyde’s question and spend a little more time working on his first written response. Ms. Jones’ comments about punctuation and sentence structure, indicating she values correct formatting equally as much as correct content. After the first answer is complete, Ms. Jones reads the second question again.

Ms. Jones: And then XXXX in front of it, it says what evidence from the Apollo landing makes this unlikely?

Clyde: Yes

Ms. Jones: Okay

Clyde: ***I read all of that and I had it but I lost it.***

Ms. Jones: Sit up straight please, put XXXX back up. Okay it from the landing, ***it's because*** *they took the instrument and tested the heat flow of the surface. It's just right here, see right here it says another kind of instrument that they left behind measured the amount of heat flowing from uh the moon's interior, and once you studied the inside of the moon, like the moon is like, the instrument showed that* ***the moon has cooled almost completely since it was formed, testing an instrument, test the heat flow, the moon has cooled completely. So you need to get that in a***

sentence, formed, testing, an instrument, test the heat flow, the moon has cooled completely. So you need to get that in a sentence.

Clyde: Whadyou say?

*Ms. Jones: **Write your own words**.*

Clyde: The moon

Ms. Jones: period

Clyde: was

Ms. Jones: get a period, go on

Clyde: XXXX

*Ms. Jones: **evidence from the Apollo landing***

*Clyde: **evidence from the Apollo landing***

*Ms. Jones: **makes this unlikely because and then write why***

Clyde: (.15) from (.5) from Apollo landing (.7) makes this unlikely

Ms. Jones: See whatchya got

Clyde: lost it

*Ms. Jones: evidence from the Apollo landing ma- (.2) first of all (.2) mak- wha-, what's this wha'st the word? This (.5) evidence from the Apollo landing made this unlikely because (.2) the moon has cooled (.8) almost **completely (.6) since it was formed (.6) period**. Put your, I want the page numbers there page 58- ssss 588, number page 588 numbers one through four, and then get your workbook out please and turn to page 210.*

Once Clyde indicates that he *read all that* and still did not have an answer to the question, Ms. Jones chooses to paraphrase the key information from the text, repeating

the information twice. At this point, she tells him to *get that in a sentence* and *write your own words*. Nevertheless, she ends up dictating the beginning of the sentence to him before she directs him to *write why*. However, when she checks with him after giving him a little time to write, he again states that he *lost it*. At this point, Ms. Jones dictates the remainder of the sentence to him, ending by telling him to put a period, the page number, and question numbers on his paper. Clyde’s final response can be seen in *Figure 13*. Clyde’s answer to question four Day 4.

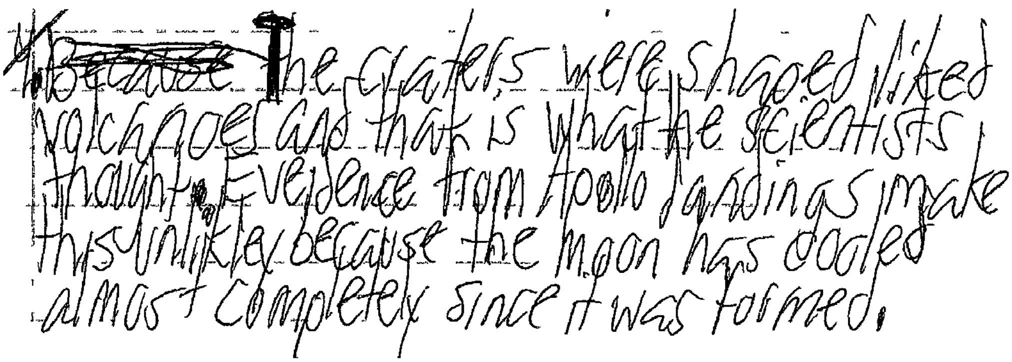
~~Because~~ The craters were shaped liked volcanoes and that is what the scientists thaught. Evedence from Apollo landings make this unlikley because the moon has cooled almost completely since it was formed.

Figure 13. Clyde’s answer to question four Day 4

Participation

Clyde was an active participant in both his interaction with me and his interaction with Ms. Jones. However, because our expectations for his participation differed considerably, he interacted with us in very different ways. As a literacy educator, I constructed this activity as one in which the primary goal of the activity was to make an inference by using evidence from the text. Thus, my interaction with Clyde was centered around close reading and the use of textual evidence to support a judgment. Although Clyde at first attempted to participate by answering my questions and rereading text,

when he began to experience some difficulty, he instituted some avoidance tactics such as not directly answering my questions. Ultimately, he chose to consult Ms. Jones for help.

Ms. Jones did not conceive of this task as being primarily about a particular literacy strategy. Her job in this classroom was to assist the five special education students, four of whom were “struggling” readers, in completing their assignments. To her, the ultimate goal of the interaction was to complete this particular task by having a correctly written answer by the end of the event. Furthermore, she did not need to reread the text herself because she had previously read the answer in the teachers guide. When Clyde indicated he had already read the text and still did not know the answer, Ms. Jones explained the answer to him using key phrases from the text. She then expected him to write the answer on his paper in his *own words*. When he also experienced difficulty putting the answer in his own words, she revised her expectations. Ultimately he experienced success with the assignment, however, his participation amounted to correctly writing text dictated by Ms. Sand.

Learning.

Although it is certainly possible that Clyde learned any number of things about inferences and about science content from these interactions, this learning in not apparent in the product of the interactions. Certainly, our conversation about the sequence of events leading to the collection of moon rocks by the astronauts revealed some degree of uncertainty on Clyde’s part about these events. It would have been extremely difficult for Clyde to arrive at a reasonable inference on his own given these underlying confusions. However, Clyde’s final written product is but one example of the method used most often by these “struggling” readers to successfully complete science assignments. Clyde’s written answer contained a sentence copied verbatim from

the text; *the moon has cooled almost completely since it was formed.* There is no indication Clyde would be able to connect this phrase to the idea that there could, therefore, most likely not have been volcanoes on the moon.

However, it is equally likely if Clyde is able to remember this phrase, he could answer a similar multiple choice question on a test of this material. Unfortunately, this was not the question asked on Day 9 when Clyde took the Chapter 18 unit test. Instead, he the question read, "*Instruments left on the moon to measure heat flow show that-*" (*"Prentice Hall Science . . . Workbook,"* n.d., p. 207) The correct answer was the phrase above, *the moon has cooled almost completely.* In our interactions with Clyde, neither Ms. Jones nor I had managed to make the connection between the astronauts, the instruments they took to the moon, and the moon rocks. Therefore, Clyde was not likely to have the elaborated understanding necessary to answer this question. In fact, he ultimately did not answer this question correctly.

Incident two

During seatwork on Day 12, Ms. Sand gathered the special education students together so she could more easily assist them. Javon and Sierra generally sat on the left side of the room closest to the door while Clyde and Alice generally sat in the row of desks at the back of the room. On this day, Ms. Jones invited Javon to sit in the back section of desks close to Alice and Clyde. He had put his head down on his desk and been particularly disengaged at the beginning of the event. (Sierra was absent from class.) After he moved closer to Ms. Jones, Javon readily interacted with her until he completed his work. In fact, at one point later in the event, he even called Ms. Jones over to his desk and began to whisper in her ear.

The students were completing *SOL Test Preparation Benchmark Test B ("Prentice Hall Science . . . Workbook," n.d.)*, a multiple choice test. Because they were not allowed to write in these workbooks, Ms. Sand required them to write out the entire correct answer rather than simply the letter indicating their answer choice. Ms. Jones is concerned these students will end up writing out incorrect answers so she suggests they should *get your answers and let me check 'em before you write out all those answers.* Ms. Jones did not exclusively give assistance to only the special education students, and this particular incident is typical of the way she sometimes included others. A few minutes after she called Javon over to her group, she decided to include Lloyd in this process,.

> *Lloyd, Lloyd: Are you okay? Lloyd, if you want me to check 'em before you write out all the answers, you let me know. If not you have to erase 'em all. So get your answers and let me check 'em so you don't write out XXXX answers.*

Her concern for Lloyd indicates that while she knows he is not one of "her" students, she is also aware he may struggle with this task's heavy reading demands. Lloyd moves to the seat behind Clyde, and Ms. Jones checks the answers he has written out so far. They are all correct, and Lloyd goes back to work. However, a few minutes later Javon notices that Lloyd has continued writing out the entire answer choice for each question so he reiterates Ms. Jones's plan.

> *No, see like this. [He reaches across to Lloyd's desk and puts his pencil on Lloyd's paper.] See like, no, no see you don't XXXX, you don't XXXX, A,*

B, C, D and when ***she checks 'em she CHANGES 'em*** *XXXX wrong.*

That's what you're talking, I'm talking about.

Javon's emphasis on the word *changes* indicates not only that this process will save Lloyd time but also that Ms. Jones will indicate the correct answer if the wrong letter is written on the paper.

Participation

This incident illustrates how the "struggling" readers in this class were able to participate in seatwork events despite finding the reading demands of the text to be onerous. Although these particular students did not assist each other very often with the content of the work, they all readily accepted assistance from Ms. Jones. Even Lloyd, who was not technically considered one of Ms. Jones's students, readily accepted her help when she invited him into the group. Furthermore, as incident one illustrates, this assistance went beyond helping students locate relevant information in the text or think through the answers to questions. As Javon points out, if a student's answers are incorrect, *she CHANGES 'em*, thereby assuring these particular students of success not only in completing the written work, but also in correctly answering questions later when they will be expected to publically share their answers.

Learning

Although Ms. Jones will ultimately ensure these four students have the correct answers on their papers, it would be wrong to assume that they have not learned anything at all during this event. Ms. Sand often read the questions and answers to the

students. As the transcript excerpt below indicates, she would often pause and use words and gestures to explain complicated science concepts as she read.

> *Number four. According to the modern model of atoms **[she gestures with her hand to indicate an atom is small]** an atom . .*

In addition, in these interactions, even when text was pointed out and read to them by a teacher, these students were having an additional encounter with visual representations of important content words. Especially for students such as Lloyd, who tended to rely more on listening than on reading text, these additional encounters were beneficial.

Incident three

An incident with Jack on Day 15 further illustrates how "struggling" readers got assistance in this classroom. On this day, Ms. Sand has told the students to work on their various study guides. She has already asked Jack for two papers that he could not find and directed him to "*stop pickin' your arm*." A few minutes after the students have begun working, she realizes Jack is not working and threatens to send him to the principal's office. Twenty minutes into the class period, she asks Jack if he has *any study guides?* When he answers in the affirmative, she makes the following comments:

> *Where are they? Turn around, Josh and you all ask each other questions. Jack, turn around, Josh and ask each other questions. Alright, um, Josh you start off.*

Jack immediately picks up his paper and turns around in his desk to face Josh. However, Josh completely ignores Jack, and Jack turns away from him and gives up his attempt to

work with him after just a few seconds. Jack then begins to work on one of the study guides by himself. He does not have a textbook or any other resources on his desk.

About fifteen minutes later, Jack approaches Ms. Sand's desk, apparently to ask to leave the room. She sends him back to his desk to retrieve the set of true/false questions he has been working on. The students had been told to correct all of the false statements in order to make them true. Jack has marked the first sentence as *false* but he has failed to correct his answer. The sentence states that day and night are caused by revolution. Ms. Sand says, *Un-uh, revolution's not right, you change it to what? rotation, change that.* Jack has attempted to correct the final statement on the page by completely rewriting it. The original statement read, "The moon's average density is greater than the density of Earth's outer layers" *("Prentice Hall Science . . . Workbook,"* n.d., p. 207). Jack had completely rewritten the sentence as follows: *The moon's density was nothing every thing on it is dead & o & no gravity.* Ms. Sand reads this question and Jack's answer to herself and then looks up at Jack.

Ms. Sand: Read this to me I can't understand it.

[He apparently reads but this is not audible.]

Ms. Sand: That's not right. What were you, you say the moon's density is, is it greater than or is it less than? What were you sayin'? You say the moon's density, read this right here"

[He quietly reads the question aloud again.]

Ms. Sand: ***Is it greater than or less than?*** *So you need to change that so everything else you say is true. I'm askin' , astronauts and equipment are*

launched into space mainly by space stations? How are astronauts and equipment launched into space? Jack: XXXX

Ms. Sand: How do they usually launch astronauts what do they call 'em?

Jack: XXXX

Ms. Sand: Yeeeaaah so that's just see you just put go back and see can you XXXX cause I sent a couple more that's not right"

Jack returns to his seat with his paper. About five minutes later, he again approaches Ms. Sand's desk. They quietly discuss his paper for several minutes and then she makes the following comment to him before stating, *so I told you you gotta go back and look over it you gotta read over it before XXXX.* At this point, Jack returned to his seat and sat quietly playing with his pen. Meanwhile, Josh sat behind him locating answers to the questions in his handouts. The two did not speak. A short time later, Jack approached Ms. Sand's desk again to ask for a bandaid for his elbow.

Participation.

This event illustrates how a "struggling" reader could be marginalized during literacy events structured as seatwork. Although, as the previous incident illustrated, Ms. Jones sometimes included "struggling" readers who were not special education students into the group of students she was monitoring, this did not happen for every one of these students each time the class activity was seatwork. On this particular day, Ms. Jones did not offer assistance to Jack. Because Ms. Sand noticed on a number of occasions that Jack was disengaged from his work, she finally suggested he work with Josh in an effort to get him to participate. However, Josh effectively indicated he refused to work with Jack because he completely ignored him. At that point, Jack turned around and removed

a study guide which had been distributed with the answers already written on it. He wrote on this for several minutes, an exercise that still did not demand his full participation in this literacy event as he was essentially tracing over answers. Next, he attempted to remove himself from the classroom by showing Ms. Sand that he had completed a different assignment – one that was also relatively nonthreatening in that he was only required to indicate if statements were true or false. At no time did he attempt to use his textbook or any other resources to figure out answers to any questions. He also did not talk with any other students about science content during this time.

Learning.

Certainly Jack's individual interactions with Ms. Sand were potential learning resources for him. As they discussed individual questions, and she prompted him for answers, it is likely that he solidified some concepts about space exploration. For example, when she twice asked how instruments and equipment are launched into space, although his answer is inaudible both times, it is apparent by her response he has managed an appropriate answer the second time. However, it is clear from Jack's revision of the final statement (*The moon's density was nothing every thing on it is dead & o & no gravity)* that he does not understand the meaning of the word *density*. Ms. Sand's question (*Is it greater than or less than?*) does not address his inadequate understanding of this term.

Participation and learning in literacy events structured as seatwork.

Taken together, these three incidents illustrate how "struggling" readers in this class participated in the literacy practices of literacy events structured as seatwork. Although the use of reading as a tool for locating answers was modeled by the teachers

with whom these students interacted, they did not often appropriate this strategy for their own use. Instead, they often sought help from adults in the classroom. Although they were also encouraged to work with other students at times, the nonstruggling readers in this classroom were not always willing to partner with students they viewed as less capable. When help was not forthcoming, ‘struggling” readers often instituted strategies to avoid working on their assignments. These strategies included finding excuses to leave the room and making numerous trips to the pencil sharpener.

The adults in this classroom often modeled the use of the textbook for locating information. When they discussed questions with the “struggling” readers, they pointed out sections of the text, provided hints and clues, and, if these strategies were unsuccessful, they dictated an answer. However, the interactions these “struggling” readers had around the text did not often include extended discussion of the concepts in the text. Rather, the ultimate goal of these learning experiences was to obtain the “correct” answer, an answer that usually could be encapsulated in a short phrase. Such phrases tended to occur with little variation in wording in the textbook and on the multiple choice tests that would be used to evaluate student learning.

Literacy events structured as group work.

For the purposes of this study, group work is defined as any two or more students working together to accomplish a task. Over the course of the observations for this study, students worked together in numerous configurations. At times, they worked with one partner and at other times, they worked with a small group of three or four students. Ms. Sand sometimes told the students whom to work with, especially if they appeared not to

be working or if they were working alone. At other times, Ms. Sand allowed some students to work alone while others worked with a partner or small group.

Structure of group work.

Ms. Sand felt, in general, students had paired themselves up *a weaker one with a strong one*. For example, she explained that Pam, Tara, and Niah always wanted to work together. However, an examination of the observed grouping configurations reveals that this was not always the case. For example, on Day 6 students were working together to answer the study guide questions in the *Interactive Notetaking Teachers Guide Science 6.8 Part 7(It's Elementary!, Inc., 2006).* Ms. Sand directed students to, *"Alright, take out your study guide and get with your study buddy.*" Adam chose to work with Ashley while Sam worked with Cam. All four of these students were not students identified as "struggling" readers and all but Cam had been on the honor roll list for at least two of the previous three grading periods. Also during this class period, Jack and Javon, both "struggling" readers who had never made honor roll, worked together. Even when a "struggling" reader ostensibly worked with a nonstruggling reader, as was the case with Niah and Tara, they did not necessarily cooperate in completing the assignment. For example, on one occasion, although these two girls spent the entire time allotted for group work sitting next to each other, they each worked independently to complete the assignment.

Substance of literacy events structured as group work

The substance of four instances of partner work and two instances of a larger group working together are analyzed in detail in the sections that follow. Taken together, these vignettes illustrate the wide variety of roles played by both "struggling"

and nonstruggling readers when they worked with each other in this science classroom. Aspects of these interactions that appear to advance student learning are also highlighted.

Incident 1: day 4.

This literacy event was audiotaped on a Monday afternoon. Mr. Patton was substituting for Ms. Sand. Ms. Jones was also present in the classroom. The literacy practices with which these students are engaged involve locating information to answer questions and writing answers in their science workbook. Near the end of the class period, students are allowed to continue working on an assignment in the science workbook. There is much student talk and background noise in the room because some students are finished or not working. Daniel has a history of being positioned as a successful student in this classroom. He has more turns at talk in whole class discussions than any other student. In addition, Ms. Sand often requests that he get things for her or take messages to other teachers. Sierra, a "struggling" reader and a special education student, is ostensibly completing the workbook pages. Although she does not have an overt history of being positioned as a poor reader in this classroom, she does have a history of being positioned as a struggling student. For example, she frequently receives individual help from Ms. Jones during individual seatwork. Ms. Jones' suggestion that Daniel "do her a favor" positions him in the role of her assistant. The favor she requests is that Daniel help Sierra with her work. She then requests that Ashley attempt to help Javon. According to my field notes, Javon rejects the role of "helpee" and refuses Ashley's help. Daniel is somewhat confused about what he should do and asks Ms. Jones, *What do you want me to do with Sierra*? Ms. Jones simply responds, *See if she needs help*, and then adds, *Like partners*. However, as the following exchanges

illustrates, Daniel does not assume the role of a partner but rather assumes the role of a teaching assistant.

Ms.Jones: ***Do me a favor.*** *Why don't you go over there and help Miss Sierra?*

Daniel: What do you want me to do with Sierra?

Ms. Jones: Miss Ashley, ***go see if Javon needs help.*** *You go help with Sierra.* ***See if she needs help****. Ashley you go with Javon see if he needs help.* ***Like partners*** *like XXXX*

[Me, random students Ms. Jones can be heard talking.]

Daniel: There's only one for right here. Okay. So you, you would circle Apollo 11. "What did, what did Neil Armstrong say when he took his first step onto the moon." [See Appendix K. Sierra’s Answers K1. Group Work Sierra’s answer Question 11.] *It is right her (.6) right her, right her, right her ba dump bump bu- bump buh.*

[Many minutes of random student talking as Daniel hums.]

That's alright. Take the time you need*. [More singing. Lloyd is heard to comment about the noise.] "How have scientists learned material XXXX the moon?"*

Sierra: ***You're horrible.***

Daniel: Alright. Any who, How have scientists learned about the material makes up the moon? ***That would be answered in exploring the moon****.*

[Daniel continues to make silly noises and Lloyd complains the "monkey noises" are distracting him.]

Ms. Palmer: I'm wondering if she's gonna be able to get finished cause you seem like you're wasting a lotta time.

Sierra: We're not wasting a lotta time. I just hate doing this.

Daniel: ***I'm just waiting for her to finish cause I'm not supposed to tell anybody***

Ms: Palmer: Oh so she knows she knows where the answer is then?

Daniel: ***Uh, I'm telling her it's right in here****. XXXX finish reading that.*

[See Appendix K Sierra's Answers K2. Group work Sierra Question 12]

*Sierra****: What if I don't wanna do that?*** *XXXX*

[Ms. Jones can be heard telling the class it has gotten too loud. Daniel resumes singing.]

Daniel: I'm a little hyper.

Ms. Palmer: You might be distracting to XXXX at the same time as you're trying to help her.

Sierra: I'm not distracted.

Ms. Palmer: Oh, okay.

Participation

Daniel enacts the role of teacher in this instance of group work while Sierra enacts the role of the resistant student. In Daniel's exchange with me he asserts that he is, *not supposed to tell anybody* the answers. Instead, in that particular instance, he has indicated to Sierra the subheading in the book under which the answer can be found. At the same time, Daniel, in his usual fashion, attempts to defuse the power differential inherent in the teacher/pupil relationship with humor by singing, mispronouncing words,

and making funny noises while Sierra works. Sierra responds to this rather than to his help with the work. She does not reject Daniel's help, and when I try to intervene by suggesting that Daniel should stop wasting time, Sierra takes his side and responds, *We're not wasting a lotta time. I just hate doing this.* Later when I suggest Daniel's silliness may be distracting, Sierra comments, *I'm not distracted.* In this way, she asserts a possible reason for her need for assistance; she needs help because she "hates doing *this*." In other words, she positions herself in the role of a resistant student rather than an incapable one. Daniel attempts to put Sierra at ease not only with entertainment but also with his comment, *That's alright. Take the time you need*, when she is writing an answer. However, when I ask if Sierra knows where the answer is, Daniel responds, *I'm telling her it's right in here.* This runs counter to his earlier argument that a teacher does not simply give a student the answer. Sierra exercises agency by resisting engaging in the literacy practice of reading written text. When Daniel attempts to get directive by saying, *Finish reading that*, Sierra responds, *What if I don't want to*? She then responds to his silliness echoing Lloyd's complaint that Daniel is making too much noise by saying, *You're horrible*. Sierra is likely more interested in a social relationship with Daniel than in participating in the class assignment. She is attempting to enact an alternate Discourse of flirtation as another means of exerting agency in this situation.

Learning.

Although Daniel attempts to encourage Sierra to read for information and even models the use of text headings as a means of locating answers, Sierra's minimal participation casts doubt on her ability to internalize the use of text headings. Furthermore, she completes very little reading during this time period. However, the

answer she writes for Question Twelve is taken from the text under the subheading Daniel pointed out, indicating she at least followed his directions and read this section of the text to locate the answer. The activity in which they are engaged does not lend itself to extended discussions of scientific concepts so any learning of science content is at the level of discrete facts such as the date of the moon landing.

Incident 2: Day 7.

Students are working together to answer multiple choice questions on a study guide for their upcoming unit test. The study guide is actually a test provided in the teacher materials for the textbook series, *Chapter 18 Test Earth, Moon, and Sun ("Prentice Hall Science. . . Workbook", n.d.).* Ms. Sand told me after class that she had them do this study guide to prepare for next week's test but that she considered it to be easier than next week's test. However, she explained the two tests were similar in that the actual test will also be from teacher materials for the textbook series. She said the tests differ in that *one might have the summer solstice and one the winter*. I noted that a couple of grouping arrangements were different from the previous group work event. This time, Daniel worked with Jack . (Daniel worked with Ms. Sand last time. Jack worked with Javon last time.) Sam worked with Lloyd. Clyde worked with Ms. Sand when Ms. Jones had to leave momentarily. I sat with Jack and Daniel as they worked together for nearly twenty-four minutes to answer the questions. I had my digital recorder in my pocket so it was not visible during their interaction. They sometimes appealed to me for help because I was nearby, but I did not focus my attention on them at all times so they did not feel under my scrutiny throughout the session.

Although both students appeared to begin the task with enthusiasm, they soon perceived it as a difficult one. They quickly agreed on the answer to the first question, but were unsure of the answer to the second question. A few minutes into the session, Daniel appealed to me for help by commenting, *We're confused.* Later he commented, *I'm sick and tired of this*. Jack responded by saying, *This is math, I'm tellin' you.* Later Daniel again complained, *I don't know this. This is boring*. Jack's response to him this time is, *It's hard.* Toward the end of the session, Daniel began working independently. When Jack asked him about his answers, Daniel commented, *I don't even know if any of these are right.*

They had a number of tools for answering the questions; the textbook, me, and the other students in the class. Most often, Daniel attempted to answer questions by locating relevant sections of the textbook and reading them aloud. However, he experienced little success with this and at one point after attempting to figure out a question by reading an extended passage from the textbook aloud, he commented, *This is not helping*. Jack viewed Daniel as a resource as well. In fact, Daniel immediately assumed the role of text reader. Although Jack followed along as Daniel read and attempted to locate answers to questions, he never initiated any oral reading of passages. Jack also viewed Daniel, at times, as the ultimate authority for the correct answer. For example, the following exchange occurred when Jack was unsure what Daniel had put for the answer to a question.

Jack: A or C?

Daniel: A or C

Jack: You said c at first cause cbbb aa d a

Later, when Daniel had begun to work on his own, Jack asked, *which one you on?*" The following exchange then occurs between the two of them.

Jack: ***Which one you on?***

Daniel: fifteen (.4)

Jack: What's thirteen and fourteen?

Daniel: Alright, each of the XXXX, you ***should try to find these on your own,***

Jack: I'm trying to see what you just XXXX

Daniel: well ***work faster***

Jack: ***You know what. I'm not a honor roll student. I can't work fast.***

Daniel: ***Neither am I.***

Jack: ***You are so a honor roll student.***

Daniel: not XXXX

Jack: ***butt-headed liar Did you just try to kick me?***

Daniel's reaction to Jack indicates that he does not wish to function as a resource for Jack. In fact, he believes that Jack should independently locate the answers rather than simply obtain them from him. So while Daniel appears to define this as an activity in which one may share answers obtained from various resources with a partner, he does not wish to assume the role of a resource for Jack. Jack, however, is correct in his assertion that Daniel is an honor roll student. Daniel did, in fact, make the honor roll list for the first and third nine weeks of the school year. Despite the fact that Daniel has rejected that role in this situation, Jack wants him to assume it while he wishes to assume the role of someone who *can't work fast*. Daniel, however, rejects

Jack's attempt to assume that identity. Although both boys have a common perception of the task they are to complete and of the majority of the resources they should use to complete it, they apparently differ in the manner which they believe this should be enacted as a cooperative activity and in the identities each of them wish to assume and expect of each other in completing this task.

Jack's role in this situation is actually more nuanced than the role he attempts to get Daniel to recognize. Jack is not wholly dependent on Daniel for answers. For example, when Daniel initially chooses the wrong answer for the second question, the following exchange occurs.

Daniel: "Which of the following events occurs once every 24 hours? Earth a ro- revolves around the sun."

Jack: ***Yeah, earth, wait w-w-what?*** *"earth ror- earth rotates on its axis"*

Daniel: Earth rotates on its axis causes day and night. "As the earth rot- rotates eastward, the sun appears to move westward across the sky. It is the day"

Jack: ***wait, what what causes***

Daniel: the earth rotate around the sun

Jack: ***But what causes the 24 hours****?*

Daniel and Jack: "Earth rotates around the sun."

Jack: What causes the light?

Daniel: Exactly

Jack: ***twenty-four hours***

Daniel: XXXX right here

Jack: ***Then why'd you put earth?***

Jack apparently has read the answer choices to himself and determined that the correct answer is *Earth rotates on its axis*. When Daniel begins reading a different answer that also begins with the word Earth, Jack initially agrees but then says, *wait w-w-what*? and reads the correct answer. In addition, he repeatedly points out that the question mentions twenty-four hours as a clue to the correct answer. Daniel does not actually admit he is wrong but instead reads a sentence from the book and makes some tangential statements. The exchange ends with Daniel agreeing about the answer by saying, *right here*, and Jack asking a question which goes unanswered by Daniel, *Then why'd you put Earth*?

A few minutes later in attempting to answer a question about the shape of the moon's orbit, Daniel apparently has difficulty pronouncing the word oval.

Daniel: the moon's moves around the sun ***has the shape of an ooooo-ohhh-uh***

Jack: What is up with you and your kooky XXXXX ***Is it oval?***

Daniel: ***I don't know. Give me a minute.***

Jack: XXXX Well, ***in the sky it looks like a***

Daniel: that the moon. The moon's orbit around Earth

Jack: No it's orbit XXXXXX it's orbit XXXXX

Daniel: Um, ***Sam isn't this oval****? Isn't this oval? I'm gonna say* ***I'm gonna say this is oval.***

Jack: ***I'll go with circle*** *XXXX*

In this exchange, Jack has no difficulty determining that the word in the text is oval, in fact, he asks, *is it oval*? Daniel interprets this comment to mean that Jack is asking if this is the correct answer. When Daniel responds that he does not know if this is the answer, Jack begins to try to reason to arrive at the answer. His comment about how the moon looks in the sky prompts a discussion about orbits that ends when Daniel consults Sam for the correct answer. Neither boy attempts to use the textbook as a resource. Daniel does not wait for Sam's answer, however, before deciding to select oval as the answer. Although not audible on the recording, it's likely Sam responded to Daniel because Jack's comment, *I'll go with circle* was likely his response to Sam's answer. Sam's paper shows that he, in fact, selected circle as the answer. However, despite Jack's comment, he ultimately chose oval as the answer. In this case, Jack does appear to depend on Daniel as the authority, however, he also sees himself as someone with agency who can reason out an answer or publically state that he is choosing to *go with* a different answer than the one Daniel has chosen.

Furthermore, although both boys define the task as a difficult one, their reactions to the perceived difficulty differ. Daniel has little patience with the task and engages in a number of behaviors to distance himself from the activity. Jack attempts to get Daniel back on task. For example, when Daniel and Jack are unable to locate the answer to a question in the text, the following conversation occurs.

Daniel: I'm gonna ***random guess****. I'm thinking d. marias are oh, marias.*

(singing) maria oh XXXX maria

Jack: ***you can stop now***

Daniel: (still singing) maria oh ave maria

Jack: ***stop***

Daniel: XXXX maria (singing in a lower voice) XXXX maria

Jack: ***You're not allowed for singing***

Daniel: it's an opera you're sposed to deep singing

Jack: ***You're not allowed for singing***

Daniel: ahhhhh, so what was I looking for again? never mind, marria mahrrrra maria (.12) ***We are gonna go over this, right?***

Ms. Sand: Yeah, we going over this

Daniel: marrriaaa owwww

Jack: ***come on Daniel***

Participation

Daniel has employed three different strategies to distance himself from what he perceives as a difficult task. First of all, he has decided to *random guess*. Secondly, he has begun to sing to pass the time. Finally, he asks Ms. Sand if the answers will be discussed in class. At one point, Daniel even offers me money to *research* an answer for him. Jack, however, attempts to focus Daniel on getting the work done. He, apparently, does not wish to avoid this difficult task, in fact, it appears he is anxious to obtain the correct answers before they are discussed in class. He repeatedly asks Daniel to stop singing and twice informs him he is *not allowed for singing*. After Ms. Sand fails to comment on Daniel's lack of attention to his work, Jack is finally able to get Daniel back on task when he says, *come on, Daniel*. Yet later on in the event after Jack and I worked together to locate an answer in the text which Jack then shared with Daniel, Jack commented, *Hey* ***at least*** *I found that*. In this case, his use of the words *at least* appears to disparage his prior contributions. Jack is anxious to enact the role of a

"good student" in this case although he feels he cannot manage the demands of the text as readily as Daniel. While Daniel is ultimately unable to persist when he has difficulty locating the answers, Jack is persistent in the face of the difficulties the two boys encounter.

Learning.

Jack had difficulty with some content words in these texts. For example, Jack told me he did not know the word *satellites*. I pronounced the word for him. Jack did correctly answer a question about rotation on the final exam, information he encountered in completing this activity with Daniel in questions one and sixteen. In the second half of the session, Daniel began to completely lose patience with the activity. In order to finish, he began to quickly read the study guide and fill in answers. This ultimately ends in the discussion about honor roll alluded to earlier. Although Jack correctly answered question twelve on the study guide, it was clear he did not understand how Daniel arrived at the answer. When Daniel said the answer was *tides*, Jack responded, *whoa, whoa what*? Although he wrote down what Daniel said, Jack went on to miss a similar question on the Chapter 18 test. When Daniel lost patience with the activity, he began to rush through it. At that point, he did not share his answers with Jack. This, in turn, served to limit Jack's opportunity for learning because of Jack's perception was that he needed to depend on Daniel to obtain the answers.

Incident three Day 8

Lloyd, Clyde and Sam were reviewing together in order to get ready for the quiz bowl game. This is a voluntary group as Ms. Sand has allowed students to review together or alone if they wish. Their goal is to make sure they know the information in

order to answer questions correctly for their team in the upcoming game. This event was recorded using my laptop computer which I left near the group as I circulated around the room observing other students. Lloyd is reading from the *Chapter 18 Test Earth, Moon, and Sun ("Prentice Hall Science. . . Workbook," n.d.)* study guide. The class had gone over the correct answers the previous day. Clyde apparently did not bring his study guide to class on this day so Sam lent him his copy. The entire transcript is reproduced here. The discussion follows. Lloyd reads each question and the four answer choices aloud.

Lloyd: Okay, XXXX, "the measurement" hold on "the measurement of distance the measurement of distance from the equator is a circumference b latitude c phases d degrees"

Sam: latitude

Lloyd: That's the only one that's up there that "the moon's, the moon's orbit around earth has the shape of a a circle, b ***ogle,*** *c sphere, d crescent"*

Clyde: oval

Sam: It looks more like an oval that or that (motioning with hands).

Lloyd: "In the northern hemisphere XXXX, In the northern hemisphere the winter solstice occurs during a December, b January, c February, d June."

Sam: December, wait, what was the qu- what was the question?

Lloyd: "In the northern hemisphere the winter solstice occurs during a"

Sam: December

Lloyd: "A rocket pushes forward as a reaction to the expelling,

expelling" hold it of "a the expelling of hot gases throughout the nozzle at the rear, b the exp-l the expelling of rocket fuel XXXX" throughout "the nozzle of the rear, c the heat of burning rocket fuel, d the gravity of earth"

Sam: XXXX

Lloyd: seem like it

Sam: I'm have to say a.

Lloyd: "The pull of gravity on the surface of the moon is a six times on the earth's surface."

Sam: b

Lloyd: b

Clyde: ***Let him finish***

Lloyd: "one quarter of that on the Earth, c one eighth Earth's surface, d one sixth Earth's surface."

Sam: d

Lloyd: d ***"Maria are" my mya***

Sam: ***maria***

Lloyd: ***Yeah, right*** *"a sea on the moon, b regions with many craters, c regions flooded by molten material, d lunar highlands"*

Clyde: c some of em are molden material, molten material

Lloyd: Oh yeah, yeah, yeah, yeah. ***I was thinking of that one word.***

Sam: ***Do you want me to ask the question? [laughter]***

Lloyd: darkness "darkest part of earth's moon shadow is the a penumbra, b umbra, c, solar eclipse, d new moon, the darkest part of the moon's

shadow is- Humans first landed on the moon in a 1861, d 196,1 c 1969"

Clyde: Oh god, hold on.

Lloyd: d 1971

Sam: c

Lloyd: nineteen b

Sam: c

Lloyd: nineteen no, wait

Sam: You said it was c.

Lloyd: It's not c.

Sam: You said it was c.

Clyde: That's wrong.

Sam: ***Oh it's a no, wait.***

Lloyd: ***Wait man, that was that was before the civil war even started.***

Clyde: ***I know, right.***

Sam: ***I meant b.***

Lloyd: b b yeah

Clyde: ***I got that one right too.***

Lloyd: The two days which the sun o-v ah ***you got c man the whole time***

Sam: ***[laugh]*** *XXXX the top XXXX you're reading, actually, I want to know what it says.*

Lloyd: "The two days on which the sun is overhead earlier at 23.5 degrees north or south is called," Clyde

Sam: ***wait llll-***

Lloyd: ***Hold it hold I, have you ever seen the movie Transformers?***

Clyde: yeah

Lloyd: You know what type car Jazz is? What type car is it? That's the name of the answer.

Clyde: oh (.4) that's a um

Sam: ***I know what it is.***

Clyde: That's a um I can't pronounce that word one comes XXXX and one comes XXXX, I can't pronounce that word

Sam: No this is the type of car, XXXX keep that

Clyde: oh my god

Sam: Wait, wait wait is it?

Clyde: I can't remember it one comes XXXX

Lloyd: tell me what it start with XXXX blank "are the **raise** *XXXX every 12.5 hours or so"*

Sam: ***tides***

Lloyd: "Satellites" hold on this is XXXX "Satellites are blank orbits around Earth in the same time it takes for Earth to rotate on its axis, Satellites with blank orbit, orbit revolve around Earth in the same time it takes Earth to rotate on its axis"

Sam: See answer it.

Clyde: Oh geo geo no geo no it's it's geo it's the geo thing

Sam: there you go

Lloyd: ***XXXX it's geo sumpin.***

[much "one-word" discussion also "nah, that ain't right]

Clyde: umbra

Unidentified student: umbra geo

Clyde: It rhymes with umbra except geo something.

Sam: geo well I think it's that

Lloyd: Do you know this answer? Do you wanna answer it?

Ms. Palmer: You guys tell me. What is it?

Lloyd: geo and umbra something

Clyde: You don't know that? That's what we had down.

Ms. Palmer: Where do you have it written down?

Lloyd: geo and umbra XXXX

Sam: Where, right there?

Adam: It was geosynchronous

Lloyd: It looks like numbers s - y - n

Clyde: can't find that one

Sam: ***Let me finish the rest of this.***

Ms. Palmer: So, Sam, can you say it?

Sam: geo - synchronous

Ms. Palmer: Right, right and do you know what geo means?

Sam: XXXX

Ms. Palmer: Is it, geo means the Earth and chronus has to do with time so isn't that related to the definition of the word?

Lloyd: “A lunar eclipse occurs when” moon and a in the XXXX “A lunar

eclipse occurs when the moon is in the" blank" phase", wait hold it

Lloyd: Um, "each of each of the two days of the year when neither hemisphere is tilted toward the sun is known as an"

Unidentified student: you said equi that's not like half of it. just said it equi equin- equinox? Yeah

Sam: ***No, I wanna ask the question***

Clyde: Thank you. Which one we - oh, ok

Sam: ***True or False Clyde, look***

Clyde: XXXX In one year, XXXXXX the day in March on which the sun is overhead at the noon at noon at the equator is called the blank XXXX a 18 I got a 18 have to see it XXXX on wait when the moon is in Earth's blank you see a total lunar eclipse XXXX whoa when the moon is in Earth's blank you see a total lunar eclipse okay ***Okay, we know it.***

At the beginning, Sam is answering the questions rapidly from memory. Clyde is holding Sam's paper and listening. Lloyd has taken on the role of text reader. After Sam answers a number of questions very quickly, he attempts to answer question seven after Lloyd has only read the first answer choice. Prior to hearing the answer choice, he picked b. At this point, Clyde reacts and says, *Let him finish.* Lloyd stumbles on the pronunciation of the word *maria* in the next question, and Sam quickly corrects him. Lloyd responds, *yeah right*. Clyde then begins to participate by attempting to answer the next question. Lloyd suggests he was thinking of *molten*, perhaps in an attempt to explain his mispronunciation of *maria*. Sam responds by asking if Lloyd would like him to read. Although Lloyd ignores Sam's comment and continues reading the questions,

later in the session, Sam again tries to take the job of question reader. The second time, he does not phrase it as a request but rather as a direct statement, *I wanna ask the question.*

Next, the boys have a disagreement about the correct date of the moon landing. Lloyd first suggests it was in 1971, and Sam asserts that the answer is c and that Lloyd has previously said that. Finally, Sam suggests the answer is a. Lloyd asserts this cannot be the right answer because it is a date prior to the beginning of the Civil War. Clyde endorses Lloyd's assertion, and they agree that the answer is b. Clyde then comments that he got that one right, presumably on his own paper which he does not have today. However, Lloyd apparently notices that c is written as the correct answer on Sam's paper a few seconds later and comments, "*You had c the whole time.*" Sam laughs.

When Lloyd asks the next question, he states Clyde's name at the end of the question indicating that Clyde should answer it. Sam protests, but Lloyd immediately tries to give Clyde a hint as to the correct answer by making a connection to popular culture. This does not help Clyde come up with the answer. Although Sam comments, *I know what it is*, neither Lloyd nor Clyde ask him to give the answer. When Lloyd asks the next question, Sam immediately answers it. Sam suggests Clyde should answer the next question. Neither Clyde nor Lloyd knows how to pronounce the answer, *geosynchronous*. They eventually agree that the answer is some amalgamation of geo and umbra. It is unclear if Sam can pronounce the word at first, but he pronounces it correctly when I ask him to do so after the boys ask me for help. Shortly before I ask Sam about the word, another student, Adam, has overheard their conversation and told

them how to pronounce the word.

It is after this that Sam twice tries to take over reading the questions. After his second comment, he tries to direct Clyde's attention to the questions by telling him to look at the true or false part. Clyde then begins to read the section rapidly and ends the event with his statement "*we know it*". The boys then go on to discuss their next class, gym, and Clyde's recent trip to Busch Gardens.

Clyde: XXXX I did. I went of Alphengeist Pompeii

Lloyd: XXXX ***I'm broke. I can't go.***

Clyde: I went on Alphengeist Have you been on Alphengeist?

Lloyd: ***I've never been to Busch Gardens.***

Clyde: Oh. XXXX When did you go to Busch Gardens? Oh. Did you go to XXXX I did that.

Sam: ***Next time we go*** *XXXX*

Clyde originally attempts to discuss Busch Gardens with Lloyd until Lloyd informs him that he has never been there and can't go because he's *broke*. Clyde then directs his attention to Sam. Although it is unintelligible on the audio, my field notes indicate that Sam tells Lloyd that he will work with his dad to get enough money so that Lloyd can go to Busch Gardens with his family the next time they go.

Participation.

Despite Sam's attempts to take over Lloyd's role in asking questions, Lloyd maintains control throughout most of the session. He does have some difficulty reading the text aloud. For example, he has difficulty pronouncing *maria, geosynchronous, rise,* and *oval*, and he has to reread words and phrases several times in order to read them correctly. However, he is also able to correctly read most of the questions and many of

the scientific vocabulary terms on the study guide. When he does stumble, Clyde readily jumps to his defense. Likewise, Lloyd attempts to help Clyde answer the question he has directed at him by giving him a hint from popular culture. Lloyd and Clyde are both quick to acknowledge the implausibility of Sam's answer about the date of the moon landing, but Lloyd also points out that Sam must have known the correct answer all along. Despite the fact that Lloyd and Clyde are somewhat allied against him because of their sense that he can access the correct answers fluently without the aid of the study guide, Sam tries to get control of the process three times. Although Clyde and Lloyd ultimately refuse to cede control of the text reading to him, Sam is eager to try to help Lloyd when he discovers Lloyd can't afford a trip to Busch Gardens. Apparently, their academic rivalry does not extend into their personal social interactions.

Learning.

As the following individual student analyses indicate, it was apparent later that both Lloyd and Clyde benefitted from this opportunity to go over these questions and answers with Sam. However, because their discussion was based on a multiple choice practice test, their focus was on the "right" answer rather than on a deeper understanding of the concepts they discussed. This made it difficult for them to analyze more complicated questions when they were asked later on.

Clyde.

Although he does not answer the question about rocket propulsion, Sam does, Clyde is able to answer this question correctly in the quiz bowl later in class. He also chooses the correct answer on the test the next day. The discussion about *maria* appears to have actually led Clyde astray. He chose this as the answer on the Chapter 18 test the

following day although, in that case, the answer was actually craters. He had correctly stated the definition of maria to Sam and Lloyd, and this was not the definition written in the test question. Although the boys spent a great deal of time discussing the solstice, the question on the test addressed slightly different information than they covered in the small group. Clyde needed to know where the sun was during the summer solstice in the southern hemisphere. He missed the question. This was also true for the questions about tides on the test. Clyde needed more information than was covered on this study guide in order to answer them correctly. Clyde also missed the question about geosynchronous satellites. In order to answer that one, he needed to know that they stay above the same point on Earth. He chose an answer indicating they "revolve faster than other satellites".

Lloyd

Lloyd answered the questions about rocket propulsion and the tides correctly on the Chapter 18 test. In addition, he answered the question about geosynchronous orbits correctly on the test. However, he did not correctly answer this question during the quiz bowl, but when Ms. Sand read the question to him a second time, he was able to answer it correctly. Because Ms. Sand read the questions from the actual test during the quiz bowl game, what Lloyd encountered during the triadic dialogue section of class was the actual test question and answer choices he would have to answer the next day. Although the boys spent a great deal of time discussing the solstice, the question on the test addressed slightly different information than they covered in the small group. Lloyd needed to know where the sun was during the summer solstice in the southern hemisphere. He missed the question.

Sam

Sam answered all the questions discussed during this session correctly on the test. During whole class triadic dialogue, the quiz bowl, Sam answered a question about the tides incorrectly, indicating that he needed to refine this concept somewhat. However, after answering the question incorrectly, he was able to answer the same question correctly on the actual test.

Incident 4 Day 13 June 9.

On June 9, Ms. Sand told the students to get with their "study buddy" and complete any questions on any of the study guides that they had not yet completed. She asked students who they were working with and paired some students with partners. Sam and Clyde ended up working together on *SOL6.8 Earth/Space Systems Part 6 Interactive Notetaking Teachers Guide Science (It's Elementary!, Inc.,2006).* Sam has apparently completed the study guide, but Clyde has not. Therefore, Clyde's goal is to get the correct answers written down to as many questions as possible. The questions that go along with the text are labeled by the paragraph of the text where the answers can be found. However, aside from reading the questions, the boys make only one reference to the text in their discussion. Instead, Sam dictates the answers to Clyde. They begin by discussing the questions that accompany paragraph four of the text.

Sam: ***okay, um, first question What happens as the moon revolves around Earth?***

Clyde: (.12) ***I don't know that one.***

Sam: the moon experiences phases

Clyde: ***hold on*** *XXXX* ***going so fast*** *what number one on paragraph four?*

Sam: um,uh, "the earth as the moon revolves around Earth we see different amounts of the illuminated half of the moon"

Clyde: ***could you say that slowly***

Sam: ***say the moon experiences phases***

Clyde: the moon experiences what

Sam: phases

Clyde: phases

Sam: of that

Clyde: moon ex- wait what? experiences phases XXXX "How many phases have scientists identified"

Sam: eight ***It shows you in the next question***

Clyde: "What are the eight phases"

Sam: okay new moon

Clyde: new moon

Sam goes on to name the phases of the moon, and Clyde repeats each one as he writes it down. So far in this exchange, Clyde has ceded power to Sam. This begins when Sam asks the first question, and Clyde responds by saying, *I don't know that one*. Initially, Clyde is confused by Sam's answer as Sam has summarized the text and written the answer in his own words. Clyde comments that Sam is *going so fast* that he doesn't understand his answer. Sam responds by reading the first sentence of paragraph four to Clyde. When Clyde requests that Sam *say that slowly*, Sam responds with *say* and then proceeds to restate his original answer. Clyde then writes what Sam

tells him to write. When Clyde reads the next question, Sam responds by giving him a helpful tip, *It shows you in the next question.*

After Sam names the phases of the moon for Clyde, trouble ensues and the balance of power between the two boys shifts. Sam has written the same information as the answer to the next two questions. As he tells Clyde the answer to the second question, he realizes he has made a mistake.

Sam: Okay "what is waxing"

Clyde: what

Sam: wax XXXX "over half the moon is visible"" over half the moon is vis-ab-le"

Clyde: "What is waning?"

Sam: um over half wait no let's see same thing

Clyde: what over half oh

Sam: ***(.8) let me see***

*Clyde**: you got that wrong XXXX over again Sam I can see your face already right***

Sam: ***okay I got that wrong***

Clyde: what

Sam: ***you're gonna be mad at me but those answers were wrong answers***

Clyde: ***WHAT***

Sam: ***well, those two at least*** *XXXX you should go smaller it's waning*

*Clyde**: no, I'm not rewritin' it you made me write that for no reason***

Sam: ***well I'm kinda kidding actually***

Sam comments that Clyde will be angry at him, and Clyde apparently is. He accuses Sam of making him write an answer *for no reason.* In an apparent effort to defuse the situation, Sam responds that he is *kind of kidding actually.* However, an examination of Sam’s study guide, collected after the exam, revealed Sam erased the duplicate answer on his paper and wrote in the correct answer. Although it is clear that Clyde is completely dependent on Sam for the correct answers and that he apparently does not make any effort to consult the text in order to obtain the answers, he is not so dependent on Sam that he is unwilling to criticize him. In fact, his accusation that Sam *made* him write the wrong answer compels Sam to suggest the he was *kidding*.

However as the class begins to break up, Clyde once again asserts his dependence on Sam. Sam moves on to the next section of the study guide, Part 7, which has five paragraphs and twenty questions. Sam asks the first question but at this point, group work is ending, and Clyde has not had the opportunity to answer any of these questions.

Clyde: I've already done this question [XXXX] ***Sam I have to go back and do that****?*

Sam: you gotta do XXXX

Clyde: Is that?

Sam: I did XXXX

[Ms. Sand and other students are talking.]

Sam: okay who was Robert Goddard?

[Ms. Sand and other students are talking.]

*Clyde****: Sam I need you right now*** *[Background noise] .] Sam what's the XXXX gotta move with XXXX is this question wrong [Background noise] nothin'*

Sam: the answer XXXX here

Clyde: XXXX what is the XXXX ***just let me just l just let me move with you*** *I don't need to see it*

participation

In Clyde's view, Sam is a tool that is available to him to use to fulfill his goal of completing as many questions as possible on the note taking guide. Sam is a student who has made honor roll two out of the previous three grading periods in sixth grade. Clyde views him as likely to have the information he needs and is willing to cede power to him and take direction from him so long as he fulfills his function as a tool for gaining information. However, when Sam falters in this function, the balance of power quickly shifts, and Sam is forced to attempt to defuse the situation.

Learning.

As one of the special education students, Clyde has often received individual help from Ms. Jones, the special education aide. When students were completing individual seatwork on Day 4, Clyde sought help from me. When I attempted to get him to arrive at his own conclusion about the answer, he asked Ms. Jones for her conclusion. He commented that he "*had*" the answer but then "*lost*" it. Later, my field notes from Day 12 contain the following entry:

> Clyde asked me for help. When I tried to get him to reason though the answer or read the question aloud to me, he very reluctantly read part of the question and then wanted to guess the answer. Is it possible this is his solution for not knowing the answers – to guess wrong and then have whoever is helping him lead him to the correct answer?

In addition, Clyde was often inattentive during triadic dialogue activity. For example, on Day 2, after asking Clyde to stop talking once, Clyde and Ms. Sand had the following exchange.

*Ms. Sand: Well, our lesson today is, **scuze me**, I XXXX my talk. **Clyde, if you're interrupting me, I'm gonna let you go and call your mama.***

*Clyde: **okay***

*Ms. Sand: **Okay, thank you.***

Although Clyde is clearly positioned on the periphery of the classroom learning community, in this case, he does not have the opportunity here to engage in an authentic learning activity. Sam has already located the information and has previously answered the questions. Therefore, Clyde does not have access to Sam's actual learning processes. In the one instance where Sam realizes he has made a mistake, he does not think aloud or even explain to Clyde why he realized his answer was wrong or how he arrived at the correct answer by consulting the text. Therefore, his mental processes and interactions with the language of the text are not made apparent to Clyde, who is only upset that he has wasted time and effort writing down the wrong answer. Because Clyde defines this event as one in which his task is to compile as many correct answers as possible, he neither initiates any interactions with the text nor question Sam about his own interactions with the text.

Incident five Day 13 Alice and Pam.

This incident occurred simultaneously with incident four and was documented with a video recording. Ms. Sand had directed students to get with their "study buddies".

Alice and Pam have chosen to work on their interactive notes. They are working on *SOL 6.8 Part 6 The Solar System: Phases of the Moon (It's Elementary!, Inc.)*. Although Alice very rarely speaks out during periods of whole class discussion and often receives individual help from Ms. Jones to complete individual seatwork, she often takes the lead in this interaction by reading the questions aloud and then reading the part of the text referred to in the question.

> *Alice: Yeah, "**are the Earth and moon similar**? The Earth and the moon have a number of things in common. One of the most important sim- similarities is the way in which they move through the heavens. We have learned that the Earth circles or revolves around the sun and spins or rotates on its axis. Similarily, the moon revolves around the Earth and rotates on its own axis."* ***Okay, uh, here it is, right here.*** *"One of the most important similarities between the Earth and the Moon is- similarities between the Earth and the moon is the way in which they move through the the heavens."*
>
> *[Pam is drawing on Alice's paper.]*
>
> *I need a pencil. Ouch [gets up and goes to get a pencil] I thought somebody stole my pen. It says . . . earth moon yes*
>
> *Pam: What's the answer? yes*
>
> *Alice: "What is the most important similarity between the Earth and the moon"* ***it right here "the way in which they move through the uh heavens"***
>
> *Pam: the way what?*

Alice: "the way in which"

Pam: in which

Alice: "they move through the heavens" (.11) Do another one they move (.8) okay now (.4) [

Unidentified student: YOU SUCK

Alice: They suck (.6) heavens what's the next one?

Alice uses the exact wording of the text in order to answer the question. She underlines the sentence in the text and then writes the answer on the page with the questions. She does this on several more occasions.

Alice: Number two "What is another similarity What is another simia- What is another similarity"

Pam: What is a similarity

Alice: What is another similarity what is it? [Pam is making inaudible short comments. Alice stops and the girls look at each other and begin to laugh .]

Pam: another si-

*Alice: Ouch I found it "**Another similarity between the Earth and moon is that neither of them produces their own light**." [Alice is underlining the sentence on her paper. Pam is reading this aloud at the same time.] Ohhh. I found it before you.*

However, this strategy does not always work to their advantage. One question the girls attempt to answer, "Why doesn't the moon produce its own light?*"* " *("SOL 6.8,"* 2006) is not answered explicitly in the text. The text does state that, unlike the

sun, the moon is "nothing more than a gray ball of rock" (*"SOL 6.8"*). Initially, Alice determines this as the correct answer; however, she then changes her mind.

> *Alice: Let's do this work now for real. "Why doesn't the moon b- produce its own light." I know why. I know why.* ***Because uh huge balls of hot gases that gives off light and e- energy our moon is nothing more than a great ball of rock" oh, no it's not it's because the light hits the moon and bounces or reflects off the moon's surface***
>
> *Pam: you messed me up*
>
> *Alice: the* ***light hits it***

Alice and Pam are interrupted in their discussion of this question. Several minutes pass and then they turn their attention back to the question. In the excerpt below, Alice begins by misreading the question and then goes on to copy part of the text for an answer.

> *Alice: Okay okay What does the moon produce-* ***I just found this one*** *something As the sunlight hits*
>
> *Pam: because of*
>
> *Alice: the moon "it bounces or reflectes off the moon's surface."* ***put that*** *light hits the moon "****it bounces or reflects OFF the moon's surface****"*

This part of the text does not answer the original question, "Why doesn't the moon produce its own light?", and, in fact, would not be grammatically or syntactically correct as an answer. However, Alice's belief that the answer can be "found" in the text reinforces her judgment that copying words directly from the text is an appropriate strategy for answering the questions. Moreover, as the excerpt below demonstrates,

Alice did not always notice errors in the words that she wrote. Pam corrected Alice's written answer to the first question when she noticed that Alice had written two of the words in the text as one word.

[Pam reaches over to Alice's paper again]

Pam: let's put

[Alice protests]

Pam: ***let's make a space here so you can understand it it's not own axis ownaxis its own axis own and then***

Alice: ***own axis own axis***

[Pam draws a line between the words for Alice who has written them as one word.]

Pam takes a different approach to answering questions. Rather than consult the text, Pam quickly states an answer based on her own existing knowledge. In this exchange, Alice initiates Pam's rapid-fire question answering by making an offhand, quick answer to a question herself.

Alice: "Why does the moon shine?" because Earth shine um ah wah because wah -

*Pam: "**Why does the moon shine**" because of, it's **because of the sun** because of the sun. "**What does the reflected light allow us to see" the stars.***

While Pam's first answer is correct according to the text, her second answer has no basis in the text at all; the text-based answer is related to what parts of the moon are visible. At this point, Pam has taken the lead in answering the questions, and Alice is

simply attempting to keep pace. She does not refer to the text herself or question Pam's answer. In fact, Alice comments,

> *Alice: the what* ***hold up when I go fast you slow,*** *be slow, and* ***then I slow down you go fast bXXXX***

However, the next time Pam attempts to answer in this fashion, Alice, apparently skeptical, stops her and then cites the text.

> *Alice: "What are some of the things we see in the night sky." It's*
>
> *Pam: the planets*
>
> *Alice:* ***no***
>
> *Pam: yeah if you have a if you have a*
>
> *Alice****: full circle it says "sometimes in the nighttime sky we see a full circle"***
>
> ***Pam:*** *a full circle* ***which is the moon***

Here the two girls differ in what they write down on their papers. Pam writes "the moon and the stars and planet" without consulting the text. Alice tells her this is not the answer, and Pam begins to protest. However, Pam crosses her answer out when Alice reads "*sometimes in the night sky we see a full circle*" and informs Pam the answer should be full circle. Pam then writes *circle* on her paper. Pam takes the final step of drawing the conclusion from the text that this full circle is, in fact, the moon.

A little later when the girls are trying to answer another question, Alice adopts Pam's strategy of answering from prior knowledge.

Alice: "Can we always see the moon." ***No, we can't always see the moon cause you know it only come a full moon once a month, so I smart I remembered that, yes.*** *"Why do we see the different phases of the moon?" Why? [Josh tosses something on the floor near them. They are distracted.] Yeah "Why do we see these different phases of the moon?"* ***[Pam begins to sing while Alice rereads to find the answer and begins to write the answer on her paper.***

Alice's comment that she is smart for *remembering* the answer indicates that she believes someone who is smart is able to remember the answers without consulting outside sources. When she cannot answer the subsequent question in this fashion, she again consults the text.

Furthermore, both girls argue against being positioned as struggling students several times while they are working together. First, they are interrupted in their work when two students walk around the room distributing papers. Cam comes over and puts Alice's paper down on the table between the two girls.

Alice: I missed two, I got a A XXXX [laughs]

Pam: You trip me.

Alice: I got one wrong, ouuu no, I got two wrong. No, I got three wrong. I got a eighty.

[Pam takes paper from Alice.]

Pam: You got

Alice: I got a eighty.

Pam: one, two, three, four, five, six, seven, eight, nine, ten, wrong

Alice: No, I don't, I got-

Pam: You got a zero.

Alice: I got two wrong, one, two look.

Pam: Look, five nine

Alice: I got number two wrong.

Pam: five nine

[Alice is taking the paper back from Pam.]

Alice: Stop

Pam: I wanna see it.

Alice: no, ***you're gonna mark it all wrong. I will put my stuff away from you.*** *You trip too much*

The girls continue their banter for a few more exchanges and then Alice puts her paper away. Cam then arrives with Pam's paper.

Pam: Oh I got a ninety, ohhh.

Alice: I got a eighty.

Pam: Ohhh, I got a B.

Both girls place value in high grades as an indication of their standing in the classroom community. Alice puts her paper away to prevent Pam from defacing it. At the end of the class period, Clyde comes over to talk to the girls and, seeing Alice's paper, comments

Clyde: You got a eighty. ***You're in my range****. I got a eighty too.*

As the girls are finishing up work on the study guide answers, they have the following exchange.

> *Alice:* ***I'm smart. I know the answer to everything.***
>
> *Pam: XXXX* ***genius, I'm one too?***
>
> *Alice: a -*
>
> *Pam:* ***You're smart***
>
> *Alice: I'm so smart ev-* ***I know everything. I read things fast and I get 'em right, that's why I'm genius.***
>
> *Pam: I'm sm- I'm a rich, yeah, I'm so smart I should be in high school by now.*
>
> *Alice: Me too, they're jealous cause they can't find a smart girl like me that, that's, that smart.*
>
> *Pam: put* ***me put me in a small class XXXX cause they think I'm stupid but I'm smart***

A few minutes later Pam returns to this theme as she is writing an answer on her paper.

> *Pam:* ***I'm so smart*** *XXX ole I'm so smart XXXX* ***ole ast er oid belt*** *I'm so smart XXXX ole XXXX*

She is apparently also referring to an earlier exchange with Alice in which she corrected Alice's misreading of the words asteroid belt.

Participation.

Pam and Alice both understand that their task is to find the answers to the questions they have been given by using the accompanying text. Although there are differences in the ways Alice and Pam interact with text and arrive at answers, they appear to have balanced roles in this literacy event. Sometimes Alice takes the lead and tells Pam what to write as an answer, and at other times, Pam takes the lead (*when I go fast you slow be slow and then I slow down you go fast bXXXX*). Alice believes that the way to answer the questions is to locate a specific spot in the text (*Okay, uh, here it is, right here.)* which contains the answer and copy it word for word. Pam, on the other hand, also considers her own personal knowledge as legitimate for answering the questions. Alice's comment, *Can we always see the moon. No we can't always see the moon cause you know it only come a full moon once a month so I smart I remembered that, yes* demonstrates that she values the ability to arrive at answers without the use of written text. One is smart if one can remember information.

Although both girls exhibit a sense of agency during this task, both also argue against a larger class and school discourse which they assert has constructed them as failing students (*put me put me in a small class XXXX cause they think I'm stupid but I'm smart)*. Clyde's comment (*You're in my range.*) speaks to the function of grades as a category marker for students. Indeed, Alice suggests two of the criteria for a "genius" student, reading fast and getting *'em right*. Pam equates being rich with being smart. Pam's comment, *I'm so smart XXX ole I'm so smart XXXX ole ast er oid belt I'm so smart* in which she not only asserts her "smartness" but also specifically refers to an instance in which she was able to demonstrate this, is emblematic of the ways in which

these girls construct literate identities for themselves in opposition to the identities they feel are constructed for them by the classroom and the school.

Learning.

Because Alice's primary method of arriving at answers was to copy them directly from the written text, it is difficult to say if she learned anything about science in this segment. In addition, none of the information addressed in the written text or questions is directly tested on the subsequent test. Furthermore, this text was not used as a basis for answering many questions in whole class discussion formats because it does not directly address the exam information. Pam's method of answering questions without the use of the written text constrains her learning of new information. In addition, the girls have the opportunity to learn from their interaction with each other. While Pam may have obtained correct information from Alice's reading of the written text or her dictation of answers, it is not clear if Pam actually engaged in meaningful learning as a result of these interactions. Furthermore, Pam did not appear to adopt Alice's method of locating answers. Alice, on the other hand, did adopt Pam's method of arriving at answers from her head. Furthermore, Alice's comment that she is smart because of this indicates that she values the ability to remember answers and retrieve them at opportune moments. However, her earlier skepticism of Pam's answers indicates that she did not necessarily arrive at her conclusion about the strategies of "smart" people from Pam.

Incident six day 15: Pam, Ashley, and Niah.

This interaction was documented with a video recording. Pam and Ashley are sitting on the window side of the room in their usual desks. Ashley is sitting in the row behind Pam, and Pam is turned around in her seat answering the questions Ashley is

asking. Niah is sitting in the next row in the back seat beside Ashley. Niah had been working with Daniel, but he has left to talk to Ms. Sand. Ashley is asking questions from the *Fourth Nine Weeks Exam Review ("Prentice Hall Science . . . Teachers Guide, n.d.)*. Niah also has a copy of the exam review in front of her. Pam does not have a copy and is answering Ashley's questions from memory. Although Ashley does not direct any questions at Niah, she introduces herself into the conversation when Pam has difficulty answering a question.

Ashley: Earth's rotation takes about how many hours?

Pam: oh no um um two hundred and three hundred and sixty five no no no I'm wrong I'm wrong it's two hours and

Niah: twenty four hours

Pam: oh yes

Niah: XXXX two hours there's XXXX two hours in a day

Ashley: Okay Pam which moon phase will a lunar eclipse occur?

Pam: what what? (.3) um full moon

Ashley: Only one side of the moon is visible from Earth because

Pam: (.5) the cause the sun lights up um other side or maybe cause um cause the moon is not there or because

Ashley: the near side is always the near side always faces Earth

Pam: XXXX increase wait oh

*Niah: **you know what you want to know what it is for real it's because the near side face is facing***

Niah continues this behavior the next time Pam has difficulty with a question.

Ashley: What country was the first to launch an artificial satellite?

Niah: Soviet Union

Pam: ***shhhh*** *China*

Niah: no girl it start with a s it got two words s and then a u word

Pam: oh Russia

Niah: no girl

Pam: Soviet Union yeah yeah

Niah: yeah Soviet

Pam: ***it's Russia same thing***

Niah: XXXX ***look at me like that***

In this second exchange between Niah and Pam, Pam begins to protest Niah's intrusion into the group. At first she tells Niah to be quiet and directs her gaze at Ashley as she answers, but later in the exchange when Niah continues to correct her, Pam looks at Niah and asserts her answer is the *same thing*. Niah responds by telling Pam not to look at her *like that*, indicating a certain degree of hostility although both girls are smiling.

The two girls continue to clash.

Ashley: XXXX What astronaut was the first to walk on the moon?

Pam: (.3)Neil Armstrong

Ashley: yeah

Niah: ***you said XXXX***

Ashley: Which United States president launched a huge space program?

Niah: ***Mr. Kennedy***

Pam: President Washington, it's Kennedy.

Niah: Barak Obama

Ashley: Okay, how many days are in a calendar year?

Niah: twenty four hours, ***got you back***

Pam: ***It wasn't a insult.***

Niah: I'm just tellin' her nah XXXX its three hundred sixty XXXX

Ashley: What shape are the orbits of the planets?

Niah: *theys no such shape of the-*

Ashley: What scientist believed that the sun was the center of the solar system and the orbits were -

Pam: geo- geo-

Niah: That's that's, Galieo spelled that's not called g,e leo it's called XXXX Can I answer it?

Ashley: try

Pam: oh, oh, oh

Niah: It's Copernicus

Ashley: yes

Pam: ***I gonna say that.***

Ashley: Which scientist had the correct theory of how the solar system is?

Pam: Gileo

Niah: No, that's Galileo.

Ashley: No it's not Geleo, Galileo. It's not Galileo, no, it ain't.

Niah: the last name Newton

Pam: E zak

Niah: ***e zak [laughing]***

Ashley: Isaac

Niah: ***E zak [laughing]***

Pam: Isaac

Niah: ***E zak***

Ashley: Where is the asteroid belt in the illustration?

Niah: ***E zak Newton***

Niah temporarily loses interest in the conversation. A few minutes later she asks,

Niah: Which one ya'll on?

Ashley: the second to the last one

Niah: Can you say fusion, can you?

Pam: oh

In this exchange, even when Pam answers Ashley's questions correctly, Niah suggests that Pam has made a mistake. First she attempts to say Pam misstated the answer when she insists, *you said XXXX* after Pam correctly answers a question about Neil Armstrong. Niah then proceeds to preempt Pam's opportunity to answer the next question by answering it herself. When Pam provides a silly answer (*President Washington)*, Niah tops her answer by stating another silly answer (*Barack Obama)*. When Ashley asks the next question, Niah again preempts Pam but this time she provides what she knows is the wrong answer and then immediately comments to Pam, *got you back*. Pam responds that her comment *wasn't a insult*. A few exchanges later, Pam, for

whom English is a second language, mispronounces both Galileo and Isaac Newton's first name. Niah laughingly repeats Pam's mispronunciation of Isaac four times. A few minutes later, when Niah reenters the conversation, she refers to Pam's difficulty pronouncing words by asking, *Can you say fusion, can you?* Niah, as the only of the three students involved in this exchange classified as a "struggling" reader, is aggressive in asserting her knowledge of the content in this event. Rather, it is Pam who is positioned as the struggling student here because she does not have a written copy of the questions and answers as Niah does.

Participation.

An unequal balance of power is demonstrated in this literacy event. Niah and Ashley, both of whom are holding a copy of the questions and answers, assert their power over Pam, who does not have a copy of the questions and answers. In particular, Niah, seizes this opportunity to intrude on the conversation between Ashley and Pam in order to assert this power. At first she simply answers when Pam has difficulty coming up with the answer herself. However, when she persists in this behavior despite being asked by Pam to stop, the conflict eventually escalates as demonstrated by Niah's comment, *I got you back.* Finally, Niah resorts to ridiculing Pam's pronunciations of the names of famous astronomers.

Learning.

Because Niah had a copy of the correct answers in front of her, it would be difficult to ascertain if her participation in the activity contributed to her learning, Pam later correctly answered several questions that she missed during this activity. On the final exam, she answered two questions related to the content covered here correctly.

However, the exchange she had with Niah concerning how to correctly pronounce Galileo did not assist her in answering question about his involvement with the heliocentric model of the solar system. Niah also missed this question on the final exam. It appears both students did not internalize an association with Galileo perhaps due to their contentious exchange.

Participation: roles, relationships, and power in small group work.

Taken together, these interactions illustrate the variety of roles, relationships, and power structures that occurred during small group work in this science classroom. The "struggling" readers in this classroom sometimes took on the role of text reader despite being partnered with students who were more capable readers than they were. For example, Lloyd maintained the role of text reader throughout the small group activity on June 1 despite Sam's repeated bids to be the reader. Likewise, Alice takes the lead in her partner work with Pam although Alice generally does not speak at all during whole class instruction. The power of the nonstruggling readers in these interactions stems from their greater knowledge of the information, information presumably more easily acquired by them due to their greater facility in reading text. Niah readily seized this power as well in her interactions with Pam when she had a copy of the written text and Pam did not.

However, as illustrated in both the interaction between Jack and Daniel on Day 7 and the interaction between Sam and Clyde on Day 13, greater knowledge does not equate to greater social power. In both instances, the students with the greatest knowledge were derided by the "struggling" readers when they faltered in their production of the correct answer. Clearly, all students made an effort to learn the

information and to participate in small group activities. However, both Daniel and Sierra reduced their participation when they experienced difficulty answering questions. In contrast, Clyde, Alice, and Jack, all "struggling" readers, demonstrated persistence even when their coworkers' interest flagged.

Learning in small group work.

Although in some instances, students appeared to have gained knowledge of science facts through these interactions, they often simply wrote what was dictated by another student or picked a multiple choice answer when told the correct answer choice. Students may have come to associate certain vocabulary with certain rote definitions simply by the repetition of these definitions by more knowledgeable peers. When "struggling" readers took the initiative to read the text during these interactions, they likely benefitted from the opportunity to practice reading text and from the opportunity to be exposed to visual representations of the content vocabulary contained therein. However, little evidence exists to indicate students enlarged their conceptual understandings of science or greatly expanded their skills in content area literacy demands such as locating information in text or writing explanations of concepts using appropriate vocabulary.

Triadic dialogue.

According to Lemke (1990), triadic dialogue is composed a distinct sequence of events; teacher questioning, student response, and teacher evaluation. However, he suggests other optional elements as well. Lemke's model of triadic dialogue, including optional elements, is as follows:

[Teacher preparation]

Teacher Question

[Teacher Call for Bids (Silent)]

Student Bid to Answer (Hand)

[Teacher nomination]

Student Answer

Teacher Evaluation

[Teacher Elaboration] (Lemke, 1990, p. 8)

Optional elements appear in brackets. Lemke also suggests this model could include branching elements to allow for flexibility in the case of a negative evaluation. Such a structure could include elements such as further hints and clues.

Structure of literacy events with triadic dialogue format.

Triadic dialogue was initiated by Ms. Sand most often as a format for reviewing information for tests. After a class during which triadic dialogue was the primary activity format, Ms. Sand commented that it was very difficult to get the students to remember things. It appeared she counted on the oral repetition of information during triadic dialogue as means of helping her students remember science facts. On some occasions, Ms. Sand used tests that the students had not seen as a means of formulating questions. Even though Ms. Sand may have gotten the question from a text, this was not apparent as it appeared she was formulating the question on her own in the moment. The

students usually did not consult their books or study guides to locate answers unless Ms. Sand insisted that they do so in order to verify an answer. There is, therefore, a somewhat gray area between triadic dialogue and external text dialogue. For the purposes of this study, external text dialogue related to question answering is reserved for class periods when Ms. Sand is reading somewhat extended text including extended choices in a multiple choice question or when the students are reading answers they have prepared ahead of time.

The structure of triadic dialogue events often varied from Lemke's model at the level of Student Bid to Answer. This variation is important to recognize because it can help to explain the context for individual interactions. For example, students who volunteer to answer a question would be likely to believe they know the answer to the question. At times when Ms. Sand asked the initial question (Teacher Question), she either called on a student first and then asked the question or asked the question of the whole class and then nominated a student to answer the question. Sometimes students raised their hands to indicate they wanted volunteer to answer, but at other times students blurted out the answer to a question without waiting for Ms. Sand to call on someone. In these instances they said the answer aloud immediately after she asked the question. In addition, at times during these events, a number of students would volunteer answers at the same time, and Ms. Sand would simply respond to the group as a whole. Often, the students on the side of the room closest to the window called out the answers to most of the questions. This might go on for a number of minutes as Ms. Sand asked questions of the group as a whole.

Twenty-three literacy events with a triadic dialogue format occurred during the course of this study. The days, times periods of each event, purpose of each event, and absent students are shown in Appendix L *Literacy events with triadic dialogue format.* After initial identification, each event was further examined at the level of individual interaction to identify the student participants, response type, and whether the students correctly answered the questions Ms. Sand posed. Examining the response type and correctness of student response added additional information about context that was important for understanding the substance of each interaction.

Three response types were identified; unsolicited, volunteered, and selected. Unsolicited responses were those responses that were blurted out by students without their either raising their hands or being selected by Ms. Sand to answer. Only five of the total 194 responses (2.6%) fell into this category. Volunteered responses were those responses in which a student volunteered to provide the answer either verbally or by raising a hand. Selected responses were those provided by students after Ms. Sand selected them to answer without their indicating a desire to answer. If there was no video recording of an interaction, the interaction was designated as selected unless it was apparent by a comment or a field note that the student volunteered to answer. Students volunteered 40.7% of the answers and were selected to answer 56.7 % of the time. *s.* Total Number of Questions Answered and Response Types shows the total number of questions answered by each student as well as the total number of each response type for each student over the course of the 23 events. Daniel overwhelmingly answered the most questions, 56 questions. Lloyd answered the second most often but his 18 answers

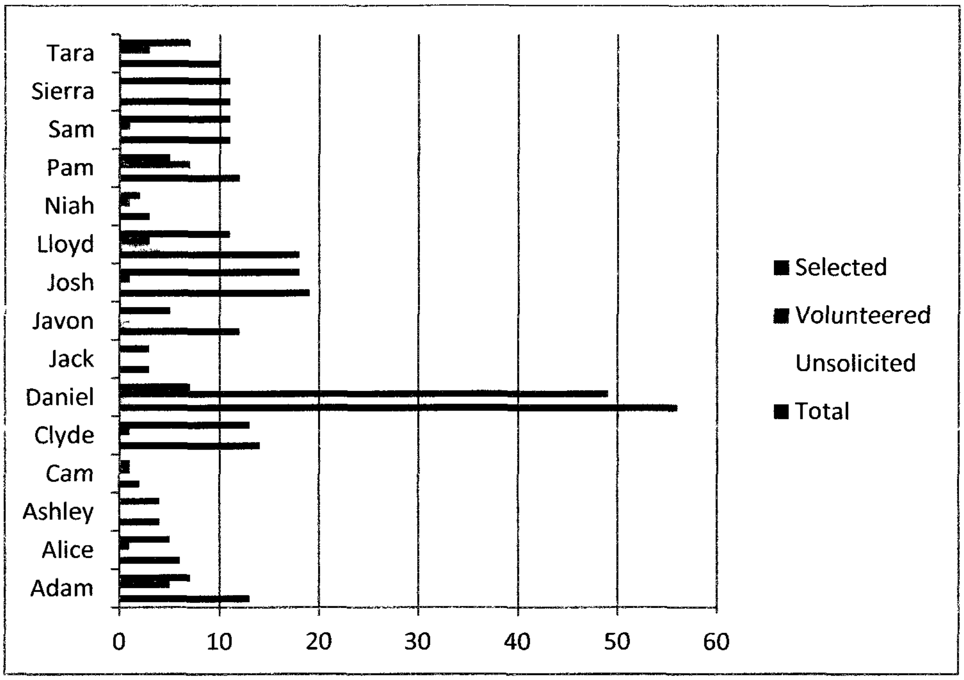

Figure 14. Total Number of Questions Answered and Response Types

were less than half the number of answers given by Daniel. Six students, Ashley, Alice, Cam, Jack, Niah, and Tara answered ten or fewer questions each. Daniel also volunteered to answer questions more often than all the other students combined. In fact, this accounted for the majority of his answers. Daniel, Javon, and Lloyd were the only students who could be identified as providing unsolicited answers; however, on a number of occasions several students or nearly the entire class attempted to state the answer at the same time. In those cases, it was not possible to identify discrete individuals who answered correctly or incorrectly. Ashley, Jack, and Sierra did not volunteer any answers at all. Josh was selected most often by Ms. Sand to answer questions, 18 times. Cam was selected to answer only one time. Only Sierra, Lloyd,

Clyde, Sam, and Josh were selected more than 10 times. Jack and Ashley, students who never provided unsolicited answers and who did not volunteer to answer any questions, were among those students selected to answer less than 10 times. All groups of students contained students who were classified as “struggling” readers and students who were not.

These data were further examined to determine if there were differences between the two groups of students (“struggling” and nonstruggling readers) in response types. *Figure 15.* Percentage of Selected Response Types for “Struggling” and “Nonstruggling” readers shows the percentage of students in each group who gave each type of response. Struggling readers gave fewer answers overall. They also volunteered answers far less often than the other group and were selected to answer questions less often than the nonstruggling readers. Although Ms. Sand selected “struggling” readers to answer nearly as often as the nonstruggling readers, the fact that “struggling” readers volunteered fewer answers appears to indicate that they did not know the answers to Ms. Sand’s questions as often as nonstruggling readers did.

This low rate of voluntary participation is further confirmed by an examination of the percent of answers by group as seen in *Figure 16.* Percentage of Total Responses of Group for Response Type. While the “struggling” readers group answered fewer questions overall, of the questions they did answer, the overwhelming majority were answered as a result of a student being selected to answer by Ms. Sand. In fact, the “struggling” readers group also had a higher percentage of selected answers relative to

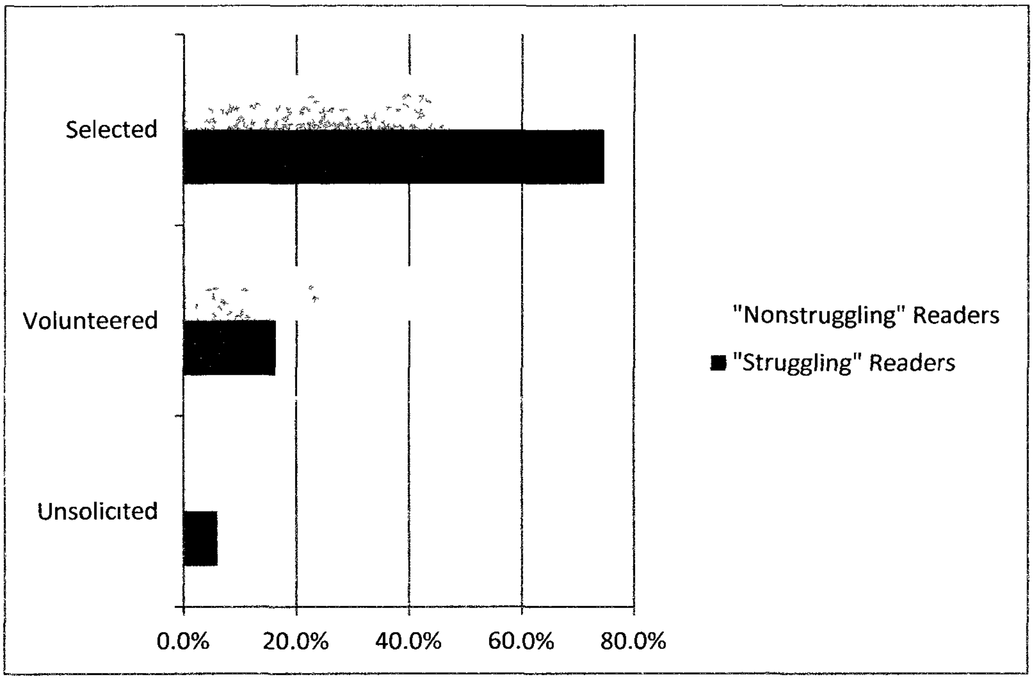

Figure 16. Percentage of Total Responses of Group for Response Type

counted as correct or incorrect. If a student got an answer partially correct, the answer was counted as both correct and incorrect. *Figure 17.* Total Number of questions answered and correct and incorrect answers by student shows the number of incorrect and correct answers to questions for each student and the total number of answers given by each student. Alice, Clyde, and Sierra gave more incorrect than correct answers. These students were selected far more often than they volunteered to answer questions. All of these students were classified as "struggling" readers.

As is apparent in *Figure 18.* Percent of Correct and Incorrect Answers by Group, not only did "nonstruggling" readers answer more questions overall than did struggling

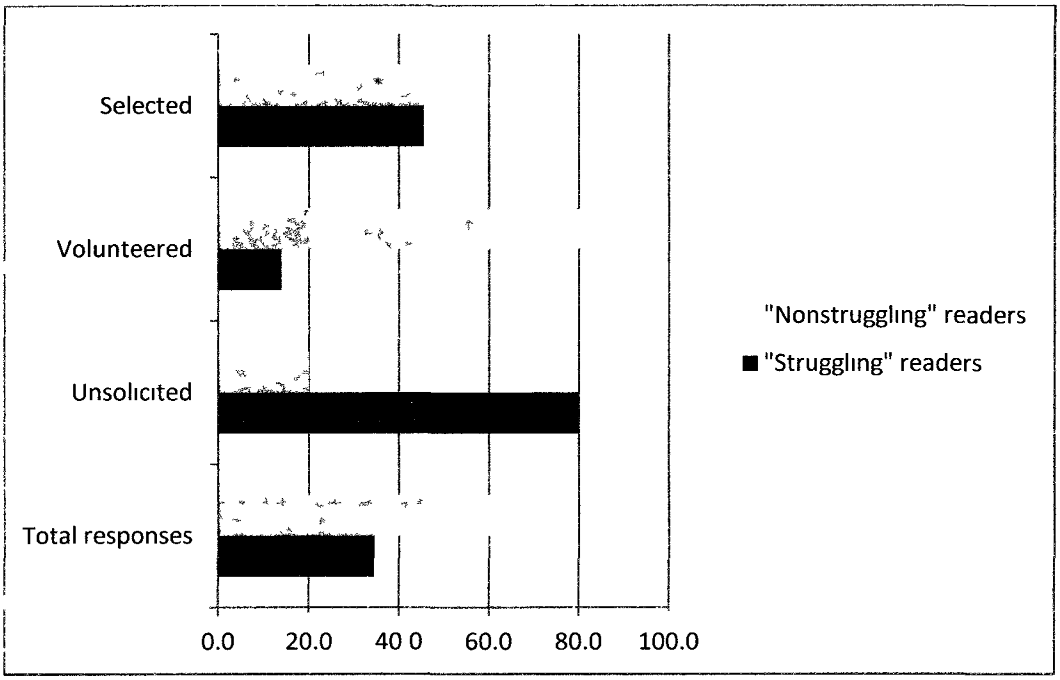

Figure 15. Percentage of Selected Response Types for "Struggling" and "Nonstruggling" Readers

the number of questions answered by the group than did the nonstruggling readers group. The nonstruggling readers volunteered to answer questions more often than they were selected by Ms. Sand to answer. In the "struggling" readers group, on the other hand, only 16.4% of the total number of questions they answered were as a result of a student volunteering to answer.

These data were then further examined to determine how often both groups of students answered questions correctly and incorrectly. Occasionally, students gave answers that were not confirmed by an evaluation from Ms. Sand. These responses were not

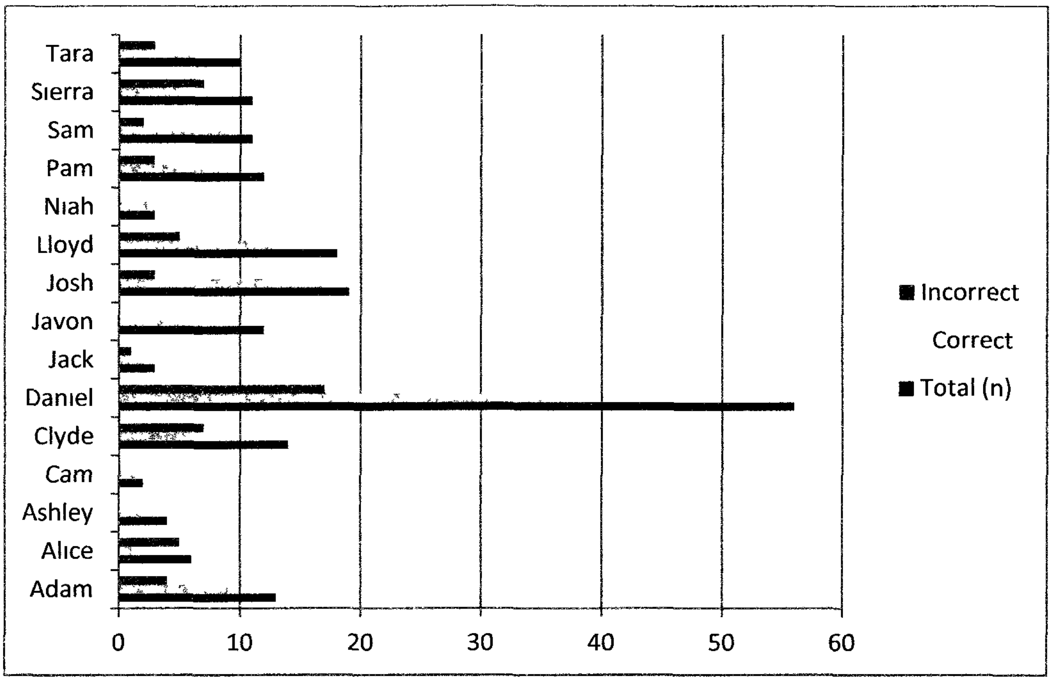

Figure 17. Total Number of questions answered and correct and incorrect answers by student

readers, they also answered a greater number of questions both correctly and incorrectly. Although both the "nonstruggling" readers and the "struggling" readers answered more questions correctly than incorrectly, the "struggling" readers had a higher percentage of incorrect answers relative to the total number of questions they answered (37.3%) than did the nonstruggling readers (25.2%). Nevertheless, further examination of the data revealed that "struggling" readers and "nonstruggling" readers had a more similar profile of correct and incorrect answers when the total number of questions answered by each group was considered instead of the total number of answers overall. Both groups answered more of the questions they actually answered correctly than incorrectly. The "struggling" readers simply answered far fewer questions overall than did the

nonstruggling readers. One major factor in this difference was Daniel, a nonstruggling reader who answered over a quarter of the questions overall.

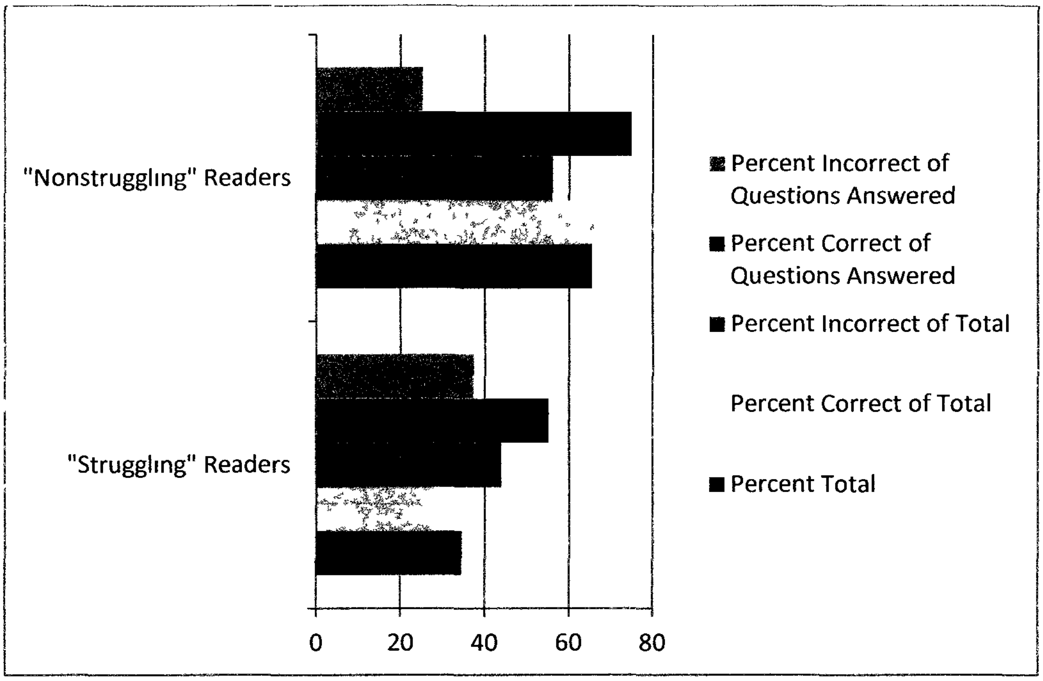

Figure 18. Percent of Correct and Incorrect Answers by Group

Substance of triadic dialogue events

In order to construct a more complete picture of how “struggling” readers participated and learned during literacy events structured as triadic dialogue, the transcript of each of these literacy events was examined, and data charts were constructed for each student based on the individual questions answered by each student across triadic dialogue structured events. These charts also indicated whether each student answered each question correctly or incorrectly and the response type (selected,

volunteered, unsolicited) for each question. Transcripts, video, and audio of each individual interaction of each "struggling" reader were then examined and analyzed, and the transcript and analysis were included in one of six memos: selected correct responses, selected incorrect responses, volunteered correct responses, volunteered incorrect responses, unsolicited correct responses, and unsolicited incorrect responses. Each of the six memos was then analyzed across cases for common features of student participation and learning. This analysis was focused by the nine questions previously developed based on the work of Gee (2005a), Bloome, et al. (2005), Bloome, et al. (2008) and researchers included in an edited volume (Cole & Zuengler, 2008).

Selected correct responses.

Twenty-five or 37.3% of the 67 total responses by "struggling" readers were classified as selected correct responses. Of all "struggling" readers, only Alice had no selected correct responses during the course of the study. Possibly, because these answers were given as a result of students being selected by Ms. Sand to answer and were, therefore, not volunteered answers, it appeared students were often selected as a means of gaining their attention to the class proceedings. In fact, several "struggling" readers, most notably Clyde, Javon, Sierra, and Jack, often appeared disengaged during triadic dialogue events. For example, on Day 13, Ms. Sand was going over items on the exam study guide she had obtained from another teacher. She asked Clyde to pay attention twice prior to selecting him to answer a question. Finally, eight minutes and thirty-five seconds into the event, she selected Clyde. At this point, he had his jacket spread across his desk and was busy drawing on his hand. Again on Day 14, Ms. Sand selected Clyde to answer at 32:28 into the event. Clyde had just picked his head up

slightly from his arms. He has been resting his head on his desk. In the course of praising Clyde's correct answer, Ms. Sand comments on his lack of attention.

Ms. Sand: Inertia. Very good. ***Pay attention.*** *Good answer.*

On Day16, Clyde again appeared disengaged from the lesson when Ms. Sand selected him to answer. Clyde was resting his head in his arms face down on his desk. He quickly raised his head but appears confused when he answers.

Clyde is not the only "struggling" reader who correctly answers a question after appearing disengaged during periods of triadic dialogue. On Day 14, the following exchange occurred between Ms. Sand and Jack.

Ms.Sand: ***Jack you gone make me scream.***

Jack: I was getting the question.

Ms. Sand: I know. Every time I look over you, you're doing something whether it's givin'or takin' or but ***you not paying attention, okay****. Maybe I should print you all off a progress report so you can see where you stand. Alright, next thing.*

After a brief discussion of the fifth and sixth planets, Ms. Sand selects Jack to answer a question, and he does so, correctly.

Javon also correctly answers a question on Day 14 after being selected by Ms. Sand. According to my field notes, when Ms. Sand called on him, Javon was resting his head on his arm which was extended across his desk. On Day 17, Javon was resting his head in the palm of his hand when he was selected to answer a question. In this instance, he appeared reluctant throughout the exchange.

Ms. Sand: Josh and others tell me which one would - who believed in the heliocentric. Is it Ptomely

Unidentified student: No

Ms.Sand: Is it Tycho, is it Galileo, Galileo? Okay Javon, which one believed in heliocentric? Do you `member?

Javon: Galileo

Ms.Sand: huh?

Javon: ***I don't know.***

Ms. Sand: ***Well, take a guess****. Want me to give to you again? Ptolemy, Galileo, or Tycho; which one believed in heliocentric?*

Javon: ***I don't know****, Galileo.*

Ms. Sand: Very good, you do know. Galileo did.

Ms. Sand has an irritated tone when she tells him to *take a guess*, and Javon sounds equally as irritated when he answers, *I don't know, Galileo.* When she asked if he wanted them read again, he moves his hand slightly and shrugs. On Day 16, Ms. Sand also suggested to Lloyd that she has selected him to answer because he was not paying attention, *pay attention, that's why I call you.* When Ms. Sand selects Sierra to answer on Day 16, Sierra's body position is an indication that she is not engaged in the lesson. Sierra is sitting sideways in her desk with her back to Ms. Sand. It appears she is engrossed in doing something with an item in her hand.

However, although these “struggling” readers often appeared disengaged during triadic dialogue events, they were able to answer correctly 37.3% of the time when they were selected by Ms. Sand. These correct answers often, but not always, elicited praise

from Ms. Sand. This praise ranged from *"very good"* and a quick repetition of the correct answer to, on Day 17 in an exchange with Sierra, more effusive praise from Ms. Sand and the entire class.

> *Ms. Sand: Alright all right, let's see, what else I need to say? Um, Sierra, how old is the Earth?*
>
> *Sierra: four point five billion years old*
>
> ***[clapping]***
>
> *Ms. Sand:* ***good answer Sierra. Excellent, very good. four and a half.***

Even if "struggling" readers were only partially correct in their answer, they were praised by Ms. Sand. For example, on Day 17 Ms. Sand was asking about the science lab conducted earlier in the quarter.

> *Ms. Sand: What was the purpose of that balloon lab? Do you remember, Javon, were you out there with us when we were blowin' up the balloons?*
>
> *Javon:* ***somethin' 'bout rockets***
>
> *Ms. Sand:* ***That's right.*** *What Ms. Sand tryin' to show how rockets*
>
> *Unidentified student: launch off*
>
> *Ms. Sand: launch off very good.*

On these occasions, despite their initial disengagement from the lesson, these students were positioned by Ms. Sand as successful students deserving of praise. In fact, on Day 17, Ms. Sand further positions Lloyd as successful by selecting him to answer based on his earlier correct answer.

Ms. Sand: Okay, who answered me about just answered me about the geocentric? Who was that ?XXXX ***Lloyd tell her the geocentric one - tell her again what you said.*** *Wait a minute, hey* ***come on uh, uh, tell her Lloyd.***

Lloyd: ***The geocentric one is where, uh, everything revolves around Earth.***

Ms. Sand: Earth, Earth and it's all about Earth.

However, on this occasion, the student Ms. Sand has asked Lloyd to help is, in fact, another “struggling” reader, Sierra. In addition, Lloyd was, himself, the recipient of this type of help on Day 16.

Ms. Sand: What are two factors, Lloyd, that combine to keep the planets in orbit - takes two factors what are they?

Lloyd: gravity and um

Ms. Sand: gravity is one that's good ***who can help him out*** *what's the other one Pam?*

Ms. Sand and Ms. Jones frequently provided a scaffold to the answers to the questions Ms. Sand selected “struggling” readers to answer. Less than half of the selected correct answers were elicited from students without some form of scaffold. These scaffolds appeared to be preemptive, that is, they were often given prior to the student having an opportunity to answer the question, possibly indicating a presumption that these “struggling” readers would not know the answer. At times, the two teachers simply offered basic encouragement. For example, Ms. Jones encouraged Sierra to

answer a question on Day 9. Note also that Sierra's correct answer was followed by praise from Ms. Jones.

Ms. Sand: Nooo, what is it, Sierra? What kind of moon would it be?

Sierra: oh, um, um

Ms. Jones: ***You know this, Sierra***

Ms. Sand: What kinda moon?

Sierra: XXXX

Ms. Sand: Full moon, ***excellent.***

Ms. Sand also used repetition as a means of focusing students on her question as the following query from Day 14, in which she repeats a question three times in a row, illustrates.

Ms. Sand: Which of these are caused primarily by the gravitational force between Earth and the moon, Javon. What what's caused by the gravitational force, Javon. What's caused by the gravitational force between Earth and Moon honey?

In addition to repetition, Ms. Sand and Ms. Jones used both verbal and nonverbal cues to scaffold questions. The following exchange, in which both teachers help Clyde arrive at an answer on Day 14, illustrates a number of these scaffolds. (Note: Because gestures are important to understanding the exchange, they have been included in the transcript. The format is from Jordan & Henderson, 1995.)

Actor	*Verbal*	*Nonverbal*
Ms. Sand	*What two factors that combines to*	*Clyde picks his head*

	keep the planets in orbit?	*looks around.*
	What two *uh Clyde,* ***what two*** *factors keep planets in orbit* ***give me two name two****.*	*He rests his head in his hand and gazes at a paper on his desk which he*
	What keeps the planets in orbit?	*which he turns over*
Ms. Jones	***Think of something that pulls up****.*	***Ms. Jones walks toward Clyde raising her right arm.***
Ms. Sand	*Huh, what keeps-*	
Clyde	*gravity*	*Clyde gazes at Ms. Jones.*
Ms. Sand	***What keeps 'em from flying all over the place?***	*Ms. Jones raises her right hand to indicate Clyde should answer.*
Clyde	*gravity*	*Clyde gazes at Ms. Sand.*
Ms. Sand	*and gravity and what's the other one?*	
Clyde	*inertia*	

Ms. Sand *inertia very good* ***pay attention*** *good answer*

In this exchange, Ms. Sand uses repetition to assist Clyde in arriving at the answer. After her initial question, she repeats the word *two* and subsequently leaves out the academic vocabulary word *factors* in an effort to make the question clear. Then Ms. Sand further scaffolds the answer for Clyde by giving him a definition of gravity phrased in everyday language (*What keeps 'em from flying all over the place?)* Ms. Jones gives both a verbal clue (*Think of something that pulls up)* and a nonverbal clue (Ms. Jones walks toward Clyde raising her right arm) to help Clyde arrive at the correct answer. Indeed, he initially answers Ms. Jones rather than Ms. Sand.

On Day 13, Ms. Sand provides several clues to Clyde and even modifies the question *(And if you don't can't put it give me some examples)* after she selects him to answer a question about revolution and rotation.

Ms. Sand: Uh, what's the difference between, ***I want Clyde to answer this one Clyde, what is the difference between revolution and rotation? And if you don't can't put it give me some examples XXXX what is it what, what when we have a rotation, do we have day and night or do we have seasons?***

Ms. Sand also provided hints as to content specific vocabulary words as the following exchange with Lloyd illustrates.

Ms. Sand: Earth has seasons because what reason what the what are the reason uh Lloyd? that Earth has seasons?

Lloyd: spin on its axis

Ms. Sand: it's tiltin' while on it's axis while what? ***re- re-***

Lloyd: ***uh uh what?***

*Ms. Sand****: re re***

Lloyd: ***re?***

Ms. Sand: when its tilted on its axis while it is what? ***re what?***

Lloyd: huh?

Ms. Sand: ***re what?***

Lloyd: ***revolving***

Ms. Sand: ***revolving very good***

A similar incident occurs in an exchange with Sierra on Day 17.

Ms. Sand: Alright now, equinox, what is that to you? Have you heard those words in here, Sierra, equinox? Good, good that you heard it. ***Now do you know what it is? Think about it equ- wa- nox, equa- nox. Where do you hear it? Equa, what does equa mean?***

Unidentified student: XXXX

Ms. Sand: from here

Sierra: ***same***

Ms. Sand: Same, okay now think in terms of seasons or days or nights. What would a equinox be? (.6) Tara what would a equinox be?

Sierra is able to answer the question Ms. Sand uses to scaffold the answer, *what does equa- mean,* but is not able to connect this to the term *equinox* despite hints from Ms. Sand.

Struggling" readers often appeared unsure of their answers even when they were correct. On several occasions, Ms. Sand challenged these students after they gave a correct answer. They then demonstrated their uncertainty about the answer they had given. An exchange with Clyde on Day 13 illustrates this point.

Ms. Sand: Sam, you payin' attention? when we rotation what do we have? What do we have, uh, Clyde?

Clyde: ***day and night***

Ms. Sand: ***y- you sure about that?***

Clyde: ***seasons?***

Ms. Sand: huh?

Clyde: seasons

Ms. Sand: ***Why you changed your mind if you sure?***

Clyde: ***I don't knowwww***

*Ms. Sand****: That tells me you're not sure because you sure about something XXXX asking if that's what I want to say that's not gonna make you change it.***

Interestingly, this exchange differs from Lemke's triadic dialogue model in that Ms. Sand does not indicate whether Clyde answered correctly but instead asks him another question, *are you sure about that?* Although Clyde has given the correct answer, he then changes his answer indicating that he is no longer sure.

A similar exchange occurs with Javon on Day 16.

Ms. Sand: Alright which of these are caused by primarily gravitational pulls between the Earth and the moon? Do we get tides from that, seasons,

winds. or magnetic poles? What do we get from that, Javon? When we have a gravitational pulls between the Earth and the moon?

Javon: a XXXX the first one

Ms. Sand: Hmmm, first one tides. ***Want me to read 'em all or that's the answer you say?***

Javon: ***yeah***

Ms. Sand: ***Yes what?***

Javon: ***No just, yeah what I – what- read it again, read it again.***

Javon: tides

Ms. Sand: Very good, tides, good job.

Ms. Sand did encourage "struggling" readers to answer even when they were reluctant. On Day 16, Ms. Sand has asked when humans first landed on the moon and several students attempted to answer. Some students have provided unsolicited answers ranging from 1865 to 1986. Clyde has quietly stated an answer that Ms. Sand apparently feels is correct so she selects him to answer.

Ms. Sand: What is it, uh, Clyde?

[Unidentified students shout out dates.]

Clyde: 1969

Ms.Sand: What is it, what did you say, Clyde. I can't hear Clyde. Clyde, what you say? What did you say?

Clyde: 1969

Ms. Sand: 1969 remember I XXXX

Although Clyde had originally stated an answer, it does not appear he is certain of his answer because when Ms. Sand asks him to repeat his answer, he remains silent, touches his forehead to his desk, and looks around, apparently hoping someone else will answer. This is why Ms. Sand repeats his name several times. After much encouragement from her, he states the answer again. Ms. Sand's voice rises in appreciation when she repeats his answer.

Although events classified as selected correct response triadic dialogue structured events were not primarily dependent on the use of a particular text as those events classified as external text structure events were, nevertheless, text was available to assist students in determining answers to questions during these events. However, students did not take advantage of these resources in order to arrive at their correct answers. For example, in the previously cited exchange on Day 14 between Clyde, Ms. Sand, and Ms. Jones, although Clyde halfheartedly attempts to consult his written text for the answer, he appears to have used Ms. Jones's clue to arrive at the correct answer. Similarly, on Day 14, Jack avoids using the text despite Ms. Sand's direct reference to it.

> *Ms. Sand: Alright look at the uh um illustration there. Where is the asteroid belt in the illustration? What number, Jack, what number is the asteroid belt?*
>
> *Jack: Five*
>
> *Ms. Sand: Number five go back to the front page. See that. I XXXX right there.*

Interestingly, although Ms. Sand directs the class to look at the illustration on their study guides, Jack makes no effort to do so. Instead, he shifts in his seat. He answers

five from memory which prompts Ms. Sand to refer to the *front page* where the illustration is. It is only at this point that Jack picks the study guide up from his desk.

Overall, it appears the "struggling" readers in this class were reluctant participants in triadic dialogue events even when they knew the correct answer. Ms. Sand selected them to answer questions nearly as often as the nonstuggling readers (45.5% of selected answers), but their selected answers comprised a greater percentage of their total answers (74.6%) than did the selected answers of the nonstruggling readers group (47.2%). As will be apparent in the next section, when "struggling" readers were selected to answer Ms. Sand's questions during triadic dialogue, they were correct in their answers only about half of the time, answering correctly 24 times and incorrectly 25 times. Although Ms. Sand often tried to encourage them, struggling readers at times indicated they were not secure in their knowledge of the content even when they knew the correct answer. In fact, these students often indicated they were disengaged from the activity by behaviors such as putting their heads down on their desks and turning their back to the teacher. These behaviors demonstrate that these "struggling" readers perceive their own low prospects for success and lack agency during periods of triadic dialogue.

Furthermore, despite the ready availability of at least one tool for locating answers, written texts in the form of study guides, these "struggling" readers appear to rely on their pre-existing knowledge or verbal and physical signs from the two teachers for answers to Ms. Sand's questions. This is not an unreasonable strategy on their part as several incidents illustrate how these students' prior verbal interactions appear to have been a tool of learning for them.

On Day 14, thirty-seven minutes into the lesson the following exchange occurs between Clyde and Ms. Sand.

Ms. Sand: alright how many tides we have a day, uh. Clyde?

Clyde: four

Ms. Sand: How many tides do we have a day?

Clyde: four

Ms. Sand: very good Clyde we have four tides

This answer is not available to Clyde on the study guide. However, the previous day when Ms. Sand had asked a similar question, Clyde’s answer to Ms. Sand had been interrupted by Daniel. The number of tides in a day was the exact information Daniel provided to the class. It appears that Clyde’s interaction the previous day, although not one in which he was successful, served as a tool for his learning this particular bit of information.

Similarly, an incident involving Sierra on Day 17 demonstrates how she used a previous verbal interaction to learn science content.

Ms. Sand: Alright all right, let's see, what else I need to say? Um, Sierra, how old is the Earth?

Sierra: four point five billion years old

[clapping]

Ms. Sand: good answer Sierra. Excellent, very good. four and a half.

Sierra had answered this question incorrectly on Day 16, and Ms. Sand cautioned her to remember this information because she would see it again. In addition to her correct answer here, Sierra answered question a question about Earth’s age correctly on

the final exam. Furthermore, this appears to be one of a limited number of facts that she has learned as her overall score on the final exam was only 43 percent. Therefore, it appears a lack of success in a previous interaction has served as to scaffold learning for both Clyde and Sierra. These verbal interactions were tools they both were subsequently able to use to demonstrate new knowledge.

Selected incorrect responses analysis.

Twenty-five of the selected responses (37.3%) of the total 67 responses by "struggling" readers during triadic dialogue structured literacy events were classified as incorrect responses. On these occasions, students often chose to remain silent rather than guess at the answer to Ms. Sand's question. On Day 16 Ms. Sand was quizzing the students in preparation for their exam. On this occasion, Alice had no papers on her desk. Ms. Sand addressed the following statement to Alice.

> *Now, if you have some scientists, Ptolemy, Galileo, Tyco, which one of them believed in the heliocentric, Alice, which one believed the heliocentric, Ptolemy, Galileo, Tyco, which one?*

Alice fidgets in her desk but does not attempt to answer the question. Ms. Sand soon calls on Clyde, who is sitting next to Alice.

Alice again chose to remain silent rather than attempt to answer a question on Day 17 despite attempts by Ms. Sand and Ms. Jones to help her determine the answer.

> *Ms. Sand: XXXX* ***name the uh planets Alice***
>
> *Ms. Jones: XXXX*

Ms. Sand: outer planets what are the outer planets what's the problem Javon now you better get a grip cause every day I'm havin' to deal with this attitude and I'm don't like it get a grip now we up here tryin' to help you who did I call on lost my train of thought

Unidentified student: XXXX

Ms. Sand: ***Alright Alice name the outer planets sweetie out outer***

Ms. Jones: ***the gas giants think of the***

Ms. Sand: ***the gas giants planets do you know wha-***

Ms. Jones: XXXX ***yeah what are the four outer planets they're the large ones***

Unidentified student: Jupiter XXXX Uranus Neptune

When Alice does not reply, eventually another student answers for her. On another occasion, Ms. Sand demonstrates her frustration with Alice's silence.

I'm lookin' for the one who believed in the geocentric model the one where everything revolves around Earth What is it Alice who was it (.4) Alice ***are you here today*** *which one was it (.3) who I'm talkin' 'bout XXXX Lloyd*

In this case, Ms. Sand is seemingly frustrated with Alice's failure to respond so she asks, *are you here today?* Apparently, Alice has again chosen to remain silent rather than risk answering incorrectly.

Alice was not the only "struggling" reader who chose silence when unsure of the answer. On Day 16, Clyde chose silence when Ms. Sand nominated him to answer a question.

Ms. Sand: Clyde what's a maria?

Daniel: oh I know, I know

Ms. Sand: (.5) XXXX Not paying any attention sweetie pie. Lloyd. What's a maria?

While Clyde looks in Ms. Sand's direction when she asks this question, he sits with his arms folded in his lap and does not attempt to speak. After a few seconds, Ms. Sand selects Lloyd to answer.

Jack also chose silence rather than engaging in an interaction on Day 14. Although Jack had his textbook open, he had his head resting on it, and he appeared to be asleep. When Ms. Sand nominated him to answer, he did not immediately move. Josh tapped him on the shoulder, and he sat up and stared toward the front of the room.

Ms. Sand: So what was the name of that other, uh, theory Jack? What was the other, uh, theory, heliocentric what was the other one (.4) Josh, help him out, tell him.

When Ms. Sand nominates Josh and Josh gives an explanation, Jack stares towards the front of the room and yawns. Javon behaves similarly during the same triadic dialogue event on Day 14.

Ms.Sand: Rotation spins earth is on axis. How long does it take for the Earth to make it one rotat- Javon? Just to make a rotation, how long it take honey?

Unidentified student: XXXX

Ms. Sand: twenty-four hours that's XXXX answer twenty four hours yes

When Ms. Sand asks this question of Javon, he sits staring at his desk and makes no attempt to answer. Sierra also makes no attempt to answer a question on Day 14.

Ms. Sand: Alright, let's go to the next one. Which body is at the center of the solar system Sierra? Which body is at the center of the solar system? think about out there in space, what's the center the main thing out there in space what do you see (.8) hmm?

Sierra flips through the papers on her desk, but she never looks up or makes eye contact with Ms. Sand. When Sierra doesn't answer, Ms. Sand asks Josh the question.

On all of these occasions, when these "struggling" readers remain silent, Ms. Sand soon goes on to another student and poses the question again. These students have chosen to remain silent in order to avoid hazarding an incorrect response to the question. The effect of this strategy is that the students gain power in the interaction, and Ms. Sand is forced to abandon questioning them. In other words, it appears they realize Ms. Sand will soon go on to ask another student if they choose not to answer.

However, "struggling" readers did not always choose silence when Ms. Sand selected them to answer questions about information they didn't know. At times, they elected to attempt to enact the identity of a good student by attempting an answer. It was not clear in these cases whether students incorrectly felt they knew the answer or

whether they were simply guessing. For example, on Day 9, Ms. Sand addressed the following question to Clyde.

> *Ms. Sand: Galileo thought that the dark flat parts of the moon's surface were really what? What did he think Gal- Galileo the dark parts of the, what I have XXXX hands going up, now pay attention, XXXX pay attention. Clyde, do you know? What were, what did he think those dark spot flat, um, parts of the moon surface were? Did he think they were oceans, deserts, rivers, mountains or craters?*
>
> *Clyde: craters*
>
> *Ms. Sand: hmm? what do you think Daniel?*

Rather than evaluate Clyde's incorrect response, Ms. Sand asks another student for an answer to her question.

Again On Day 16, Clyde attempted to appear engaged in thinking about the answer to Ms. Sand's question although he is ultimately unsuccessful in formulating a response.

> *Ms. Sand: what do we call those, Clyde, you know little spots on the sun?*

Clyde put his hand on his forehead and then brings it forward seemingly to indicate he is pulling the answer from his head. When this technique fails, he pounds his fist on the desk and makes a gesture of exasperation. Meanwhile, Ms. Sand calls on Niah who correctly answers her question.

However their underlying insecurity about their own knowledge was also apparent at times. Lloyd demonstrated how "struggling" readers lacked confidence in their answers even when they initially selected the correct answer.

Ms. Sand: Now sh- now that you know what I'm talkin' about which one of these explorers believed in the geocentric model? Wait a minute, I'm gonna give you a choice, a choice. Was it Brahe, Aristotle, Galileo, Copernicus? Brahe, Aristotle, Galileo, Copernicus. I'm lookin' for the one who believed in the geocentric model -the one where everything revolves around Earth. What is it Alice? who was it ?(.4) Alice, are you here today? Which one was it? (.3) Who I'm talkin' 'bout XXXX Lloyd ? [Ms. Sand is interrupted by a student from English class who has an assignment to show her.] Who was my person I'm still waitin' on? The, would like XXXX which one of those four, Brahe, Aristotle,

Lloyd: :Aristotle

Ms. Sand: Galileo

Lloyd: Aristotle

Ms. Sand: or Copernicus? [Ms. Sand is briefly interrupted once more.] You said what you say sweetie?

Lloyd: Bree

Ms. Sand: DXXX Aristotle how many of you agree with him cause I do.

*Lloyd**: I don't agree with myself.***

Although Ms. Sand has only been briefly distracted and has not indicated to Lloyd that he may be incorrect in his answer choice, he changes his answer twice during this interaction.

Furthermore, Ms. Sand also demonstrates she has less confidence in the assertions of "struggling" readers than she does in those of the other students in the class. For

example, in the following discussion of multistage rockets, Ms. Sand at first disregards Lloyd's assertion.

> *Ms. Sand: and built three and what, what, uh, why do they call it multistage?*
>
> *Lloyd: because it has four stages*
>
> *Ms. Sand:* ***It does?***
>
> *Unidentified student: it got three*
>
> *Ms. Sand: three*

After this, Daniel informs Ms. Sand that multistage rockets actually have four stages, and they have a brief discussion about what answer is correct. Ms. Sand explains that a multistage rocket *"has the vehicle and then the two."* Although Ms. Sand is quick to question Lloyd's answer, she pauses to reflect on her answer when questioned by Daniel.

However, despite often remaining silent and the fact that Ms. Sand often went on to other students for answers when "struggling" readers did not answer quickly enough, Sierra demonstrated a stubborn belief in herself even when unable to correctly explain a concept. She demonstrated her frustration with Ms. Sand by means of her gaze and physical gestures as well as by verbal means during an interaction around theories of the solar system. Furthermore, although Sierra was not positioned as knowledgeable in this interaction, she subsequently correctly answered a question on the final exam about this very concept. Ms. Jones was standing next to Sierra during this interaction. Although she whispered *heliocentric* to her, she did not tell her the answer even though Sierra looked to her after the question was asked. As the

interaction proceeds, Ms. Sand eventually states an answer to the question. Sierra attempts to suggests she knew the answer all along by stating, *that's all I was tryin' to say while ago but –*

Although Sierra's subsequent correct response to the exam question concerning models of the solar system further indicates verbal interactions, albeit negative ones, are a viable, if unpleasant, tool for learning for "struggling" readers, the evidence here, similar to student behavior during selected correct triadic dialogue events, indicates that "struggling" readers failed to use the written text available to them during selected incorrect responses, despite the fact that it would appear more likely these students would search available written texts for answers when they did not have the answer readily at hand. For example, on Day 14, although Jack has his textbook open on his desk, he has his head resting on it, and it appears he is asleep. When Ms. Sand selects him to answer her question, he makes no attempt to consult his book for the answer. On Day 16, Ms. Sand was quizzing the students in preparation for their exam. On this occasion, Alice had no papers on her desk, despite the fact that students had been given several written texts Ms. Sand called *study guides*. Clyde is sitting next to Alice at his desk which is also clear of books and papers. On Day 17, although Sierra has papers on her desk, she makes no attempt to consult them when Ms. Sand selects her to answer. She is resting her head on her right hand and is turned in her seat so that she is partially facing the back of the room.

Volunteered responses in triadic dialogue structured events.

"Struggling" readers volunteered to answer and subsequently correctly answered questions posed by Ms. Sand 11 times (16.4% of their 67 total answers) during periods of triadic dialogue. By contrast, nonstruggling readers volunteered to answer six times as

often (52.8% of their total 127 answers.) No "struggling" reader volunteered an answer that was positioned by Ms. Sand as incorrect during the course of the study. Not all of these volunteered answers were evaluated by Ms. Sand, and only one of them was constituted by an extended explanation on the part of the "struggling" reader. Four of the correct volunteered answers were constituted by a simple triadic exchange in which the student provided a one or two word answer. For example, on Day 16, when Ms. Sand asked the class which planet had a large red spot, Alice raised her hand. She answered *Jupiter* when Ms. Sand called on her. Ms. Sand responded, *Jupiter, very good.* Clyde, who was seated next to Alice, grinned broadly and gave her a thumbs up sign. Javon, Lloyd, and Niah also engaged in similar exchanges with Ms. Sand during periods of triadic dialogue.

During the remainder of these volunteered interactions, some variation of the triadic dialogue pattern occurred, usually at the evaluation stage of the exchange. For example, on Day 16, Ms. Sand asked the class to name things that are unique about planet Earth. A number of students had offered answers, and Ms. Sand had asked for more. Lloyd had just commented that it, meaning planet Earth, has water. Javon raised his hand and answered, but his answer was not acknowledged or evaluated by Ms. Sand.

Ms. Sand: water very good it has water on it

Javon: oxygen

Ms. Sand: like, uh, water is our most unique feature water

Similarly, on Day 16, Ms. Sand failed to acknowledge Lloyd's answer. Ms. Sand was questioning students about what makes Earth unique.

Ms. Sand: What else makes it unique? Lloyd

Lloyd: It has the ocean like you know XXXX

Unidentified student: water it has water

Ms. Sand: Water, very good. It has water on it.

Although Lloyd's answer indicates water, it is not clear to him that he has answered correctly because Ms. Sand, rather than pointing out the ocean contains water, appears to be responding to the unidentified student rather than to Lloyd.

In only one case did a "struggling" reader, Javon, volunteer to answer a question that required an explanation. This interaction occurred at the beginning of the class period on Day 16, just after Ms. Sand had announced they were going to review for the exam. Javon was sitting at his desk with his head resting on his backpack. The front of his backpack was sticking up in front of his head making it difficult for Ms. Sand to see his face. As he began to explain his answer, he became animated and sat up straight in his desk. He raised his arm in the air as he attempted to explain what the asteroid belt is.

Ms. Sand: Alright, who can tell me what is the asteroid belt?

*Javon: **Me, oh, I know.***

Ms. Sand: Un huh, what's the asteroid belt? Alright, Javon.

Javon: The asteroid belt is it's it's meteors no, no, it rocks, it's the rocks around the uh outer outer it's it's it's like uhhh I can't explain it.

*Ms. Sand: **Take your time.***

Javon: It's like, um, like when you go into the outer planets it's this like

Ms. Sand: It's kinda the back of the what?

Javon: Yeah the back of the inner planets and the outer planets.

Ms. Sand: inner and outer planets

Unidentified students: inner and outer planets

Ms. Sand: Very good.

Although Javon experienced some difficulty making his explanation clear, Ms. Sand both reassured him (*Take your time.) and* scaffolded his answer (*It's kinda the back of the what?)* prior to her evaluation *(very good)* which positions him as a success in answering her question. However, although Javon is positioned as successful, this exchange has done little to assist him in being better able to articulate a definition for the scientific term in question. Furthermore, it is apparent that struggling readers only volunteered when they felt confident of their answers. Moreover, Ms. Sand failed to evaluate many of these correct answers meaning these readers did not receive feedback and did not, therefore, have confirmation that they were correct.

There is no evidence that "struggling" readers used any additional tools besides their prior knowledge and oral language capabilities to answer these questions. For example, on Day 16, when Alice volunteered her one correct answer in a whole class setting, Ms. Sand was sitting at her desk formulating questions based on some notes she had made, an exam review, and a copy of the last test the students had taken. Although she told the students they could use their study guides, interactive notes, and copies of the last test as resources, Alice had none of these on her desk . These interactions were similar to the ones around the correct and several of the incorrect selected interactions in that students were attempting to position themselves as knowledgeable. However, even when attempting to enact the role of "good student", these "struggling" readers at

times experienced difficulty communicating concepts and often volunteered to provide only brief bits of factual information.

Unsolicited correct answer responses in triadic dialogue structured events.

Only five instances could be documented in which "struggling" readers provided unsolicited correct answers to questions, and these answers were provided only by Javon and Lloyd. Some of these answers went unacknowledged by Ms. Sand, which is to be expected considering that these answers were, in effect, interruptions to the class proceedings. For example on Day 17, Lloyd had just finished naming one characteristic of the outer planets after being selected by Ms. Sand. He then volunteered a characteristic of the inner planets. However, Ms. Sand does not acknowledge his answer.

Ms. Sand: Anymore characteristics that we didn't mention ?

Lloyd: inner planets XXXX rocky

Ms. Sand: Alright, I, I know one thing I didn't talk about the history of space exploration.

Previously on Day 14, Ms. Sand had also failed to acknowledge Lloyd's answer. On this occasion, she was quizzing students to get them ready for the final exam.

Ms. Sand: which direction does uh Earth move?

Javon: left

Lloyd: clockwise

Ms. Sand: Alright, left mean what? What you call left?

However, it should be noted that in this case, another struggling reader, Javon, has provided an unsolicited answer as well, and Ms. Sand is actually attempting to apply correct terminology to his answer. This may be why she does not respond to Lloyd.

Unsolicited incorrect responses in triadic dialogue structured events.

Only one occasion on Day 16 could be documented in which a "struggling" reader provided an unsolicited incorrect answer. Although Ms. Sand did not overtly negate his answer, her comment indicates that while his comment may be true, this is not the answer the class will use.

Ms. Sand: Which planet is farthest from the sun?

Daniel: Pluto [unidentified students: Pluto] No, Neptune Neptune

Javon: It's not really true [XXXX: unidentified students] It could be the new planets though.

Ms. Sand: Alright we going with the XXXX uh Pluto.

While Ms. Sand clearly states her preference not to use Javon's answer as the correct one, she also does not overtly negate his answer. Instead, she says the class will be "*going with the XXXX uh Pluto.*"

Summary of student responses in literacy events structured as triadic dialogue.

"Struggling" readers did not participate in literacy events structured as triadic dialogue as often as nonstruggling readers. Moreover, "struggling" readers demonstrated a low incidence (5.7% of total responses) of voluntary participation in triadic dialogue events. The fact that no incidents of volunteered incorrect answers could be documented

during this study combined with only one documented unsolicited response that was incorrect indicates that "struggling" readers were more likely to attempt to answer Ms. Sand's questions when they were confident they would be correct. While this is to be expected, the infrequency with which they answered indicates they were not often sure of their answers. For example, Niah, the only struggling reader who answered no questions incorrectly, answered only a total of three questions during periods of triadic dialogue. Furthermore, the numerous incidences of teacher scaffolding in the form of repetition, hints, and gestures provided by Ms. Sand and Ms. Jones when students managed to answer correctly suggests limited content knowledge on the part of these students. The fact that "struggling" readers answered incorrectly more often than correctly when selected to answer questions further confirms this analysis. Furthermore, these students at times chose not to participate in these events by remaining silent during triadic dialogue or appearing disengaged from the classroom proceedings.

Although some evidence of student learning as a result of triadic dialogue is apparent, at times this learning was based on interactions in which these students failed to provide a correct answer. Apparently, negative interactions rendered the information memorable for these students. Furthermore, "struggling" readers exhibited little evidence of agency in their learning as they demonstrated little effort to use available resources to locate information. This lack of interaction with available text leaves these students with few resources for learning other than depending on others to provide hints or clues to the information.

Nevertheless, despite their limited content knowledge and their apparent reluctance to participate in triadic dialogue events, these "struggling" still attempted to

position themselves as good students. While it is true that some of these students were disengaged at times, two of them also volunteered answers. At times, they insisted they were right or gave the appearance of being deeply engaged in thought about the topic at hand, all behaviors one would not expect to see if they were completely alienated the classroom discourse and culture.

External text dialogue.

External text dialogue related to question answering is reserved for class events during which Ms. Sand was reading somewhat extended text including extended choices in a multiple choice question or when students were reading texts they had prepared ahead of time. Lemke (1990) suggests external text dialogue can be identified by a differing voice inflection from that of the individual's normal speaking style. In addition, external text dialogue events in school can often be characterized by a greater incidence of academic and content specific vocabulary terms. Lemke (1990) further states that these incidents often differ from triadic dialogue in that the preparation for the question is briefer and serves the function of orienting others to the text (in the case of external text dialogue initiated by the teacher) and in the length of the follow-up discussion. Lemke asserts in external text dialogue, teachers may lengthen the follow-up discussion as a means of controlling the event. For the purposes of this study, events classified as external text dialogue events also include those events during which the students are interpreting graphic texts such as charts, diagrams, and graphs and events during which students must silently read text in order to answer a question or make a comment.

Structure of literacy events structured as external text dialogue.

Twenty-seven external text dialogue events were identified during the period of this study. The days, times periods of each event, text used in each event, and absent students are shown in Appendix M *External Text Dialogue Events*. These events were analyzed using the same process used to analyze triadic dialogue events. Each interaction was examined to determine student participants, type of response (unsolicited, volunteered, or selected), and whether the student correctly answered the question. If the event involved oral reading, the event was examined to determine if the student received a positive comment from Ms. Sand or, in the case of longer oral readings, at the least did not receive a negative comment. If there was no video recording of an interaction, the interaction was designated as selected unless it was apparent by a comment or a field note that the student volunteered to answer. Individual interactions were further categorized as TT (teacher read text), ST (student read text), or both (TT/ST). An individual data chart was then constructed for each student encompassing all events.

Only 12 of the total 214 responses (5.6%) by students during external text dialogue events were unsolicited. Unsolicited responses were those responses that were blurted out by students without their either raising their hands or being selected by Ms. Sand to answer. Fifty-six of the total responses (26.2%) were classified as volunteered. Volunteered responses were those responses in which a student volunteered to provide the answer either verbally or by raising a hand. One hundred and forty-nine of the total responses (69.6%) were made as a result of Ms. Sand selecting the student to answer without the student indicating a willingness to answer. These findings are similar to the findings for triadic dialogue events with the exception that more external text dialogue

responses were selected responses (69.6% external text dialogue as opposed to 56.7% triadic dialogue). This is most likely due to the fact that many of the external text dialogue events involved going over the answers to written student work. This activity is usually conducted in a relatively teacher-directed fashion.

Figure 19. Total Number of Questions Answered and Response Types shows the total number of questions answered by each student as well as the total number of each response type for each student over the course of the twenty-seven events. Daniel again overwhelmingly answered the most questions, 37 questions in all. Adam answered the second most often, but his 19 answers were only a little over half as many as Daniel's. Only Sierra, Sam, and Ashley answered ten or fewer questions. These three students were all absent one or more times during external text dialogue events. Daniel and Adam volunteered to answer the most questions (28 questions total), with all other students volunteering less than ten times each. Tara, Sierra, Pam, Niah, Ashley, Alice, and Adam were each selected to answer less than ten times. Of these seven students, only Tara and Pam were present during each external text dialogue event. Neither of these students was classified as a "struggling" reader. With the exception of Daniel, Adam, and Alice, all rstudents answered roughly the same number of questions overall, between ten and sixteen questions. Only Alice, who answered only seven questions, answered fewer than ten questions overall. Alice answered only six questions during triadic dialogue events. Over the course of four hours and thirty-eight minutes of combined triadic dialogue and external text dialogue events, Alice, classified as a "struggling reader", answered a total of only 13 questions. Furthermore, she volunteered to answer only one of these questions.

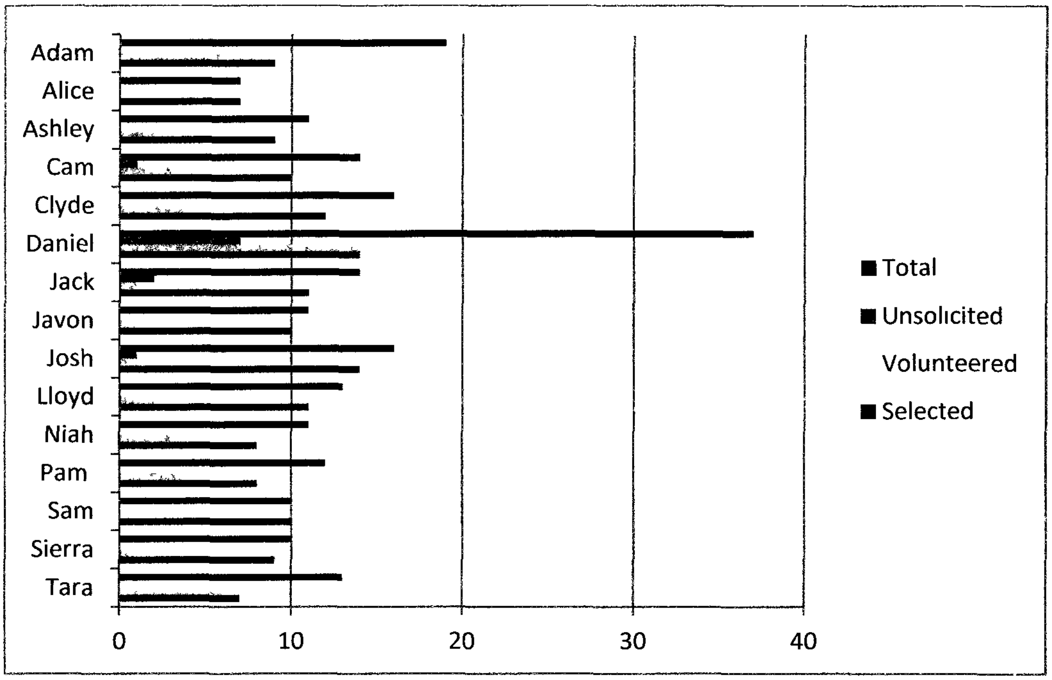

Figure 19. Total number of questions answered and response types

These data were further examined to determine if there were differences between the two groups of students ("struggling" and nonstruggling readers) in response types. *Figure 21.* Percentage of selected response types for "struggling" and "nonstruggling" readers shows the percentage of students in each group who gave each type of response. Although there was only one less student classified as a "struggling" reader than the number classified as nonstruggling, "struggling" readers answered a considerably smaller percentage of questions overall (38.3% of the total) than nonstruggling readers (61.6% of the total), and "struggling" readers answered a smaller percentage of questions of each

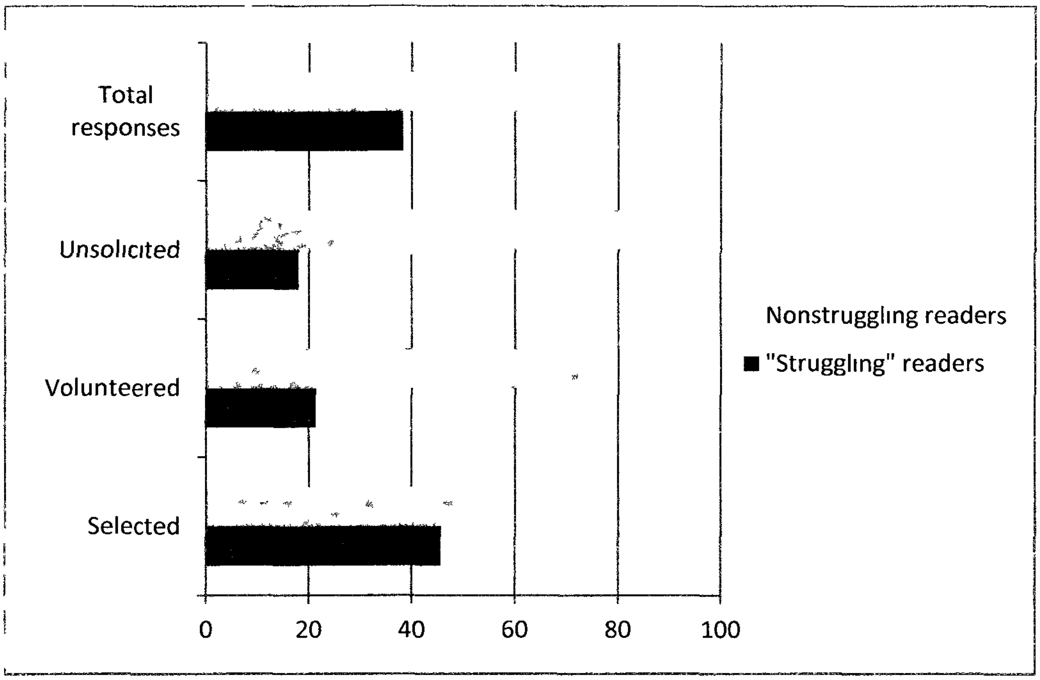

Figure 20 Percentage of selected response types for "struggling" and nonstruggling readers

response type. The two groups were closest in selected responses; "struggling" readers answered 45.6% of those questions as compared to the 54.3% answered by the nonstruggling readers. However, "struggling" readers volunteered to answer questions much less often than nonstruggling readers; only 21.4% of volunteered responses came from "struggling" readers. Although "struggling" readers received much support from Ms. Sand and Ms. Jones during periods of seatwork and presumably had access to written records of this work during external text dialogue, they volunteered answers only slightly more often (21.4% versus 13.9%) than in triadic dialogue events. Thus, it appears

"struggling" readers were not more willing to answer when they had access to and time to work with written text prior to these events.

An analysis of the percentage responses of the total of the group's responses further illuminates the relatively less active participation of the "struggling" readers. *Figure 21.* Percentage of total responses of group for response type shows the percentage of responses of each type as related to the total number of questions answered by the group during external text dialogue events. Although both groups were selected to answer by Ms. Sand more often than they volunteered or provided unsolicited answers, a greater percentage of nonstruggling readers answers were volunteered (33.3%) and unsolicited (6.8%) than the percentage of volunteered (14.6%) or unsolicited (2.4%) answers by "struggling" readers. Conversely, a greater percentage of "struggling" readers total answers were selected answers (82.9% "struggling" readers versus 61.4% nonstruggling readers).

The data were then further examined to determine how often both groups of students answered questions correctly and incorrectly. Occasionally, students gave answers that were not confirmed by an evaluation from Ms. Sand. These responses were not counted as correct or incorrect. If a student got an answer partially correct, the answer was counted as both correct and incorrect. *Figure 22.* Total number of questions answered and correct and incorrect answers by student shows the number of incorrect and correct answers to questions for each student and the total number of answers given by each student. Despite the majority of students responses occurring as a result of students

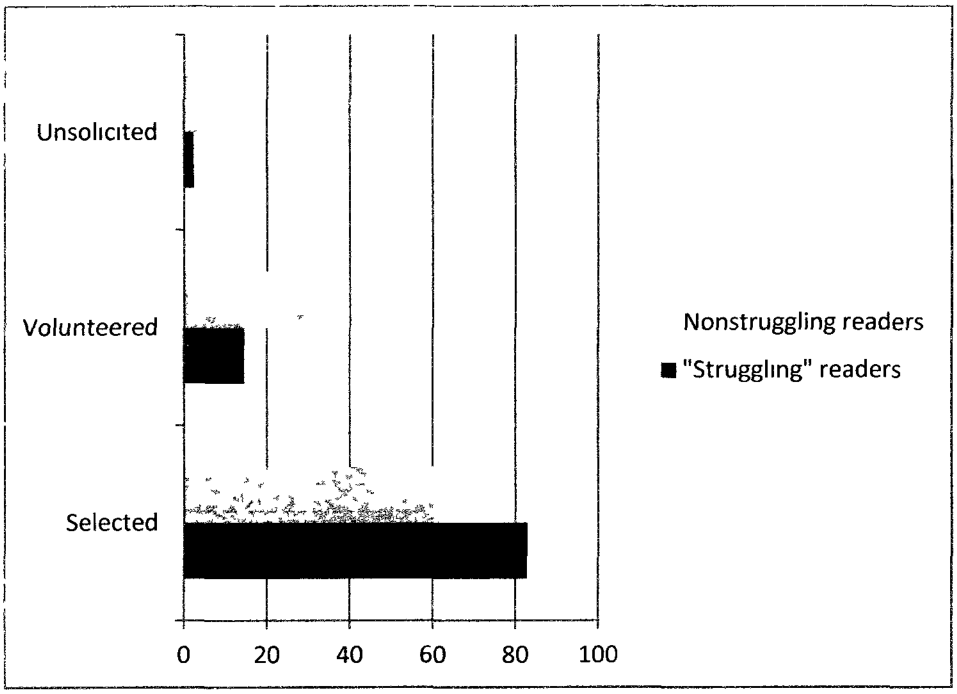

Figure 21 Percentage of total responses of group for response type

being selected to answer by Ms. Sand, every student, with the exception of Sierra and Sam, answered more questions correctly than incorrectly. Sam answered an equal number of questions correctly and incorrectly; only Sierra answered more questions incorrectly than correctly.

As is apparent in *Figure 23.* Percent of correct and incorrect answers by group, not only did nonstruggling readers answer more questions overall than struggling readers, they also answered a greater percentage of questions both correctly and incorrectly. As was true in triadic dialogue events, both groups answered more of the questions they actually answered correctly than incorrectly. The "struggling" readers simply

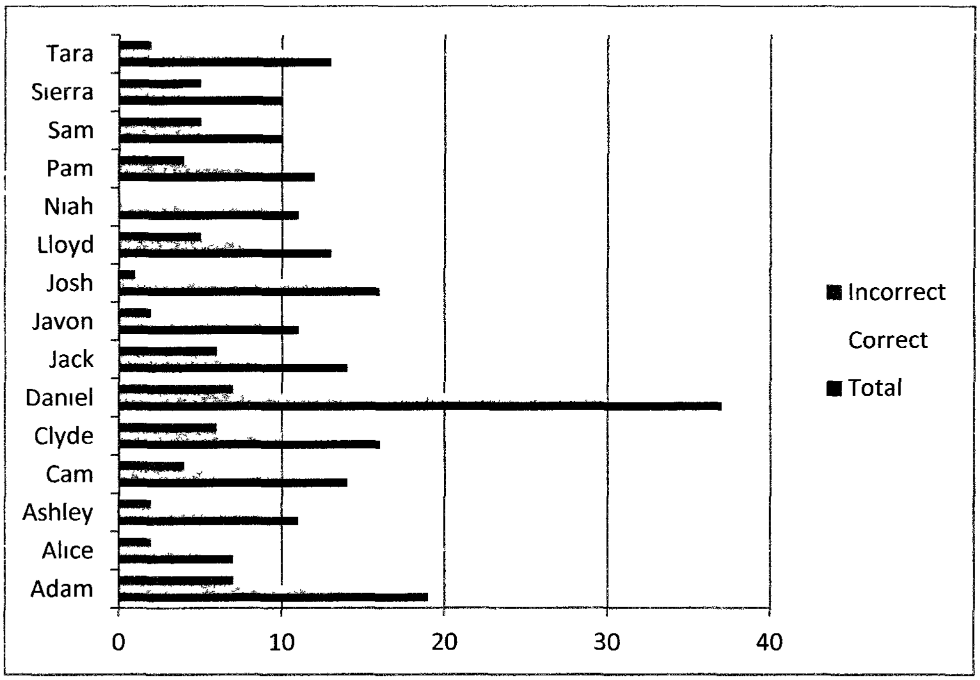

Figure 22 Total number of questions answered and correct and incorrect answers by student

answered far fewer questions overall than did the "nonstruggling" readers. The "struggling" readers answered a smaller percentage (68.3%) of the total number of questions the group answered correctly than did the nonstruggling readers (76.5%). They also answered a larger percentage of their total questions incorrectly (31.7%) than did the nonstruggling readers (24.2%).

Analysis of the substance of external text dialogue structured literacy events. As with triadic dialogue events, the transcript of each external text dialogue event was examined, and data charts were constructed for each student based on the individual

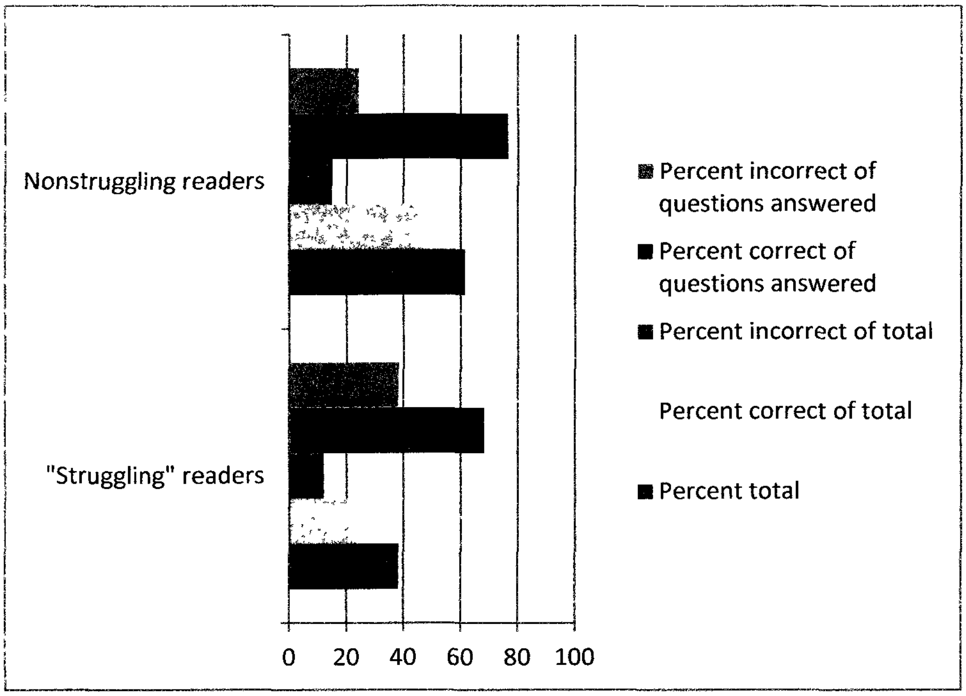

Figure 23. Percent of correct and incorrect answers by group

questions answered by each of these students across external text dialogue events. These charts also indicated whether the student answered each question correctly or incorrectly and the response type (selected, volunteered, unsolicited) for each question. Transcripts, video, and audio of each individual interaction of each student classified as a "struggling" reader were then examined and analyzed, and the transcript and analysis were included in one of six memos: selected correct responses, selected incorrect responses, volunteered correct responses, volunteered incorrect responses, unsolicited correct responses, and unsolicited incorrect responses. Within each memo, individual interactions were grouped by whether the teacher read the text (TT), the student read the

text (ST), or both read text (TT/ST). Each of the six memos was then analyzed across cases for common features of student participation and learning. This analysis was focused by the same nine questions used as a basis for analysis of triadic dialogue events, questions based on the work of Gee (2005a), Bloome, et al. (2005), Bloome, et al. (2008) and researchers included in an edited volume (Cole & Zuengler, 2008).

Selected correct responses.

Forty-seven interactions involving "struggling" readers were classified as selected correct responses. These interactions comprised 83.9% of all correct external text dialogue event interactions and 57.3% of all external text dialogue event interactions of the "struggling" readers in this study. In 29 of these interactions, students read a segment of text aloud. In eighteen of these interactions, Ms. Sand read text to the students. In the majority of these interactions, students had access to written work they had completed prior to the interaction. Therefore, students could silently read the written text if Ms. Sand read the text aloud. However, on Day 8 and Day 9, Ms. Sand read multiple choice questions and answer choices to the students directly from the test they were to take at the end of the class on Day 9. Students did not have access to this text until they took the test. In addition, because the vast majority of this written work was completed in class, students had assistance from Ms. Jones or Ms. Sand in completing the prior written work. The written work used as a basis for external text dialogue is listed in Table 7. *External text dialogue texts.*

As is apparent from an examination of this table, only three of the fourteen texts, *My launching experience*, *Looking at the Moon from Earth*, and *Missions to the Moon*

Table 2. *External text dialogue texts*

Text	Source	Format
My launching experience	"Struggling" reader	Essay
Section 4 Review	*Science Explorer,* p. 588 (Pearson, Education, Inc., 2004)	Short answer questions
Missions to the Moon	*Guided Reading and Study Workbook , pgs. 210-211* (Pearson, Education, Inc., n.d.)	Multiple choice and short answer questions
Chapter 18 Test Earth, Moon, and Sun (Study guide)	*Science Explorer Grade 6 teacher materials* (Pearson, Education, Inc., 2004)	Multiple choice questions
Phases, Eclipses, and Tides	*Guided Reading and Study Workbook* pgs. 203-206 (Pearson, Education, Inc., 2004)	Multiple choice, fill in the blank, and short answer questions
Looking at the Moon from Earth	*Science Explorer,* p. 585 (Pearson, Education, Inc., 2004)	text

Table 2. continued

Grade 6 Benchmark Test A	*Virginia SOL Test Preparation Workbook* (Pearson, Education, Inc., n.d.)	Multiple choice
Grade 6 Benchmark Test B	*Virginia SOL Test Preparation Workbook* (Pearson, Education, Inc., n.d.)	*Multiple Choice*
Missions to the Moon	*Science Explorer* p. 586 (Pearson, Education, Inc., 2004)	text
4th Nine Weeks Exam Review	Teacher-created	Short answer and multiple choice questions
Chapter 18 Test Earth, Moon, and Sun	*Science Explorer Grade 6 teacher materials* (Pearson, Education, Inc., 2004)	Multiple choice questions
Inertia and Gravity	*Guided Reading and Study Workbook* p. 214 (Pearson Education, Inc., 2004)	Short answer question

Table 2. continued

Seasons on Earth	*Guided Reading and Study Workbook* p.202(Pearson, Education, Inc., 2004)	Short answer and multiple choice questions
Earth in Space	*Guided Reading and Study Workbook* pgs. 201-202 (Pearson, Education, Inc., 2004)	

were extended texts. The remainder of the texts consisted of short answer, fill in the blank, and multiple choice questions.

Although Ms. Sand urged the students to use the textbook as a resource for locating answers during group work and seatwork, this was not their preferred strategy in their efforts to locate the answers. Therefore, even when they were later able to correctly provide answers during external text dialogue, it was usually not because they had read a text to locate information. More often, they sought help from Ms. Jones or their peers. In fact, on at least eleven occasions there was evidence in lesson transcripts of seatwork and group work interactions in which students benefitted from this type of help and then later correctly answered a specific question in a selected correct external text interaction.

Alice benefitted from such help on several occasions. According to my field notes, Alice asked Ms. Jones for help with question two from the *Section 4 Review* in the textbook. The question reads as follows. "What did the astronauts do on the moon?" (Pearson Education, Inc., 2004, p. 388) What follows is the exchange with Ms. Jones that led to a successful external text interaction later in the class period.

> *Ms. Jones: Okay, number two, it says what did the Apollo astronauts DO on the moon? What's the first thing they did? Where did they land?* ***test the surface****? So they see what the surface was like? XXXX* ***samples****, yes, they* ***took pictures****, they used XXXX to test,* ***test the temperature*** *Can you come over here?*
>
> *Alice: They did testing.*
>
> *Ms. Jones: Okay, they took* ***soil samples****, they* ***brought some rocks*** *back for scientists to study, okeydoke.*
>
> *Alice: testing*
>
> *Ms. Jones: Testing, they* ***brought back soil (.5) and surface rocks*** *for scientists.*

Ms. Jones mentioned six possible answers to this question: *test the surface, samples, took pictures, test the temperature, brought some rocks back, brought back soil and surface rocks*. Although Alice had apparently already written an answer, she scribbled it out. Alice then wrote a new response in the *Guided Reading and Study Workbook.* This response can be seen in *Figure 24*. Section 4 Review question 2 Alice's response. Alice's written response includes three of the items suggested by Ms. Jones, *testing, brought back soil and surface rock,* and *tested the temperature*. Alice did not actually

need to read the textbook to determine the answer because Ms. Jones provided a scaffold to the textbook information.

2. The Apollo did testing, they bought back Soil, and Surface rock, they tested the temperture for the heat, for the Astronauts to test on them.

Figure 24. *Section 4 Review question 2 Alice's response*

Later in this class period, Mr. Patton, a substitute, was going over the answers to these review questions. He selected Daniel to read his answer for question two, but he was apparently not satisfied with Daniel's answer because he then asks the class, *Anybody got anything different?* Ms. Jones then selects Alice to give her answer.

> *Ms. Jones: Read what you have Alice. Number two. Read what you have Listen.*
>
> *Alice: The Apollo did testing. They brought back XXXX. They tested the temperature for heat. XXXX*
>
> *Mr. Patton: Very good So it could have been either, either one of those two.*

Similarly, on Day 12, Jack changed his first answer as a result of direct assistance from Ms. Sand. During the seatwork phase of the class period, Ms. Sand sat

directly behind Jack and worked with Josh. At 32:15.6, she asked Jack which question he was on and read a part of this question aloud to him. She then commented, *You didn't read that correctly, did you?* Jack agreed that he had not read it correctly, and she then told him the answer. His corrected answer can be seen in *Figure 25.* Jack's answer from Virginia SOL Test Preparation Workbook Benchmark Test B.

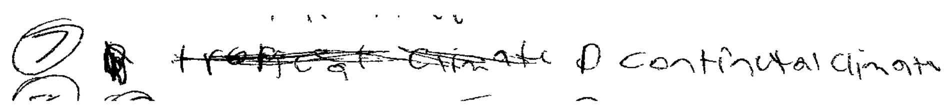

Figure 25. *Jack's answer from Virginia SOL Test Preparation Workbook Benchmark Test B*

Later in the class period, when Ms. Sand selected Jack to answer this question, he chose not to read the answer, apparently because he did not know how to pronounce the word *continental*. Furthermore, it was Ms. Sand who provided an explanation for the meaning of the word *continental*. Unfortunately, when "struggling" readers relied on a teacher or another student for assistance in answering questions, the academic and content-specific vocabulary of the text was a barrier to their comprehension. Although they may have managed to correctly write the answer they were told, this was no guarantee that they understood the information or that they would be able to state the answer in a later verbal interaction.

Furthermore, Ms Sand expressed some dissatisfaction with this "telling" strategy, most likely because she was concerned about how these students would perform on the

tests without the assistance of a teacher. On Day 17 during the last class before the final exam, Ms. Sand appeared to suggest Clyde was overly dependent on Ms. Jones for answers. Ms. Sand was going over questions in the *Guided Reading and Study Workbook* (*"Prentice Hall Science . . . Workbook,"* n.d.). Students were supposed to be following along with her and consulting their workbook for the answers. Ms. Sand had just skipped from page 211 to the bottom of page 214 from which she read the following question.

> *Ms. Sand: Alright now, anybody, uh what are the two factors Isaac Newton concluded that combine to keep the planets in orbit? Clyde, two factors, only two, only two.* ***I don't ask Ms. Jones ask you. I saw you talkin' Ms. Jones, poor Ms. Jones, whooo alright.*** *I don't know why XXXX, come on, Clyde, let's give you a little clue. One starts with a g.*
>
> *Unidentified student:* ***He doesn't know that.***
>
> *Ms. Sand: and the other one starts with gravity, and what's the other one?*
>
> *Clyde: Inertia.*
>
> *Ms. Sand: Inertia.*
>
> *[clapping]*
>
> *Clyde: I couldn't think of 'em.*
>
> *Ms. Sand: Alright.*

Clyde smiles when Ms. Sand tells him not to look to Ms. Jones for the answer. Ms. Jones is standing nearby next to Alice's desk but makes no attempt to help Clyde. Although Clyde has his workbook and a study guide on his desk, he makes no attempt to consult them to locate the answer. However, this encounter with the information later

appears to have been beneficial to Clyde. Although Clyde's overall score on the final exam was 55.9%, Clyde correctly answered a question about gravity and inertia on a later test.

Often, in order to complete a question in the *Guided Reading and Study Workbook* (Pearson Prentice Hall, n.d.), students had to locate a specific passage in the textbook. In fact, each section heading in the workbook was accompanied by specific textbook page numbers. At times, the two teachers or other students directed "struggling" readers to these specific spots in the text, and at times they located them on their own. Once they located the correct section, they could usually answer the workbook question by copying a phrase or sentence directly from the text. Alice located such a spot in order to correctly answer question one in the *Phases, Eclipses, and Tides* assignment,"What causes the phases of the moon, eclipses, and tides?" (Prentice Hall, n.d., p. 203) *Figure 26.* Alice's answer to question one below shows what Alice wrote in the workbook. The sentence Alice has written for her answer is the exact wording of a bold statement on page 570 in the textbook. On Day 17, Ms. Sand

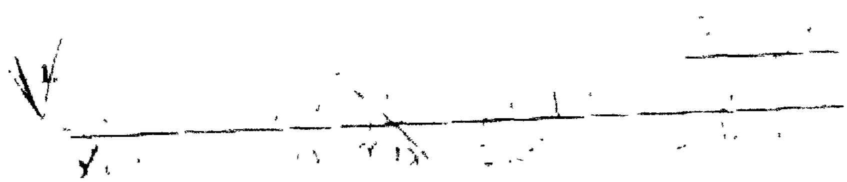

Figure 26. Alice's answer to question one

is reviewing the workbook pages with the class in order to review for the final exam. She selects Alice to tell the class the answer to this question.

Ms. Sand: Alright, what, Alice. what cause the moon's phases?

Alice: (.6) positions

Ms. Sand: That's right. Position of what?

Here Alice has read only a small part of her answer. Her verbal response indicates little understanding of the key information in this textbook statement. After Ms. Sand asks, *position of what?* other students in the class respond, and Ms. Sand expands on the answer.

Indeed, copying answers from the text does not necessarily make them memorable for students, even after they have a subsequent interaction in which they verbally state the answer. For example, on Day 4 when the students began to complete the workbook activity, Ms. Jones went to students individually to help them locate the spot in the text to copy for the answer to the question, "How have scientists learned about the material that makes up the moon's surface?" (Prentice Hall, n.d., p. 211) Alice's exact wording for this answer was in bold print on page 587 of the textbook. Her written text can be seen in *Figure 27.* Alice's answer question 12 Missions to the Moon. When Ms. Sand selects Alice to answer this question on Day 6, she successfully reads the answer from her workbook.

Ms. Sand: Alright, next, Alice, number twelve.

Alice: How have scientists learned about the material that makes up the moon's surface? ***I put Much, much of what scientists have learned about***

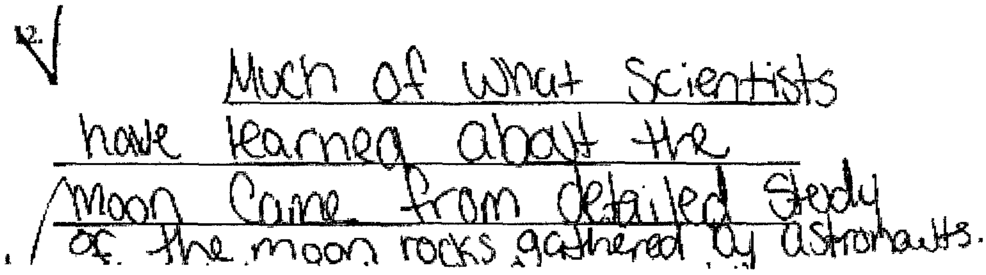
Much of what Scientists have learned about the Moon Came from detailed Study of the moon rocks gathered by astronauts.

Figure 27. Alice's answer question 12 Missions to the Moon

comes from detailed study of the moon rock gathered by astronauts.

Ms. Sand: That's right. Moon rocks gathered by astronauts.

However, despite these two encounters with this specific text, Alice did not answer this question correctly on the Chapter 18 test on Day 9. The question on the test read *Much of what scientists know about the moon has come from*, nearly the same wording as that of the textbook. The only difference is *know* has been substituted for *have learned.* Alice chose *studying the moon through telescopes* rather than *studying moon rocks gathered by astronauts*. The correct answer choice on the test has exactly the same wording as in Alice's answer above.

The difficulty "struggling" readers experienced with the science textbook during external text dialogue events was not just apparent in their answers to workbook questions. On Day 2 of the study, Clyde was selected to read a passage from the textbook aloud.

Ms. Sand: Clyde, take us out with the last paragraph there. We're on page 585, Clyde. At the bottom. The moon's surface

Clyde: The moon's surface also has dark flat areas ***which (.1)***

Ms. Sand: ***Galileo***

Clyde: ***Galileo called (.1)***

Ms. Sand: ***maria***

Clyde: maria the Latin word for

Ms. Sand: ***seas***

Clyde: Each one is ***a muh- ma-***

Ms. Sand: ***mar ray***

Clyde: ***mar ray*** *Galileo thought that the* ***ma-***

Ms. Sand: ***maria***

Clyde: maria might be oceans. Scientists know now that there are no oceans on the moon. The maria are low areas that are flooded with molten material years ago. Since you always see the same maria and craters from Earth you can tell that the moon always shows the same face to Earth.

Clyde paused five times as he read this five-sentence paragraph. Ms. Sand appears to expect that Clyde will need help as she supplies the correct word for him after a pause of only one second on two different occasions.

However, on Day 4 Niah appeared to experience little difficulty reading the science textbook. She was the third person selected to read by the substitute, Mr. Patton.

Niah: In July 1969 three astronauts circled the moon in Apollo eleven. Once in orbit around the moon Neil Armstrong and Buzz Aldrin got into a tiny lunar module called Eagle leaving Michael Collins in orbit in the

> *command module. On July twenty 1969 the Eagle descended toward a flat area on the moon's surface called the sea of tranquality. Armstrong and Aldrin were running out of fuel so they had to find a safe landing spot fast. Billions of people held their breaths as they waited to learn if the astronauts had landed safely on the moon. Finally a red light flashed on the control panel Contact light Houston Tranquality base here The Eagle has landed Armstrong radioed to Earth. After the landing Armstrong and Aldrin left the Eagle to explore the moon. When Armstrong first set foot on the moon he said that's one small step for man one giant leap for mankind. Armstrong meant to say that's one small step for a man meaning himself but in his excitement he never the uh*

She does not finish the last few words correctly (*said the "a"*) before Pam begins to read. She mispronounces *tranquility* as *tranquality* twice but no one comments on this. However, these are minor errors that would likely not interfere with comprehension of the text.

Although Ms. Sand often praised "struggling" readers when they answered questions correctly or read what they had written to the class, on at least one occasion such praise actually had the effect of positioning the "struggling" reader as less than competent. Ms. Sand asked Alice to read her paragraph about her experience watching rocket launchings on the computer.

> *Alice: They showed us how they used, they showed us how they used the rocket and when the rocket gets farther away from the sun it gets darker and darker. When the rocket starts to shift off into space smoke starts*

blasting out from each side of it. Then flames pops out of the rocket and it makes a huge loud sound like thunder.

Ms. Sand: Oh, my, you just using all kinds of (XXXX)

Alice: And what causes the rocket ship to go up is the fuel that is in it. The rocket ship slowly takes off before going into space.

Ms. Sand: Oooh, very good. ***Did you write that by yourself? (XXXX) Did you hear that Ms. Jones?***

Ms. Jones: Yes, I did.

Ms. Sand: Good job.

[Students clapping.]

Ms. Sand's question to Alice, "*Did you write that by yourself?*" positions her as someone who would be expected to need extra help to write so well. This comment probably has the opposite of its intended effect. In fact, although the students in the class clapped in appreciation several times when "struggling" readers gave answers in both external text dialogue structured events and triadic dialogue structured events, they never clapped when other students gave answers. Therefore, while some praise afforded to "struggling" readers was meant to be helpful, it also indicated their successful performances were unexpected enough to deserve an extra level of praise.

Although "struggling" readers did not read as often as nonstruggling readers, on the two occasions when the class read aloud from the textbook ("struggling" readers read two times while nonstruggling readers read seven times), Ms. Sand often expected students would read short answer, fill in the blank, and multiple choice questions aloud

prior to giving their answers in external text dialogue events. For example, on Day 6, Ms. Sand directed Jack to read the question.

Ms. Sand: Alright, now we're on Jack. Jack take number thirteen.

Jack: I put cause the crust is

*Ms. Sand**: Read it, uh, Jack**.*

Again on Day 12, Ms. Sand directs Clyde to read when she selects him to answer a question.

Ms. Sand: Alright, take number five Clyde you have number five done?

Clyde: It is, uh, b.

Ms. Sand: Are you checking yours Josh? What's your answer here? ***Read uh sweetie****.*

Clyde: What is the most likely hy- po for what happened between six o'clock am and 8:00 am? I put b shadows cast on the thermometer caused the temp-

Although Clyde attempted to skip reading the question containing what was a difficult word for him, *hypothesis,* Ms. Sand insisted he read it. However, after an unsuccessful attempt to pronounce it, he simply skipped it and moved on to the rest of the question.

However, another instance when Clyde was selected to answer a question demonstrates his usual method of answering. For example, on Day 11 the class was going over the answers students completed in the *Virginia SOL Test Preparation Workbook* on page one. Ms. Sand selected Adam to read the question for number four, but his answer was incorrect so she selected Clyde to give his answer.

Ms Sand: Alright, uh, Clyde, whatchu write for number four?

Clyde: Number four. [looks at workbook and at his paper] ***j.***

Ms. Sand: Uh, consists of a nucleus containing protons and neutrons with electrons moving around the nucleus. That's a good answer Clyde, good job.

Clyde chooses to simply indicate the letter of the correct answer, and Ms. Sand then reads the text aloud. This is despite the fact that Clyde has written the entire text on his paper as can be seen in *Figure 28.* Clyde’s answer to Question 4 Grade 6 Benchmark Test A Virginia SOL Test Preparation Workbook.

This particular text contains a number of academic words and content words that would be challenging to a sixth grade “struggling” reader. For example, the word *consists* is a level one word on *the AWL*, (Coxhead, 2000). The word *atom* is, according to Marzano, (2004), a level three Science term and the words *proton* and *electron* appear on the level four list. While level three words are classified for grades

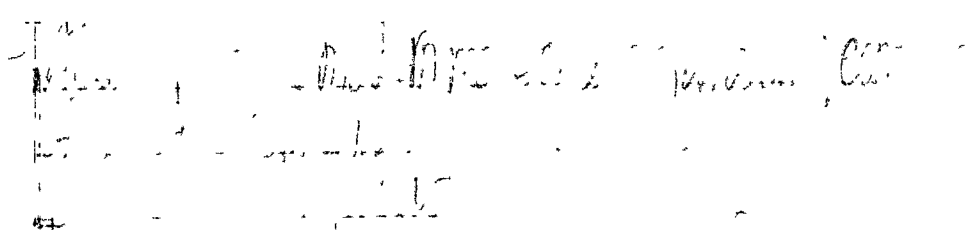

Figure 28. Clyde’s answer to Question 4 Grade 6 Benchmark Test A Virginia SOL Test Preparation Workbook

six through eight, level four words are classified for grades 9 -12.

Javon also experienced difficulty reading short answers aloud. On Day 6, the class was going over *Missions to the Moon* from the *Guided Reading and Study Workbook* (Pearson Prentice Hall, n.d.). Ms. Sand selected Javon to read the first question and provide the answer.

> *Ms. Sand: Alright, Javon, we gonna start with you. Uh, this was assigned on Monday, Shut that door please, while Ms. Sand was out and we didn't get a chance to check it, page 210. Alright start XXXX Jack turn around. Alright, Javon, start with eight sweetie.*
>
> *Javon: Which president of the United States launched* ***an enor, huh?***
>
> *Ms. Sand:* ***enormous***
>
> *Javon: program of* ***space explorato oh exploration*** *and scientific research in the early 1960's.*
>
> *Ms. Sand: Alright which person was that?*
>
> *Javon: John F. Kennedy*
>
> *Ms. Sand: Very good*

Here, Javon has difficulty pronouncing two words, *enormous* and *exploration*. Ms. Sand assists him with *enormous*. Enormous appears on the *AWL* (Coxhead, 2000) on list ten, the sublist containing the least frequently occurring *AWL* words (Coxhead, Summer 2000).

Again on Day 11 as the class was going over the answers to an assignment, Ms. Sand selected Javon to read. (*Virginia SOL Test Preparation Workbook*, n.d.)

> *Ms. Sand: Alright, Javon, take number two please.*

Javon: When a student ***condud an, oh****, Which question should he asked during* ***an inqerry XXXX. I put J.***

Ms. Sand: Does the soil feel grainy and coarse or smooth and silky. Alright and they wanna know the texture of the soil, so anytime they ask you texture the XXXX be so that's a good choice. Everybody got number two?

Here Javon completely gives up reading the question after he stumbles over several words. He then elects not to read his answer choice as well. The first sentence of the question, *A student conducted an investigation of soil texture,* contains both a level 2 word, *conducted*, and a level 4 word, *investigation*, from Coxhead's list.

It was also apparent during external text dialogue events that students were even more limited in their use of academic and scientific vocabulary when they produced their own texts for short answer questions. For example, on Day 17, Ms. Sand selected Javon to read his explanation for the seasons.

Ms. Sand: How about you, Javon? Do you have that one, number ten, why does the Earth have seasons?

Javon: ***the way the axis is***

Ms. Sand: hmmm

Javon: the way the axis is

Ms. Sand: What you mean by the way the axis is? What about it? You're right, you got it, it really does have somethin' to do with the axis. What about it?

Javon: why it rotates

Ms. Sand: rotates around what?

Javon: the sun

Unidentified student: XXXX

Ms. Sand: There you go, the way it rotates on its axis around the sun, very good.

Although Javon hears Ms. Sand verbalize the answer, he does not have the opportunity to state the answer himself. Subsequently, on the final exam, Javon was still unable to demonstrate how the concept of revolution applies to the seasons. (This interaction is analyzed in more depth in the **Language Differences** section of this paper. See page 141.)

Students also demonstrated a somewhat limited capacity for the use of academic and scientific vocabulary in the paragraphs they wrote and later read summarizing their experience watching rocket launches on the computer. However, it appears the oral reading of this text presented an additional opportunity for these students to interact with the concepts and vocabulary they did use in their writing.

Ms. Sand: Alright. Now Jack.

Jack: There are lots of space shuttle launches.

Ms. Sand: XXXX

Jack: They are called multilaunches? When one part of the rocket runs out of fuel, it breaks off and falls in (XXXX). That is how a multilaunch works. The top part of, the top part is called a cone. That is the part that goes into outer space. Sometimes the rockets don't make it off the ground. The

bottom contains the fuel, each part of it. The bottom contains the fuel. Each part contains it own fuel. The multi breaks off.

Ms. Sand: Alright, you've done a good job.

Jack is apparently beginning to grasp the idea of multistage rockets which he is calling *multilaunches*. Ms. Sand does not point out he means "multistage" but simply compliments him on his paragraph. However, Jack appears to have maintained his idea of the term on Day 9. This question is asked during the review just before the Chapter 18 test is distributed. Ms. Sand is reading questions from the test aloud.

Ms. Sand: how`bout this. Putting rockets into space was made possible by the development of what? What did they develop, uh um, Jack? XXXX rockets into space Was it the gunpowder fuels? Taller single stage rockets? Smaller single stage rockets or multistage rockets?

*Jack: **MultiXXXX***

Ms. Sand: Multistage rockets

Although Jack answered 20 out of 30 questions incorrectly on the Chapter 18 test later in the class period, he correctly answered the following question: *Putting rockets into space was made possible by the development of,* by selecting *multistage rockets* as his answer.

Furthermore, on a number of occasions, students correctly answered questions on tests after answering the same question during an external text dialogue event even when they did not have the opportunity to produce written answers. In fact, this was the purpose of the quiz bowl game and of the review session prior to the Chapter 18 test. Ms. Sand read a copy of the test the students were going to take and had them answer the

questions orally. Although the students were not aware this was what she was doing, this prior oral exposure appeared to support them in their later attempts to read and answer test questions.

For example, during the quiz bowl game on Day 8, Ms. Sand selected Clyde to answer a question.

> *Ms. Sand: Alright. Number eight. Alright The phase of the moon you see depends on a where you are on Earth's surface, b how much of the sunlight side of the moon faces Earth, c how much of the moon's surface is lit by the sun, or d whether or not an eclipse is occurring. XXXX You need me to read it again?*
>
> *Unidentified students: Yeah, yeah.*
>
> *Ms. Sand: The phase of the moon, the phase of the moon you see depends on a where you are on Earth's surface, b how much of the sunlight side of the moon faces the Earth, c how much of the moon's surface is lit by the sun, d whether or not an eclipse is occurring XXXX Clyde?*
>
> *Clyde: b*
>
> *Ms. Sand: B, how much of the sunlit side of the moon faces the Earth. Is that your final answer?*
>
> *Clyde: Yes.*
>
> *Ms. Sand: Yes XXXX alright.*

Clyde correctly answered this question about moon phases on the test the following day despite the fact that he was unable to correctly answer 19 of 30 questions on the test. Niah, Jack, Clyde, Javon and Lloyd also correctly answered

questions during the quiz bowl and the test review and later answered the same questions correctly on the text.

Jack was the only student who correctly answered a question during these two external dialogue events and subsequently missed the question on the Chapter 18 test.

> *Ms. Sand: Alright, boys. Much of what scientists know about the moon has come from come from revolving around the moon? studying the moon through telescopes? astronauts walking on the moon? or studying moon rocks gathered by astronauts? Jack?*
>
> *Jack: (.3) XXXX*
>
> *Ms. Sand: Much of what scientists know about the moon has come from a revolving around the moon b studying the moon through telescopes c astronauts walking on the moon or d studying moon rocks gathered by astronauts. What is it?*
>
> *Jack: d?*
>
> *Ms. Sand: Which one?*
>
> *Jack: d*
>
> *Ms. Sand: D is a good answer. Studying moon rocks gathered by astronauts.*

Jack was not able to read this question on his own and answer it correctly on the Chapter 18 test the following day. Instead he chose *b studying the moon through telescopes*.

Although, as illustrated in the examples above, the "struggling" readers in this study were able to correctly answer many questions during external text dialogue events,

their difficulties reading both the science textbook and workbook questions meant they often had, at best, an incomplete understanding of the text and of the answers they provided. In fact, at times they avoided using the textbook in completing their work, relying instead on the teachers or other students in the class to tell them what to write for answers. As a result, when they were selected during external text dialogue events, they were able to provide what was taken as a correct answer whether or not they understood the underlying information. They were even often able to select the correct answer on subsequent multiple choice tests because of the similarity in wording between the correct answer and the wording in the textbook.

Selected incorrect responses.

Twenty-four interactions during external text dialogue events were classified as selected incorrect responses. These interactions comprised 15.3% of all correct external text dialogue event interactions and 29.3% of all external text dialogue event interactions of the "struggling" readers in this study. In eight of these interactions, students read a segment of text aloud. In sixteen of these interactions, Ms. Sand read text to the students. In the majority of these interactions, students had access to written work they had completed prior to the interaction. Therefore, students could silently read the written text as Ms. Sand read the text aloud. However, as with the selected correct responses, on Day 8 and Day 9 Ms. Sand read multiple choice questions and answer choices to the students directly from the test they took at the end of the class on Day 9. Students did not have access to this text until they took the test, after the external text dialogue events. In addition, because the vast majority of this written work

was completed in class, as with the selected correct responses, students had assistance from Ms. Jones, Ms. Sand, or other students in completing this prior written work.

These interactions were based on the same text as the selected correct responses except that the incorrect responses occurred during the use of fewer texts. Only the *Missions to the Moon, Chapter 18 Test Earth, Moon, and Sun* (Study guide), *Grade 6 Benchmark Test B, 4th Nine Weeks Exam Review, Chapter 18 Test Earth, Moon, and Sun, Inertia and Gravity, and Seasons on Earth* texts were associated with these selected incorrect responses. (See *Table 7.* External Text Dialogue Texts for information about the source and format of these texts.)

Unlike her response when "struggling" readers answered correctly, Ms. Sand often had a minimal reaction when "struggling" readers answered questions incorrectly. A very similar interaction occurs on Day 7 with Javon.

Ms. Sand: What did you put for that, um, Ja- Javon?

Javon: Seven, a.

Ms. Sand: Alright, so we were doing for a, ***but the answer is what, Josh?***

After Clyde gave the wrong answer to a question on Day 12, he had the following exchange with Ms Sand:

Ms. Sand: Which one you say?

Clyde: b

Ms. Sand: No, which number?

Clyde: five

Ms. Jones: five

Ms. Sand: ***Alright, who can take number five. Anybody get something other than B.*** *Whatcyu say?*

Although Ms. Sand does not overtly criticize Clyde for his mistake, instead of discussing the answer with him or explaining why his choice is incorrect, just as in her exchange with Javon, she simply goes on to ask another student. Clearly if the next student answers correctly, Javon will have an opportunity to hear the correct answer. This exchange with Clyde also is an example of the difficulty struggling readers could have if they did not get assistance from someone else in locating the answers.

In fact, it was often apparent during external text dialogue structured events that "struggling" readers were unable to use text to locate information. Earlier in the class period, Clyde had asked me for help with this question. When I tried to get him to reason though the answer or read the question aloud to me, he very reluctantly read part of the question and then wanted to guess the answer. It is likely that the answer he chose was simply a guess.

Jack's difficulty reading the text to locate information was also apparent during external text dialogue events. On Day 6, the class was going over *Missions to the Moon* from the *Guided Reading and Study Workbook.* Ms. Sand selected Jack to answer question thirteen, a short answer question.

Ms. Sand: Alright, now we're on Jack. Jack take number thirteen.

Jack: I put ***cause the crust*** *is*

Ms. Sand: Read it, uh, Jack.

Jack: Uh, how did scientists, how do scientists know that the moon once had, very hot, was very hot?

Ms. Sand: Alright, how do they know it was once very hot?

Jack: I pu- ***I put cause of the crusted the part crust on the surface****.*

Ms. Sand: Cause of the what now?

Jack: Cause, I put cause of the way the surface was. ***They*** *called it* ***a hard crust****.*

Jack's use of the word *they* implies that he has gotten this information from the textbook. As previously noted, the *Guided Reading and Study Workbook* functions as a companion to the textbook and has page numbers from the textbook next to each section heading. Ms. Sand goes on to ask for answers to this question from several more students who all suggest that it was "molten material" that indicated the surface of the moon had once been hot. After these answers, Ms. Sand addresses Jack again.

Ms. Sand: Yeah, and, uh, read yours again, Jack, cause I just I gotta hear that again,

Jack: I put cause of the ***hard crusty surface.***

Ms. Sand: Cause the what now?

Jack: The hard ***crusty surface***

Ms. Sand: because of the hard crust and surface

Jack: Yeah

Ms. Sand: (.3) Well would that tell us that it was hot? That would not answer indicate that it is hot.

With this comment, Ms. Sand goes on to the next question. In fact, the word *crust* is not used in the science textbook to describe the surface of the moon. However, the word *craters* is mentioned a number of times on the page before the *Missions to the*

Moon section in the text. It is possible that Jack has misread the word *craters* as the word *crust.*

Javon experienced a similar difficulty interpreting the text on Day 6 when the class was also going over *Missions to the Moon* from the *Guided Reading and Study Workbook.* Ms. Sand selected Javon to answer question twelve.

Ms. Sand: The question was how have scientists learned about material that make up the moon's surface. If you didn't mention rocks in that one, mark it wrong. What did you write for that one, uh, Javon? Number twelve?

Javon: much of, much of what scientists have learned about the moon came from

Ms. Sand: You didn't say nothin' 'bout rocks? Okay. Huh? Mark that wrong.

As can be seen in *Figure 29.* Javon's answer to question twelve from *Missions to the* Moon, Javon was apparently copying the correct bolded sentence from the textbook but neglected to copy the entire sentence. Although technically his answer makes sense, it demonstrates an incomplete grasp of the idea in the text, the astronauts brought back

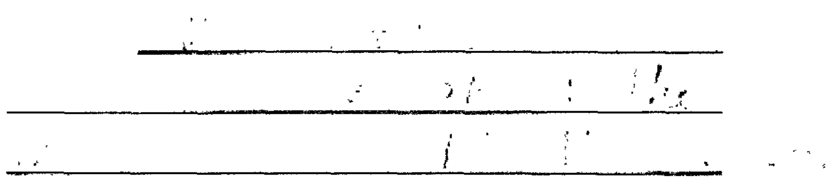

Figure 29. Javon's answer to question twelve from *Missions to the* Moon

rocks that scientists later studied.

On Day 17, Sierra further demonstrates the difficulty “struggling” readers sometimes had accurately writing content specific information during external text dialogue events. The class is going over *Seasons on Earth* in the *Guided Reading and Study Workbook.* Ms. Sand selects Sierra to answer question ten.

Ms. Sand: Why does the Earth have seasons? Sierra (.7) do you have that one, Sierra?

Sierra: I don't have the answer to it yet. I don't know why.

Ms. Sand: You don't know why. Is there anybody else without the answer?

After calling on several other students, Ms. Sand stated that the answer was the following: "*The way it rotates on its axis around the sun.*" Sierra apparently attempts to write this information in her workbook, but she is unable write the complete idea as she omits the content-specific term *axis*. Her written work can be seen in *Figure 30.* Sierra’s answer to question 12 on page 203 in the *Guided Reading and Study Workbook.* Sierra demonstrates here that she is not able to differentiate between revolution and rotation. She is not successful in accurately writing what Ms. Sand has said.

The difficulty “struggling” readers had coping with the texts used in this classroom undoubtedly contributed to their disengagement during external text dialogue events. This disengagement, in turn, resulted in incorrect answers when Ms. Sand selected these inattentive students to answer questions. For example, during the quiz

as it rotate around the
sun

Figure 30. Sierra's answer to question 12 on page 203 in the *Guided Reading and Study Workbook.*

bowl game on Day 8 the following exchanged occurred between Ms. Sand and Clyde:

Ms. Sand: Clyde, one XXXX

Unidentified boys: b the right answer? Is a the one? This, no b is the answer, no.

*Clyde: **Which, which one are they on?***

*Ms. Sand: **Clyde, you supozed been listening.***

Despite the very active participation of a number of the other boys on Clyde's team, he appears to have lost track of the game proceedings which draws a reprimand from Ms. Sand.

This disengagement is also apparent in "struggling" readers' reactions when they make incorrect responses based on their written work. On Day 7, Jack draws criticism from Ms. Sand for not correcting a false statement on his paper.

Ms. Sand: Uh, what do you have, that's, is that true or false?

Jack: I put false.

*Ms. Sand: Well why, well **you gotta make it true. You don't just say -***

Daniel: I put the equinox.

Unidentified student: I got it.

Ms. Sand: What is it?

Unidentified student: um, vernual

Ms. Sand: ***There you go, alright, that's the answer, it was equinox. You gotta know which one.***

Despite Ms. Sand's explicit direction to Jack, *You gotta know which one,* a later examination of Jack's written work reveals that Jack failed to make the correction.

In fact, this disengagement is apparent even when Jack has the correct answer readily accessible. On Day 14, the class is going over one of the final exam study guides. This study guide includes a chart followed by a multiple choice question. The answers were already lightly written on the study guide prior to Ms. Sand distributing them. Jack is sitting in his desk with his head resting on his right hand. He has his textbook open and the study guide on his desk.

Ms. Sand: Alright now the larger the mass of a planet, the greater the pull of gravity on the planet's surface. According to the information in the chart which of these planets has a mass close to Earth, ***Jack.***

Unidentified student: G

Ms. Sand: Which one? First of all, what do we needa find first?

Jack: planets

Ms. Sand: ***No, what do we need to find first Jack?***

Jack: XXXX

Ms. Sand: Huh?

Ms. Jones: ***not even on the right page***

Jack: XXXX

Ms. Sand: Nu- ***what are you lookin' at? Hold your paper up, let's see what you lookin' at. See you not even on the right page.***

Ms. Jones: XXXX chart XXXX

Ms. Sand: ***We're on this Jack right here.***

Although the correct answer to the question was circled on the study guide – and it was circled when the study guide was distributed - Jack was so completely disengaged from the activity, he failed to note the answer.

This reluctance to engage with classroom texts was even more apparent in the subsequent interaction between Ms. Sand and Sierra when Ms. Sand selects Sierra to answer the question Jack has failed to answer.

Ms. Sand: Alright, what's the first thing we need to find Sierra, lookin' at to answer this question. What's the first thing we need to, See, what what do we need to find here?

Sierra: ***I don't know.***

Ms. Sand: Who knows?

Although Sierra has her study guide open on her desk and she looks down at it, she makes no effort to pick it up or closely examine the question. In other words, she makes no real attempt to engage with Ms. Sand's question.

In addition to their disengagement, "struggling" readers often were unable to make use of new information from selected incorrect interactions on subsequent tests. Often, this failure appeared to be the result both of a density of academic and content

terms and of the fact that Ms. Sand was reading four different choices for each question. For example, on Day 9, just prior to distributing the Chapter 18 test, the following interaction occurs between Ms. Sand and Sierra:

> *Ms. Sand: Scientists think the moon was formed when? How you think the moon was formed, Sierra? What was their, their theory? How do you think they, wh- the moon was formed? (.3) hmmm? What happened? Want me to read you your choices?*
>
> *Sierra: Yeah*
>
> *Ms. Sand: a large object struck Earth and material from both bodies combined, gravitational forces attracted materials from outer space, meteoroids collected and solidified within the pull of Earth's gravity, gases from Earth escaped from the atmosphere and condensed (.8) Lloyd, you remember what it was?*

When Sierra doesn't answer, Ms. Sand selects Lloyd to answer. Although Ms. Sand has read verbatim the question from the test, Sierra missed this question on the test later in the class period. The density of content-specific terms such as *gravitational forces*, *meteoroid, atmosphere* (Marzano's *Level Three,* 2004) in this verbal stream likely made this difficult for her to internalize.

However, on at least six occasions, "struggling" readers answered test questions correctly after an incorrect selected interaction. For example, on Day 6 Javon gave an incomplete answer to Ms. Sand, but on Day 9, he answered the same question correctly on the Chapter 18 test.

Ms. Sand: The question was how have scientists learned about material that make up the moon's surface. If you didn't mention rocks in that one, mark it wrong. What did you write for that one, uh, Javon? Number twelve?

Javon: much of, much of what scientists have learned about the moon came from

Ms. Sand: You didn't say nothin' 'bout rocks? Okay. Huh? Mark that wrong.

On the test, the question read *Much of what scientists know about the moon has come from,* and he correctly chose the answer, *studying moon rocks gathered by astronauts.* In fact, the key information needed to answer this question, *studying moon rocks* is exactly the new information Ms. Sand supplied to Javon in the interaction on Day 6.

Clyde also correctly answered a question on the Chapter 18 test after missing the same question during the quiz bowl game. In this case, Ms. Sand repeated the entire question two times and then called on other students to answer when Clyde failed to respond.

Ms. Sand: and the last one for the boys, last one XXXX. Photographs of the far side of the moon show a the far side is much rougher than the near side, b there is water on the far side, c the far side has active volcanoes, or d the far side has a smooth surface uh, Clyde?

Clyde and Ms. Jones: XXXX

Ms. Sand: Photographs of the far side of the moon show that a the far side is much rougher than the near side, b there is water on the far side, c the

far side has active volcanoes, or d the far side has a smooth surface.

Which one is it? (.5) Come on, you gonna lose the turn.

As is apparent from an examination of this question on the test and the four response choices as read by Ms. Sand above, there is a qualitative difference between this question and the question Sierra was unable to answer correctly on the same test. Sierra’s question contained a number of relatively difficult content words (*gravitational forces*, *meteoroid, atmosphere*) while Clyde’s question is comprised of simpler vocabulary. None of the words in this question appear on either the Academic Word List (Coxhead, 2000) or Marzano’s (2004) science vocabulary leveled lists. It appears that Clyde was able to retain this information and successfully deploy it on the Chapter 18 test despite the fact that much of the information on the test was unfamiliar to him.

On very rare occasions, Ms. Sand or another student in the class made a negative comment about “struggling” readers during external text dialogue interactions. For example, when Ms. Sand questioned Clyde on Day 17 (see page 271 for the transcript of Ms. Sand’s comment), *poor Ms. Jones,* positions Clyde as someone who is overly dependent on her for answers. A student subsequently commented, *he doesn't know that*, indicating his belief that Clyde would not be able to give the answer. However, although Clyde cannot immediately furnish an answer to the question, he does eventually remember a part of the answer without a hint from anyone else.

On another occasion, Alice’s inability to use text to determine the answer to a question also draws a negative comment from Ms. Sand. On Day 7, the class was going over the study guide they completed earlier in the period.

Ms. Sand: What did you get, uh, Alice?

Alice: b

Ms. Sand: B, regions with many craters Well, there are many craters on there but they didn't call 'em maria.

She then nominates Josh to give the answer. After Josh gave the correct answer, Ms. Sand read the section of text from the textbook answering this question aloud:

c regions ***right there plain as day written out*** *regions once flooded by molten material*

Her comment that the information is *right there plain as day written out* seems to position Alice as someone who is not willing to expend the effort to locate the answer rather than as someone who may struggle to read the science text.

"Struggling" readers had significant difficulty answering some of the questions posed by Ms. Sand during literacy events with an external text dialogue structure. This difficulty appears to be related to difficulty interacting with the texts in this science classroom. Although Ms. Sand often minimized the incorrect responses from "struggling" readers by selecting another student without commenting on a wrong answer, she also demonstrated some frustration with the students' failure to successfully make use of these texts. For example, her comment after Alice gave an incorrect answer that the answer was *right there plain as day written out* is one indication of this frustration.

Furthermore, it is apparent that "struggling" readers relied on the teachers and on other students more often than they relied on the text as a method for locating correct information. On the occasions when they were forced to rely on the text, they were

often unsuccessful in their attempts to grasp important information. "Struggling" readers also appeared disengaged from external text dialogue and reluctant to make attempts to analyze the text under discussion. Although simply listening to other students and the teacher relay information containing challenging content vocabulary was not very effective in helping "struggling" readers understand science content, there is evidence that external text dialogue which engages "struggling" readers, even if they answer questions incorrectly, can be an effective learning strategy when the dialogue is not too dense with content terms.

Volunteered correct responses in external text dialogue structured literacy events.

Twelve interactions during external text dialogue events were classified as volunteered correct responses. These interactions comprised 7.6% of all correct external text dialogue event interactions and 14.6% of all external text dialogue event interactions of the "struggling" readers in this study. In six of these interactions, students read a segment of text aloud, and in five of these interactions, Ms. Sand read text to the students. In the majority of these interactions, students had access to written work they had completed prior to the interaction. (One interaction was comprised of a simple comment.) Therefore, students could silently read the written text as Ms. Sand read the text aloud. However, as with the selected correct and incorrect responses, on Day 8 and Day 9, Ms. Sand read multiple choice questions and answer choices to the students directly from the test they took at the end of the class on Day 9. Students did not have access to this text until they took the test, after the external text dialogue events. In addition, because the vast majority of this written work was completed in class, as with the selected correct and incorrect responses, students had assistance from

Ms. Jones, Ms. Sand, or other students in completing this prior written work. These interactions were based on the same text as the selected correct responses except that the volunteered correct responses occurred during the use of fewer texts. Only the *Missions to the Moon, Chapter 18 Test Earth, Moon, and Sun, Grade 6 Benchmark Test B, Chapter 18 Test Earth, Moon, and Sun, Phases, Eclipses, and Tides,* and a student-generated summary were texts associated with these selected incorrect responses. (See *Table 7.* External text dialogue texts for information about the source and format of these texts.) The student-generated movie summary of the movie *October Sky* is not included in Appendix L. This text was in essay format and was similar to the *My launching experience* paragraphs on the table.

It appears the "struggling" readers in this study chose their opportunities to volunteer answers during external text dialogue very carefully. No students classified as "struggling" readers volunteered incorrect responses. In contrast, eight of the nonstruggling readers responses volunteered incorrect responses. Moreover, "struggling" readers usually volunteered to respond when they felt they were likely to be successful. For example, on Day 6, Clyde volunteered an answer to a multiple choice question only after Ashley read the question and several answer choices had already been given.

> *Ashley:* ***Circle the letter of each sentence that is true about the far side of the moon. I said A and B.***
>
> *Ms. Sand: A and B. How many agree with Ashley, A and B?*
>
> *[Unidentified students respond orally.]*
>
> *Ms. Sand: How many chose A? That's not right. Why A is not a good choice?*

Daniel: Cause there's a few of 'em

Ms. Sand: It's only a few it's almost completely XXXX it's not almost A should not have been a choice.

Three unidentified students: I put C. I put B and C. I put B and C.

Ms. Sand: Alright. How many chose B? Alright. Every hand should be up on B.

Javon: I chose all of 'em.

Ms. Sand: You chose all, okay but A is not a good choice XXXX it is rougher than the near side which is true and ***how many chose C? Why did you choose C, uh, Clyde? Does it have few or many?***

Clyde: ***Few***

Ms. Sand: Few, very good.

Clyde volunteered by raising his hand, but only after a number of answer choices had been eliminated in the preceding discussion. Note also that Ms. Sand gave Clyde just two words to choose from for his response to her follow-up question. However, this experience served to reinforce this information as Clyde answered this question correctly on the Chapter 18 test on Day 9, making it one of only 11out of 30 questions he answered correctly on the test.

A similar incident happened earlier in the study when Lloyd volunteered to answer a question on Day 4. In that case, the question itself had already been read aloud by another student.

Mr. Patton: Anybody got anything different?

Lloyd: ***I do.***

Mr. Patton: different

Lloyd: They rode in a lunar buggy.

Mr. Patton: They what?

Lloyd: They rode in a lunar buggy.

Mr. Patton: They rode in a lunar buggy.

Because there is a photograph of an astronaut and a lunar buggy on page 587 in the text, it was only necessary for Lloyd to view this picture and read the caption in order to obtain this information. This selection from the textbook had been read aloud in class just prior to the seatwork activity in which the students answered these questions.

On several occasions, students volunteered to answer questions during external text dialogue but only provided a letter from the multiple choice question as an answer. Because at times, Ms. Sand would accept a series of answers by allowing a student to give just the letter of the answer, "struggling" readers could anticipate when they were not likely to be expected to read the answer choice aloud. Sometimes Ms. Sand would also read a number of questions aloud herself. Both of these factors were in play on Day 8 when Javon volunteered to answer such a question.

Ms. Sand: A neither end of Earth's axis is tilted toward nor away from the sun, b the north end of Earth's axis is tilted away from the sun, c the north end of Earth's axis is tilted towards the sun, or d Earth's axis is parallel to the sun's rays.

Javon: A

Ms. Sand: A is a good choice neither end of Earth's axis is tilted toward nor away from the sun.

Unfortunately, although Javon answered this question correctly here, he missed this item on the Chapter 18 test the next day.

A similar incident involving Sierra occurred on the same day.

Ms. Sand: In the Southern Hemisphere, the summer, summer solstice occurs when the sun is directly overhead at a the equator, b twenty-three point five degrees south latitude, c twenty-three point five degrees north latitude, or d thirty degrees south latitude. I have to have a answer girls.

Sierra: B

Ms. Sand: B is a good choice. Who said that?

Unidentified students: Sierra

Ms. Sand: Wonderful, Sierra, good job.

[clapping]

Ms. Sand: Twenty-three point five degrees south latitude. Good job.

Sierra did not answer this question correctly on the Chapter 18 test the following day. Instead, she chose *the equator*. These interactions also suggest the difficulty "struggling" readers had remembering information when their role in interactions with the information were limited.

However, both Clyde and Niah demonstrated they could be successful enough in mastering the language contained in short key phrases to feel confident in volunteering during external text dialogue activities. On Day 17, Ms. Sand was going over questions in the *Guided Reading and Study Workbook.* Students were supposed to be following along with her and consulting their workbook for the answers.

Ms. Sand: Alright, what causes the phases of the moon eclipses and tides?

Uh, yes, they are caused by what Niah?

Niah: moon earth sun

Ms. Sand: They are caused by - Adam please school be over just a few more days – alright, alright they are all caused by position of the moon, the Earth, and the sun.

Although Niah leaves out a key word here, *positions,* Ms. Sand takes her volunteered answer as correct. It appears Niah has connected this short phrase with the phrase *the phases of the moon eclipses and tides*. In fact, these phrases are repeated throughout the classroom texts, in the textbook, the workbook, and on tests the students take. Clyde demonstrates a similar ability to associate phrases when Ms. Sand asks him to explain the cause of day and night. Ms. Sand is reading questions from the test aloud.

Ms. Sand: Alright, Day and night are caused by what? What causes day and night? Clyde? You have a idea of what causes day and night? Is it the tilt of the Earth's axis? Is it Earth's revolution around the sun? Is it the eclipses? or is it Earth's rotation on its axis?

Clyde: earth's rotation on its axis

Ms. Sand: Very good, Clyde. Very good.

Clyde answered this question correctly on the Chapter 18 test later in the class session although he answered only 11 out of 30 questions correctly on the test.

On several occasions, students volunteered responses as a way of positioning themselves as "good" students. For example, Niah was the only "struggling" reader who volunteered to read a paragraph she had written aloud. On two occasions, Clyde

volunteered an answer with the ostensible purpose of checking to see if his answer was correct. For example, on Day 6, Clyde volunteered an answer just after another student.

> *Ms. Sand: Frozen ice, very good ice frozen into the moon's soil near the moon's poles.*
>
> *Adam: What if you put there is ice frozen into the lunar soil near the moon's poles?*
>
> *Ms. Sand: If it's now I just said that. Yes, now you wanna read yours, uh, Clyde? Go ahead.*
>
> *Clyde: Lunar Pros-pec-tor found that there's that there's ice frozen on in the l- lunar soil and the moon pole and the moon's poles.*
>
> *Ms. Sand: I think you almost said it like I said it.*

Note that Clyde exhibits the same “checking” behavior as Adam and that he is willing to voluntarily read his extended answer aloud. Clyde exhibited the same behavior later in the same class period.

> *Ms. Sand: You didn't say nothin' 'bout rocks? Okay. Huh? Mark that wrong. Yes, Clyde.*
>
> *Clyde: From rocks they brought back*
>
> *Ms. Sand: Can I say you mentioned rocks. Give yourself credit. Cause that's how they learned much about moon from the study of rocks.*

Although this behavior positioned Clyde favorably as a “good” student, this interaction did not help him to internalize this knowledge so that he could apply it later on. In fact, Clyde answered this question incorrectly on the Chapter 18 test. In answer

to the question, *Much of what scientists know about the moon has come from* Clyde chose the answer *studying the moon through telescopes* rather than the answer *studying moon rocks gathered by astronauts.*

Although "struggling" readers did volunteer to answer some questions during extended text dialogue, they chose relatively low risk situations when they would not be called on to read extended text or challenging vocabulary. Furthermore, although it was apparent they attempted to position themselves favorably as "good" students by volunteering answers, this did not always lead to meaningful learning for them.

Unsolicited incorrect responses.

Only two interactions during external text dialogue events were classified as unsolicited responses. Neither of these responses could be classified as correct. By way of contrast, nine of the nonstruggling readers group responses could be classified as unsolicited. The very low number of unsolicited responses on the part of the "struggling" readers group combined with the small number of volunteered responses indicates that they chose their opportunities to initiate participation in class discussions carefully. Unsolicited incorrect responses comprised just 1.3% percent of all correct external text dialogue event interactions and only 2.4% of all external text dialogue event interactions of the "struggling" readers in this study.

Both unsolicited incorrect responses occurred on Day 7 of the study as the class was going over the answers on a study guide for the Chapter 18 test. Jack was the "struggling" reader who initiated both interactions. Jack's confidence on this day had apparently been bolstered by the fact that this external text dialogue event occurred immediately after a group work event in which he worked with Daniel to figure out the

answers to these questions. In fact, he and Daniel had difficulty determining the correct answer for question number four about the shape of the moon's orbit, the question that prompted his comment.

Ms. Sand: Right, it's oval.

Jack: The earth is a oval?

Jack actually has the correct answer on his paper, although his comment here positions him as a student with the wrong answer. The earlier uncertainty of both boys is apparently what prompted the preceding comment from Jack.

A few minutes later, Jack was again attempting to clear up his own confusion when he makes a comment about another question.

Ms. Sand: D earth rotates on its axis. Alright, d is correct answer, Sierra, make the correction. It's d, number 2 is d.

Jack: ***I put b.***

Ms. Sand: Uh-huh. But it's d. And we verified every one of these in our textbook.

In the transcript of the earlier group work event, it is apparent from their conversation both Daniel and Jack have revolve and rotate confused; Jack comments that he put b for his answer. However, he also pointed out to Daniel that d was correct. Taken together, these two incidents indicate that Jack can be an engaged and curious student who actively seeks information. Although Jack actively avoided reading to locate information at times and often appeared disengaged during whole class discussions, it appears the interactions he had with other students during the group work activity prepared him to be an active learner during this literacy event.

Participation in external text dialogue events.

Students from the “struggling” readers group did not participate as readily in external text dialogue structured literacy events as did students in the nonstruggling readers group. They volunteered answers and gave unsolicited answers less often than the other students. Furthermore, Ms. Sand selected students classified as “struggling” readers less often than nonstruggling readers to participate in external text dialogue events. Although “struggling” readers received much support from Ms. Sand and Ms. Jones during periods of seatwork and presumably had access to written records of this work during external text dialogue, less than twenty percent of their answers were volunteered answers. Therefore, students classified as “struggling”readers were not equal participants in external text dialogue events. One “struggling” reader, Alice, answered only seven questions overall.

One cause of this more limited role is likely the difficulty “struggling” readers had interacting with classroom texts. “Struggling” readers experienced some difficulty reading the textbook and reading questions in the workbook and on the other study guides and classroom materials. They also had some difficulty recognizing and demonstrating understanding of both content area and general academic vocabulary. Because of their difficulty with these texts, “struggling” readers did not see written text as a viable source of information and preferred to rely on the two teachers or on other students to help them answer questions. Often new topics were introduced by whole class round robin reading of a section of the textbook, after which students completed a section review or answered questions in their workbook. The class would then go over the answers to these questions prior to taking a test. Often, a single phrase would be used to define a concept in the

textbook, in the written answers, and on the test. It was possible, therefore, for students to remember these phrases and correctly answer these questions on tests even with very little understanding of the underlying concept. Although "struggling" readers were able to meet with some success this way, they experienced more difficulty when the concept involved more difficult vocabulary and lengthier explanations.

Clearly, at times, struggling readers viewed external text dialogue events as somewhat threatening. They were sometimes reluctant to read text aloud and attempted to simply state a short answer or give the letter associated with the answer in a multiple choice question. Even when they answered questions correctly or shared extended text they produced themselves, they were sometimes positioned by Ms. Sand as less than capable students. For example, her question to Alice, "*Did you write that by yourself?*" while meant to be a compliment, actually positioned Alice as a less than capable writer. Thus, not only did "struggling" readers' histories as poor readers foster their own reluctance to engage in external text dialogue events, it also influenced the way their teachers and other students positioned them in the classroom. Ultimately, the desire of "struggling" readers to attempt to maintain the position of capable students coupled with the perceptions of their teachers and other students, limited their participation in external text dialogue structured literacy events. These students chose silence and, sometimes, disengagement as means of seizing power in these events.

Learning in external text dialogue events.

Despite their somewhat limited engagement in external text dialogue events, it cannot be said that "struggling" readers failed to learn during these events. Ms. Sand hoped to help all of her students learn information through the verbal interactions

inherent in both triadic dialogue events and external text dialogue events. "Struggling" readers were able to take advantage of several tools for making meaning in this classroom. Although these students were apparently somewhat limited in their background knowledge, they were very successful in learning from other sources.

For example, Ms. Sand decided to allow the students to view video of rocket launches on the computer when she discovered only one of the students in the class had seen a rocket launching. "Struggling" readers then generated their own text summarizing what they had observed. They were then able to read these texts to their classmates to demonstrate what they had learned. Although the density of content vocabulary in student-generated text was not as great as in the textbook, students did use a number of content words in these texts. They then had an additional encounter with these terms as they shared what they had written during external text dialogue. Such personally meaningful encounters with this vocabulary, as in Jack's use of the term *multilaunches*, served a foundation for their understanding of some science concepts.

Furthermore, "struggling" readers learned from correct interactions around text, and even when they initially stated an incorrect answer, they often apparently learned new information. On a number of occasions, these students were able to read and answer questions on tests that they did not know the answer to during external text dialogue events. Even when they were only exposed to the correct answer in these events after Ms. Sand selected another student to answer after their own incorrect answer, "struggling" readers apparently were able to remember and read this information a subsequent test. It may be these were personally meaningful encounters with this information simply because these students had answered incorrectly in front of their classmates. However, it appeared

such "learning" was often based on remembering somewhat limited phrases. When concepts were presented laden with a larger number of content and general academic vocabulary, these students were not as successful in retaining the information.

Student questioning.

According to Lemke (1990), student questioning dialogue is *an* "activity structure in which students initiate questions on the subject matter topic and the teacher answers them" (p. 217). For the purposes of this study, only instances of student questioning during whole class discussion were considered for analysis. Lemke suggests this activity structure is often marked by *a series of questions by other students* (p. 217), thus, the implication is this activity structure is meant to describe questioning which occurs in front of a group. However, although only whole group activity was examined, student questioning rarely sparked a series of questions during the course of the observations for this study. In fact, only twelve instances of student questioning could be located in an examination of the transcripts of the seventeen days of classroom dialogue.

Structure of literacy events with student questioning format.

Segments of student questioning occurred as intervals interrupting either triadic dialogue or external text dialogue. Only four of the students in the class could be identified as asking a question during any whole class activity structure, Adam, Daniel, Lloyd and Jack. Of these four students, Lloyd and Daniel asked the most questions, five each. Jack's question was simply an attempt to verify one of his answers. Adam's question occurred at the end of a whole class segment and was concluded by a private conversation at Ms. Sand's desk. Only Lloyd's question elicited more comments and questions from the other students.

Lemke's (1990), basic format for student questioning is as follows:

[Student bid to ask]

[Teacher nomination]

Student Question

Teacher Answer

[Teacher check-up]

[Student response] (p. 52)

Lemke denotes the bracketed items as optional.

Substance of literacy events with student questioning format.

The transcript of each instance structured with student questioning format was examined and analyzed for patterns of student participation and for specific features of the interactions related to student participation and learning. Of the six instances of student questioning initiated by "struggling" readers, the five instances of questioning initiated by Lloyd were identified as the most illuminating for the purposes of this study. Lloyd asked the following five questions:

- *Ms. Sand have you seen the moon's XXXX be orange?* (Day 9)
- *Don't you think that um XXXX, like there could be some, um. more planets?* (Day 16)
- *How the explorers XXXX go into space I mean like what do you mean like . . . How they were explorers if they didn't go space how did they . . .* (Day 17)
- *XXXX and added nox?* (Day 17)
- *When they show pictures from space why is, why is XXXX circle ?* (Day 17)

Lloyd's first question, on Day 9, requires only a simple yes or no response from Ms. Sand. In fact, her actual response, *it look orange,* constitutes a simple agreement with Lloyd's statement. She then ends the exchange by changing the topic. Lloyd's third question, *how the explorers XXXX go into space*, is a request for clarification after Ms. Sand has asked the class to name the *earlier explorers.* Lloyd is requesting clarification concerning Ms. Sand's use of the word *explorers* to describe those individuals who studied celestial bodies prior to the invention of the modern rocket. Lloyd's fourth question is also a request for clarification as he is asking about the etymology of the word *equinox*. She sends him to the computer lab to research the answer to this question. It is Lloyd's other two questions, (*Don't you think that um XXXX, like there could be some, um. more planets?*) and his final question about perceptions of Earth from space that elicit comments from other students and any significant amount of class discussion. It is these two key incidents that will be examined for evidence of student participation and learning.

Incident one.

The first of these two questions occurred on Day 16 as the class was engaged in a final exam review. Ms. Sand had been asking questions as to review the characteristics of the planets in the solar system. In the course of this questioning, she asks a question that sparks Lloyd's question.

Ms. Sand: What would be the largest outer planet?

Unidentified student: Earth

Lloyd: ***Ms. Sand, um***

Ms. Sand: Yes, sir.

Javon: Oh, she say outer planet

Unidentified students: XXXX

Ms. Sand: Wait a minute ***ya'll not listenin' to Lloyd and ya'll might have -***

Lloyd: There's four outer planets and they have their own characteristics. They say there's more ga- more um gas giant planets that seem like they are XXXX, Pluto. ***Don't you think that um, XXXX, like there could be some um more planets?*** *XXXX*

Ms. Sand: ***Well, do I think they're more planets out there.***

Daniel: Yes

Lloyd: Pluto's, like, it's small-

Javon: ***There's another Earth****.*

Ms. Sand: XXXX Earth

Lloyd: See how Pluto's small XXXX, gas giant, everything like it could like XXXX

Unidentified student: ***Small?***

Ms. Sand: ***I think as they go out farther they are smaller****, don't ya'll think? Alright cause if they were larger I think we would have seen them by now.*

Daniel: Pluto XXXX, they don't, ***have they gone past Pluto****? Because Pluto could be* ***one giant****, one you* ***could just only see that tiny little speck .***

Ms. Sand: ***Alright, now****, when the moon close to Earth it has a strong effect.*

Although the beginning of this interaction closely follows Lemke's structure for triadic dialogue (student bid, teacher nomination), it quickly varies from this structure.

First of all, a number of students apparently have not heard Lloyd’s question so Ms. Sand first has to obtain their attention. She does this not only by directly pointing out they are not listening but also by suggesting his question may reveal important information that they may need to know as well. Once Lloyd is able to clearly ask his question, Ms. Sand does directly answer it by agreeing with the premise of his question, that there are more planets in the universe. However, the exchange does not end because Javon joins the conversation and also attempts to express agreement with Lloyd by asserting the existence of *another Earth.* Lloyd then mentions the size of Pluto which initiates a discussion about the potential size of other planets. This discussion engages Lloyd and at least one other student in the conversation. When the size of the discussion grows, Ms. Sand apparently decides it is time to bring the conversation to a close. Her statement, *Alright, now,* serves the purpose of bringing an end to this activity structure.

Participation.

Lloyd’s question indicates he is fully engaged with the content of the classroom discussion. Moreover, the authenticity of his question is an indication that this engagement is more focused on the content of the discussion and not only focused on reviewing facts for the upcoming exam. In addition, the insertion of an authentic question into an exam review engages a number of other students and the teacher in considering the possibilities arising from the question.

Learning.

Several propositions are put forth during the discussion ensuing from Lloyd’s question. First of all, Ms. Sand asserts, essentially in agreement with Lloyd, that there are, in fact, planets after the four outer planets. Javon asserts there is *another Earth.*

Lloyd seems to assert Pluto is small, and this assertion is subsequently questioned by another student. Ms. Sand then states the planets she believes exist in outer space must be small *cause if they were larger I think we would have seen them by now.* Daniel follows this by wondering if *have they gone past Pluto* and then appears to assert Pluto could be larger than it appears. None of these assertions are definitively examined, however. Ms. Sand, apparently concerned by the number of questions raised and their potential to form the basis of a much lengthier discussion , ends the event and returns to the exam review.

Incident two.

Lloyd's second question occurred during the final observation for the study. The class was again engaged in a review for the final exam. Ms. Sand has just asked the class how the moon was formed. When she finishes this line of questioning, she recognizes Lloyd and nominates him to speak.

Ms. Sand: Uh, Lloyd has a question.

Lloyd: Why, like, see how the Earth has layers top, laXXXX, and why, why is it like, ***when they show pictures from space, why is why is XXXX circle?***

Unidentified student: ***What circle?***

Ms. Sand: ***What, what are your question again now?***

Lloyd: Okay, like, ***the ground looks like this****, XXXX the whole the whole world and everything, like why, why is like, uh, dome shape, um, like space pictures?*

Unidentified student: Huh?

Ms. Sand: now think in terms of -

Lloyd: Why is it a circle?

Ms. Sand: You know Earth goes in a orbit.

Lloyd: Yeah but like see how the ground is flat and everything? Like why is –

Ms.Sand: ***Well, Earth's not flat, Remember they, they thought it was.***

Lloyd: Yeah, I know, like it has round and everything but –

Daniel: Oh, I know, they um –

Lloyd: Do you know what I'm talking 'bout?

Daniel: Yeah, because you say the world's circular. Why does, isn't the ground circular, right?

Lloyd: No, like why-

Daniel: Why is the ground, why is the land flat and XXXX the Earth –

Ms. Sand: It's not flat. It looks like it flat to you but you get it from a aerial view, it wouldn't be flat.

Lloyd: Like, yeah, I know that when, um, if you look if you look up in space, it's like the, um, from space, like the Earth's kinda like a giant circle.

Ms. Sand: Okay, I got you now, okay.

Lloyd: Not from above, but from the side, like the way it looks from space like you XXXX like –

Ms. Sand: I don't know shape, when you lookin' at it in space, it just looks like a round ball.

Lloyd: Like it's, it's, I know. That's what I'm sayin'.

Unidentified students: XXXX basketball

Lloyd: Like, ***why is it, like, cut in half****?*

Ms. Sand: Cause it, cause I guess by lookin' at it you can't see but half of it.

Adam: ***Yeah, I don't get how the Earth***

Ms. Sand: XXXX

Adam: Is circular but

Ms.Sand: Can you, you can't see but half of it no matter which side of Earth you look at Earth, you cannot see all of Earth.

Daniel: What about if you go to the bottom?

Unidentified students: XXXX

Ms. Sand: You just, just see the bottom half.

Sam: ***What if your eyes XXXX, stretch XXXX?***

Unidentified student: XXXX

Daniel: What are you talkin' about?

Ms. Sand: ***Alright,*** *XXXX. Who was the President that uh of the United States that launched an enormous program?*

participation

Lloyd's question again indicates he is fully engaged with the content under study. However, his question does not follow directly from the topic under discussion, the formation of the moon, but rather appears to have been sparked by his own internal thought processes. Again the format of this sequence varies from Lemke's (1990) student questioning format primarily because Lloyd has difficulty making himself understood. Ms. Sand does not understand what he is asking so she cannot answer his initial question. In addition, the initial question also draws another student into the discussion in the form of a request for clarification. Ms. Sand misunderstands Lloyd's attempts at clarification and draws the apparently erroneous conclusion that Lloyd

believes the world is flat. His comment, *I know, like it has round and everything but-* indicates he still has failed to make himself clear. Daniel attempts to assist Lloyd in clarifying his question, and Adam is drawn into the conversation by Lloyd's next attempt to rephrase the question, *why is it, like, cut in half?* These attempts have drawn the attention of the other students in the class and much unintelligible conversation ensues. Even Sam, a student who volunteered only one response during triadic dialogue structured events and no responses during external text dialogue, asks a question. Not only did Lloyd's question initiate a discussion among most members of the class, it resulted in two additional students asking questions. This finding confirms Lemke's (1990) assertion that "students take the teacher's willingness to answer the first Student Question as invitation." (p. 52)

Learning.

Lloyd's inability to make his question understood limits his learning. He frequently inserts the word *like* into his questions and statements, a possible indication that he is unable to locate the appropriate words to put forth his assertions. At times, Lloyd resorts to gestures in an attempt to make himself clear. He gestures with a piece of notebook paper as he makes the comment, *the ground looks like this*. When he asks, *why is it, like, cut in half,* he makes a slicing motion with his hand parallel to the top of his desk. Initially, Daniel becomes involved in the discussion as an attempt to rephrase Lloyd's question. Lloyd has asked, *why is it a circle?* Daniel's comment, *you say the* ***world's circular*** includes Lloyd's idea but repackages it with more sophisticated science terminology. Lemke(1990) notes the difficulty some students experience in making assertions and arguments because they cannot "talk science" (p. 47) using the

same language as the teacher. As Lemke suggests, "an effort is needed to make sense of many students' points" (p. 47). At times, this inability to make oneself understood can have serve to limit a student's opportunity for learning. In this case, when Sam asks a follow-up question that puzzles Daniel, Ms. Sand apparently decides it is time to end this discussion.

Cross discussion.

Lemke (1990) specifies cross discussion is an activity structure in which the students speak to each other about the content. Although there were a number of occasions when students engaged in side conversations during whole class activity structures, on only two occasion did the whole class activity develop into a cross discussion. One of these actually began in the format of student questioning dialogue. However, in student questioning, the teacher retains the authority to answer questions that are asked. In the event included here, Ms. Sand gives up an active role in the discussion and the students control the discussion.

Structure of literacy events structured as cross discussion.

The first event involves a discussion about the events in a movie the class viewed. Sam has just read his movie summary and Ms. Sand has questioned an idea he included. The students begin a discussion about what occurred in the movie. This event is close to a side conversation because several students speak at once and it is not always possible to tell who is speaking or what they are saying. The second event begins as the result of a student question. Therefore, this event is more closely related in structure to a student questioning event. Two questions are asked and, although Ms. Sand does suggest some answers, she does not function as the ultimate authority in the discussion and, in fact,

withdraws from the event briefly before bringing it to a close. Furthermore, because of the minimal participation of the "struggling" readers in these events and the similarity of the structure of these events to other activity structures, both participation and learning will be discussed without the analysis of a detailed segment of dialogue.

Participation.

Lloyd, Niah, and Javon were the only "struggling" readers who participated in the two cross discussions. The first incidence of cross discussion occurred on Day 11 just after Sam had finished reading his summary of the movie *October Sky.* When Ms. Sand questions one of his assertions about the movie, a number of students begin to discuss the events of the movie. Niah makes a mostly inaudible comment to counter another student's assertion about an event in the movie. She is seated next to Sam and near Ms. Sand's desk. Ms. Jones leaves Clyde, who is working at his desk, to walk across the room to assist Lloyd. Jack is disengaged from the discussion, Sierra and Alice are absent, and Javon is not visible on camera.

Although Lloyd was otherwise occupied during this first event, he initiated the discussion in the second event. The second event began as student questioning dialogue with a question Lloyd posed. After mentioning Earth is tilted on its axis, Lloyd asked, *why doesn't like the oceans and stuff like go completely over the continents?* As Ms. Sand attempts to clarify Lloyd's question, a number of other students become involved in the discussion. The discussion around this question results in Cam wondering why we don't perceive the movement of the Earth. Javon and Lloyd are the only "struggling" readers to participate in this event. They both asked and answered

questions. Their participation suggests a self concept that negates a perception that they are "struggling" learners in this classroom.

Learning.

The students discuss three related concepts in this discussion, why the continents and oceans stay in place, why we do not perceive the movement of the Earth, and the rate at which the Earth spins on its axis. Although Lloyd was the only one of the two who asked a question, both he and Javon contributed to the discussion. Javon attempted to clarify Lloyd's initial question by rephrasing it. He also asserted that we do not perceive the movement of the Earth due to the force of gravity. Lloyd asserted the Earth *rotates fast* while Javon attempted to mediate the discussion by asserting the Earth moved both fast and slow. Ms. Sand contributed to this discussion at several points by asking questions and making comments but she ended the discussion without asserting any definitive answers to the students' questions.

Media presentation.

For the purposes of this study, media presentations are defined as a group viewing activity. Activities that included individual use of electronic devices were included in this study as seatwork. Ms. Sand made two media presentations to the class during the observations conducted for this study. One of these was a documentary about the Apollo space program, *One Giant Leap* (Carey, G., 1994) and the other was a fictional narrative, *October Sky (Johnston, J., 1999).*

Structure of literacy events with media presentation format.

Ms. Sand directed the students to take notes during both presentations. Some students moved to be closer to the large television hanging over Ms. Sand's desk so that they could see the presentations clearly. They talked quietly among themselves at times.

Participation.

During the second presentation, the students frequently displayed their papers to each other to showcase their length. Niah frequently held her paper up to be admired by Pam and Ashley, and by the end of class she has covered two pages with her writing. These girls appeared to have included each other in a social group centered around writing. This is but one of many instances in which Niah positions herself as a capable student rather than as a "struggling" one. All students were engaged with the movies at times and disengaged at others. Lloyd was not present for the first movie, but he pulled his desk close to the television at the start of the second movie and rarely moved his gaze from the screen. Jack was not present for the second movie. Although Alice is not seated next to these girls, she also produces two pages of writing and is quietly engaged in this for during the entire movie.

Learning.

Although several of these students wrote detailed summaries of *October Sky*, the content of the movie was more inspirational than informative. Several young men in the movie are engaged in building rockets so the students did observe the methods by which they did this and have the opportunity to view their launches. However, the details of their written summaries did not reflect much attention to these processes. Rather, the written summaries indicated the students gave much more attention to the events in

narrative. For example, Niah began many of her sentences with the word *now* which seemed to indicate she was recording these events as they occurred.

The documentary, *One Giant Leap,* told the story of the Apollo missions, culminating with the moon landing. Because this movie included interviews and video footage of actual events, it would seem to hold greater potential for student learning. However, an examination of the written work the "struggling" readers produced during this movie reveals their apparently limited background knowledge interfered with their ability to fully comprehend the events in the movie. For example, Niah noted *Rusty S. was an astronaut* and later asserted *you have to spend 2 years in space*. In the first instance, she included incomplete information and in the second instance what she wrote was actually not true. Both Alice and Sierra wrote that the astronauts were launched in 1867 and Sierra went on to point out "*you could see the moon rotate in circles*."

However, writing about both of these movies appeared to be useful in promoting student learning. Although their writing revealed these students had internalized some erroneous information, their writing also correctly included some specific facts from the movie. Furthermore, these "struggling" readers approximated some of the content specific terms they heard in the movies. For example, both Clyde and Javon included the word *velocity* along with the idea that a rocket was going faster in their writing about *One Giant Leap*. Although it is likely they included this term at Ms. Jones' urging when they finished their paragraphs after the movie was over, it can be argued the viewing of the movie provided both an oral and a visual illustration of the term. Their later use of the term in their writing was yet another encounter with it that would ultimately enable them to incorporate it in their own receptive vocabulary.

Testing.

Lemke (1990) suggests testing is similar to seatwork with the exception that the work, rather than being evaluated in an external text dialogue activity, is evaluated *nonverbally and individually* (p. 218). Students who have not been identified for special education are generally testing in the classroom and are expected to read and answer the questions on their own. Students who have qualified for special education services can have accommodations written into their Individualized Education Plans that will qualify them for alternate testing conditions. This study included one observation of literacy event with a student testing format.

Participation.

Four of the "struggling" readers in this study, Alice, Sierra, Javon, and Clyde were also identified as special education students. These four students all had accommodations written into their Individualized Education Plans that required a separate location for testing and also required their tests be read to them. Ms. Sand indicated the class was moving to a testing format after a review period by addressing the following remark to Ms. Jones:

> *Alright, now, use Miss, uh, these children they can write on this can. Is she in her room?*

It appears Ms. Sand does not normally think of these students as special education students because she asks which students are supposed to leave for testing several times. However, when she notices one student has not left with Ms. Jones, she insists that the student go. When Jack overhears this comment, he asks Ms. Sand if he has to go as well. This question indicates his assumption that he belongs with this particular group of

students who are identified by themselves and their classmates and teachers as struggling learners. Furthermore, he has been a member of this classroom community more than half the school year, and this is but the latest of many tests they have taken. Since he has never left the room for a test before, it is also possible he hopes to be included in that group.

Once the test began, the students remaining in the classroom with Ms. Sand read the multiple choice questions and answers to themselves and wrote the letter for the answer they selected in the appropriate blank. The students who left the room with Ms. Jones listened as the test was read to them and wrote their answer choice in the appropriate blank. Jack directed his gaze at his test only intermittently. The rest of the time he looked out the window or glanced around the classroom at the other students

Learning.

Although a testing-formatted literacy event is not designed to be a learning experience for students, students can learn to, for example, more fully understand concepts by writing to explain their ideas. However, a multiple choice test does not lend itself as readily to learning. Although it is impossible to say what students who remained in the classroom may have learned since their thinking was not made visible through their talk, one can conclude the students who left the room had at the very least the opportunity to learn to recognize some unknown vocabulary by virtue of the fact that the test was being read to them.

Cultural Identities and Associated Practices and Everyday Funds of Knowledge

One of the purposes of this study was to provide a rich description of how macrocontextual factors, including students' primary Discourse, interact with classroom culture to either foster or impede school literacy achievement. Therefore, one of the four

foci of this study was as the various ways struggling readers use **their social and cultural identities and associated practices and everyday funds of knowledge** to participate and learn in the discourse of science. While the many social identities the “struggling” readers in this study attempted to enact have been uncovered in the course of examining literacy practices and events and activity structures, the previous discussion has not focused on facets of student cultural identity and everyday funds of knowledge.

A number of researchers (Brown and Ryoo, 2008; Barton and Tan, 2009) have investigated the effects of incorporating popular culture and everyday discourse in science instruction. Other researchers (Gutiérrez, 2008; Moje, et al., 2004) have investigated the concept of a “third space” which can be created as a result of incorporating everyday discourse in classroom interactions. Obidah and Marsh(2006) suggest the term *literate currency* which they assert subsumes peer literacy, home and community literacy, school literacy and popular culture literacy because “students inculcate and combine sets of knowledge to form a continuum of literate currency” (p. 108).

Both Ms. Sand and several students identified as “struggling” readers were noted to use funds of knowledge from home and popular culture to remember vocabulary and to understand concepts in Science class. Ms. Sand modeled using everyday funds of knowledge by making three personal connections to the science content during whole group instruction. The first connection was related to the moon landing. On May 28, when a question was answered about the date of the moon landing, Ms. Sand commented,

> *1969 that, that was a special year for Ms. Sand, she graduated high school. I remember that.*

On Day 16 of the study, one of the questions during the exam review concerned the date of the moon landing. Ms. Sand commented,

what I remember cause it's the year I graduated

In this case, Ms. Sand simply modeled how one might tie a meaningful personal event to a specific bit of information in order to remember the information.

On May 28, as she was going over the answers to a study guide, Ms. Sand made a connection between a penlight and the scientific term *penumbra* and directly addressed the importance of connecting background knowledge with scientific knowledge in order to remember content.

Ms. Sand: when you think of a pen you think of ***I think of penlight*** *but we don't want the one we want the darkest part so it wouldn't be pen umbra it would be what*

Josh: it would be umbra

Ms. Sand: umbra, b, that's the darkest part

Josh: XXXX with ***with penumbra what what what time of of a day do you write with a pen in the daytime***

Ms. Sand: There you go Josh

Josh: ***which is light***

Ms. Sand: that would be light and we lookin' for what?

Josh: the dark part

Ms. Sand: dark there you go. ***We gotta find ways to help us to remember.***

On this occasion, Josh takes up the connection and attempts to expand on it. It does not appear that he is familiar with a penlight, however, so his explanation for the

usefulness of this connection centers around using a pen as an instrument to write. Ms. Sand ends the discussion by affirming Josh's idea and commenting on the necessity of finding *ways to help us remember*.

Ms. Sand returns to this connection on June 9 during an exam review when she again prompts Josh to make the connection between penlight and penumbra. This time she involves Daniel in the discussion as well. After Josh uses the term penumbra, the following exchange occurs with Daniel.

Ms. Sand: Right, penXXXX and penlight so the darkest part is called what? be called?

Daniel: umbra

Ms. Sand: umbra, absolutely

Then on June 10 during an exam review, Ms. Sand again returns to the connection to a penlight.

Ms. Sand: If it had said, uh, they gave you your choices and ***what would pen, what does pen mean?***

Daniel: ***light, light***

Ms. Sand: pen umbra

Here it is apparent that Daniel has internalized Ms. Sand's connection as he volunteers that pen is a term meaning light. Ms. Sand returns to this connection one more time on June 14 when she states:

alright remember penlight that's the light part

Ms. Sand has not only made the connection between a penlight and penumbra on a number of occasions but also she has suggested to her students that making such

connections is a useful strategy for remembering scientific terms. Furthermore, although there is no evidence that either Josh or Daniel are familiar with the small type of flashlight known as a penlight, it appears that Daniel has appropriated this connection. However, he may well believe that pen is a prefix meaning light. In addition, Ms. Sand has made every effort through the repetition of this connection to conventionalize the connection (Gavelek and Raphael,1996). Although all students present in the class on these days witnessed these exchanges, neither Josh nor Daniel, the student participants, is a student identified as a "struggling" reader.

On June 10, Ms. Sand again demonstrated the efficacy of connecting everyday funds of knowledge with scientific knowledge. On this occasion, she was attempting to help the students understand how long it takes the moon to rotate by having them think of a calendar.

> *Ms. Sand: Alright how long does it take the moon to rotate one complete rotation of the moon takes about how long? **Think about your calendars** how many of you get those calendars from the drugstores?*
>
> *Pam and Daniel: What? What?*
>
> *Ms. Sand: You ever get those calendars from the drugstore?*
>
> *Unidentified students: yeah yeah*
>
> *Ms. Sand: I know when I was comin' up my mother didn't have any other kind because it had up there when it was gonna be a full moon and when it was gonna be a new moon she would just go to tell me when it was gonna be a full moon XXXX and you can't do this and you gotta do that and I never forget when I um went to get uh my wisdom tooth extracted I had to*

make sure I didn't get it done on a full moon. I said now what did that have to do with it? my XXXX

Daniel: What'd that have to do with it?

Adam: Why couldn't you do it on a full moon?

Daniel: What was the saying?

Ms. Sand: I guess because you would have so much problems with it.

Daniel: Werewolves owww

Ms. Sand: ***Alright, so it takes how long you say?***

Daniel: ***one month***

In this incident, Ms. Sand illustrates for the students how everyday funds of knowledge, in this example a calendar on the wall at home, can serve as connections to scientific concepts, in this case to the concept of rotation. When she introduces the question "*one complete rotation of the moon takes about how long*", her suggestion to students to "*think about your calendars*" clearly hints at least that the length of time is related to a length depicted on a calendar. Although her story about her mother and the phases of the moon is not directly related to the answer to her question, the story does expand on the concept of moon phases which is directly related to the moon's rotation. The story sparks student interest as well which may make students more likely to remember the calendar connection.

Although the aforementioned connections were generated by Ms. Sand, in Ms. Sand's view, one of the strengths of the students in her class was their background knowledge. During an interview, she commented,

They have come with a wealth of background experiences; I have hooked

> *on to them.*

According to Gee (2005b), in order to master a secondary Discourse such as science,

> the crucial question becomes, *what sorts of experiences . . . – in terms of embodied practices and activities, including textual, conversational, and rhetorical ones –* ***has this person had*** *[Emphasis added]that can anchor the situated meanings of words and phrases of this social language?* (pp. 27-28).

Although Ms. Sand intentionally made her own connections visible for her students on a number of occasions, it was not as evident that that Ms. Sand's students were able to effectively demonstrate such connections from their own experiences. It appeared that although students may have used knowledge of popular culture to help them remember new vocabulary and understand new concepts, students did not make these connections visible during whole group discussions because they did not often have agency in the topics discussed. During the course of this study, only four instances of such connections could be documented, and students made these connections during individual or small group activities rather than during whole class discussions. All four instances involved students identified as "struggling" readers. Furthermore, these student connections between popular culture and scientific concepts were not always efficacious. Each of the four documented incidences of student use of popular culture is illustrative of different aspects of this issue. Therefore, each example will be discussed separately.

Incident one: Sierra’s paragraph and drawing.

On May 19, the first day of the study, students watched videos of rocket launches on laptop computers. Ms. Sand commented after class that in speaking with her students about the space shuttle on previous occasions, she realized only one student recalled seeing a space shuttle launch on television. For this reason, she decided to reserve the laptop computers so students could use them to view rocket launches on May 19. Although field notes indicate that several students shared information about what they found with Ms. Sand, for the most part students worked individually and quietly. On the following day, Ms. Sand asked students to write a paragraph about their *launching experience*. Students then read these paragraphs aloud to the class. Sierra’s paragraph was notable for two reasons. First of all, she was the only student in the class to summarize her launching experience using two modes of expression – words and drawing. The drawing accompanying her paragraph is very detailed. (See *Figure 31.* My launching experience drawing.) The orbiter, the rocket systems, the external fuel tank, and the launching tower are all clearly depicted in the drawing. Smoke is billowing out from the bottom of the space shuttle as if the shuttle is about to take off. In her paragraph, (*Figure 32.* Summary of My launching experience narrative text) she explains that “the fuel turns into fire *just like when you light a match* [Italics added]. And after you see the fire, you’ll see big balls of smoke.” Then Sierra makes another connection to an everyday fund of knowledge. She explains that as the rocket launches, “it goes slowly until it is ready to go fast just like *a flying speedy nascar* [Italics added] that goes around

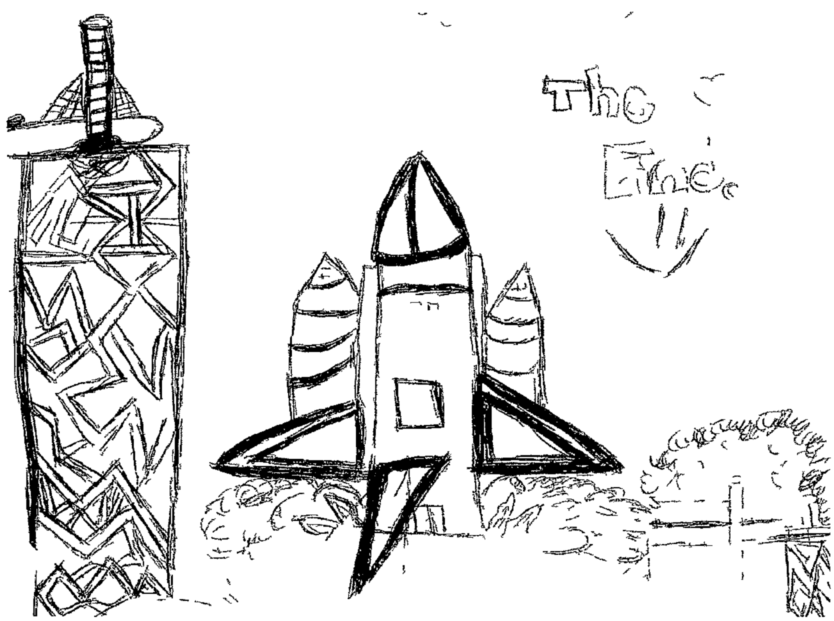

Figure 31. My launching experience drawing

big circles really fast." Although Sierra's paragraph does not contain technical vocabulary (with the exception of the term liquid fuel which appeared in several of the special education students' paragraphs and was most likely suggested for inclusion by Ms. Jones), she has used her own forms of literate currency (Obidah and Marsh, 2006), drawing, knowledge of matches, and of NASCAR, to help her interpret what she has seen in the videos. In this way, her production of this text has supported her conceptual understanding (Yore, et al., 2004b; Wallace, et al., 2004) as it has enabled her to make public the literate currency she has at her disposal.

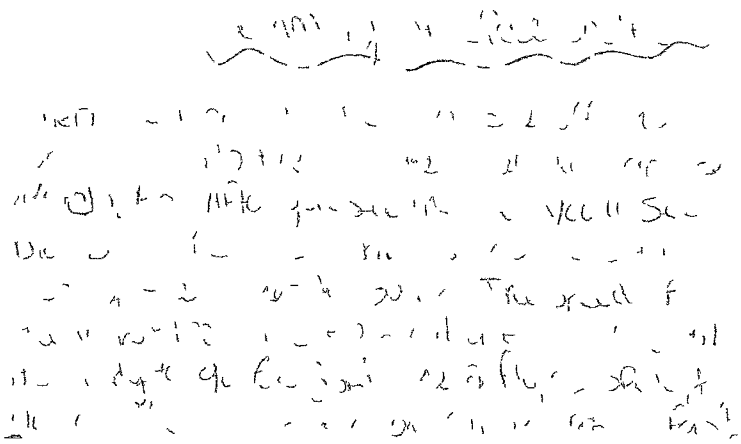

Figure 32 Summary of My launching experience narrative text

Incident two: Lloyd's Transformer's reference.

O'Brien found in his study of multimediating that male students "contrary to gender and discourse studies that indicate how males have conversational goals that place ultimate value on maintaining status" (p. 34) were willing to accept advice from their peers. This was the case in at least one instance on June 1 when Lloyd, Sam, Jack, and Clyde worked together to complete the answers to the questions on the study guide in preparation for a "quiz bowl" contest to be held during the second half of the period. They were working on a section of the study guide that required them to complete sentences. Lloyd, who had been doing most of the reading, read a statement aloud and called on Clyde to supply the correct word to complete the sentence.

Lloyd The two days on which the sun is overhead earlier at 23 5 degrees north or south is called, Clyde?

Sam: wait llll-

Lloyd: Hold it, hold it, have you ever seen ***the movie Transformers****?*

Clyde: yeah

Lloyd: ***You know what type car Jazz is, what type car is it, that's the name of the answer.***

Clyde: oh (.4) that's a um

Sam: I know what it is.

Clyde: That's a, um, I can't pronounce that word, one comes XXXX and one comes XXXX. I can't pronounce that word.

Sam: No, this is the type of car XXXX, keep that.

Clyde: Oh my god.

Sam: Wait, wait, wait is it?

Clyde: I can't remember it, one comes XXXX

Lloyd: Tell me, what it start with?

Although Lloyd tries to make a connection to a specific car in the movie *Transformers,* a 2007 American film based on the Transformers toy line, neither he nor the other boys is able to remember the word for the name of the car (Transformers, 2010). In the movie, Jazz, as a Transformer, is able to assume any shape he chooses. In this particular movie he assumes the shape of a Pontiac Solstice. In fact, *solstice* is the correct word to complete sentence. The boys went on to the next question without explicitly stating the answer but an examination of their study guides reveals that each student wrote a modified spelling of the word solstice.

Incident three: Pam and Alice group work.

Pam and Alice were working together to answer the questions associated with a text entitled *The Solar System: Phases of the Moon*, (2006) which was written to align with a sixth grade state standard. No illustrations are included with this text. When this videotape excerpt begins, the girls have been working together at a table in the corner of the room for 30 minutes. Alice is seated at the end of the table, and Pam is seated to her left. They have their backs turned to the rest of the students in the room. Alice is writing the answer to the third question under the heading Paragraph 3, "What is a crescent?"

Pam yeah if you have a if you have a

Alice ***full circle*** *it says sometimes in nighttime sky we see* ***a full circle***

Pam ***a full circle which is the moon*** *[Pam writes on her paper as to sing.]*

Alice: What is a crescent?

[Alice writes an answer, and Pam looks over and reads it.

Pam draws in the margin of her paper, then reads Alice's paper.]

Pam: What? ***A slice of***

Alice: ***pizza***

Pam: oh ***What is a crescent? a slice of pizza?***

a thin slice of

Alice: ***pizza***

Pam: ***a thin slice of a full pizza*** *[Pam is reading from Alice's paper.]*

Alice: um hum

Pam: are you sure? It says it in there? [Pam points at Alice's paper with her pen].

Alice: yeah

Pam: are you sure [Pam writes on her paper].

Alice: moon girl moon [Alice looks at Pam's paper.]

Pam: pizza [Pam smiles as she writes].

Alice was able to take a sentence from the text with a definition embedded in it and extract the definition to answer the question. Alice has made a connection between the moon and a pizza. According to the text, "Sometimes in the nighttime sky we see a full circle. At other times we see **a thin slice of the full circle** called a **crescent**" (*"Solar System,"* 2006). It appears the triggers for this connection are the words *thin* and *slice*. When Pam begins to read *a thin slice of*, Alice finishes what Pam cannot see in her answer by saying, *pizza* because this is the context in which she is most familiar with these words. At first it appears that Pam believes that the word pizza should finish the sentence because she says, *are you sure?* as she points at Alice's paper. Then she says, *it says in* – presumably she is asking if that is what the text says as she writes on her paper. When Alice responds in the affirmative, *girl, moon*, she is indicating that the correct word to finish the sentence is *moon* rather than *pizza.*

Understanding the phases of the moon by making a connection between the visible parts of the moon in each phase and the parts of a whole pizza is one way to understand moon phases. Pizza, served often in the school cafeteria, is something both students are familiar with. However, a crescent shape is not the same shape as a pizza slice.

Incident four: Lloyd's Nox story.

As the class was reviewing for the exam on June 15, Ms. Sand explained that the "key word" in the term equinox was equal. Lloyd then wondered what the rest of the word, *nox*, means and the following conversation ensues.

Ms. Sand: the autumn equinox, very good. Now remember, when you have the equinoxes ***the key word there is what, equal,*** *daytime equals nighttime, that mean the daytime hours are the same as the what?*

Unidentified student: nighttime

Ms. Sand: night time

Lloyd: XXXX ***and added nox***

Ms. Sand: huh?

Lloyd: ***equal and added nox equal***

Ms. Sand: You know that's a good question, I don't know that's somethin' we can look. I done boxed up my dictionary. What you think, nox, um, as why wouldn't you just say like, you had equal all of 'em equal.

Daniel: Nox probably stands for like twenty four hours.

Ms. Sand: What does nox mean, do you know Ms., um, Palmer, what that

Ms. Palmer: No, I don't but it must-

Ms. Sand: XXXX that's somethin' that, yeah, go look it up see what they, um, listen, see what the suffix nox means.

Lloyd: XXXX have a suffix on the word

Ms. Sand: See we learn somethin' every day don't we?

Lloyd leaves the room to go across the hall to the computer lab in order to obtain

more information about the "suffix" *nox*. After several minutes, he returns and announces upon entering the room,

Lloyd: ***it mean where it's at***

Ms. Sand: what do?

Lloyd: like ***what I pulled up on the internet it said, nox, nox means where it's at***

Ms. Sand: where it's at

Lloyd: where it's at

Ms. Sand: Oka,y let's see can we make that work for us, equal, uh, nox means where it's at at that time, where it's at, how can we make that work Ms. Palmer?

Ms. Palmer: Well, PPPOOif where it's at is equal to where something else

Ms. Sand: to where it not at

Ms. Palmer: right

Lloyd: ***equal it same time too***

Ms. Sand: at the same time, okay so remember that you might see that on a test sometime, nox, the, uh, suffix nox mean where it's at.

Several minutes later, just after Ms. Sand has complimented Josh and referred to him as her *study buddy,* Lloyd said to Ms. Sand,

Lloyd: I forgot to tell you um it said that it was like Latin like

Ms. Sand: Latin

Lloyd: it said nox was like

Ms. Sand: a Latin word, okay, alright, see we are just, um, I'm just

enjoying this little science group here.

In actuality, the Latin root *nox* in the word *equinox* means night. First of all, it is intriguing that Lloyd was interested in the origin of this particular term. An internet search for the term revealed the following references:

- Nox (mythology), the primordial goddess of the night in Greek mythology
- Nox (Stargate), a race in the television series *Stargate SG-1*
- *Nox* (video game), a video game developed by Westwood Studios
- Nox (band), a band from Hungary
- Nox (Marvel Comics), a fictional character appearing in the Marvel Comics universe, based loosely on the Nyx of Greek mythology
- Lars Spuybroek or NOX, a Dutcharchitect and artist
- NO_x, a type of nitrogen oxide
- Nox, a fictional character appearing in the *Incarnations of Immortality* series of novels
- Nox, a non-SI unit of illuminance, equal to 1/1000 lux
- Nox, a spell in the Harry Potter books
- NOX, NADPH oxidase (http://www.reference.com/browse/nox, 2010)

Note that a television series, a video game, a band, and a comic book character are among the references listed here.

In an attempt to determine how Lloyd might have arrived at his conclusion that nox means “where it’s at”, I conducted a second internet search for the term nox using Google. The results are depicted in *Figure 33.* Screen shot Nox.

NOx - Wikipedia, the free encyclopedia
Recently another pathway, via **NOx**, to ozone has been found that predominantly occurs in coastal areas via formation of nitryl chloride when **NOx** comes into ...
Formation and reactions - Sources - Health effects - Regulation and emission
en wikipedia org/wiki/**NOx** - Cached - Similar

Nox (video game) - Wikipedia, the free encyclopedia
Nox is an action role-playing game developed by Westwood Studios and ...
en wikipedia.org/wiki/**Nox**_(video_game) - Cached - Similar

Show more results from wikipedia org

Nitrogen Dioxide | Air & Radiation | US EPA
Jan 22, 2010 ... Nitrogen dioxide (NO2) is one of a group of highly reactive gasses known as " oxides of nitrogen," or "nitrogen oxides (**NOx**). ...
www.epa gov/oaqps001/nitrogen**ox**ides/ - Cached

Figure 33. Screen shot Nox

It seemed likely that a sixth grade boy would choose the link to information about a video game when researching this word so I did the same. This Wikipedia article revealed that Nox is a role-playing video game (Nox, 2010). Interestingly, further in the article, I located the information in *Figure 34*. Screen shot of Nox story. The action in this video game occurs in the Land of Nox. In other words, as depicted in *Figure 34.* Screen shot of Nox story, Nox is the setting of this video game. Certainly, it is possible that Lloyd arrived at his conclusion about this term based on his knowledge that the setting of a story is "where it's at". Interestingly, a few minutes after this discussion ends, Lloyd adds the additional information that Nox is from Latin. However, the definition

Story [edit]

The back-story of *Nox* is explained through location loading screens Some decades before Jack's arrival to the Land of Nox (the eponymous fictional setting of the game), a group of Necromancers attempted to seize control over the world but was stopped by the legendary hero Jandor wielding an artifact weapon named "the Staff of Oblivion" Following the Necromancers' defeat Jandor trapped

Figure 34. Screen shot of Nox story

that would be associated with this information would be at least similar to that found by using another Google search and simply asking the question, What does Nox mean?: According to Answers.com (2010) "the definition is *night*, from this we derive *nocturnal*." Lloyd was, therefore, partially correct as far as the information he had when he returned to class, and it appears likely he combined several different information sources to come to his conclusion that *nox* is a suffix from Latin meaning *where it's at*.

In all four of these incidents, "struggling" readers incorporated knowledge from outside of the Discourse of Science as a resource to help them understand or remember information they encountered in their Science classroom. At the simplest level, this process worked to their advantage. For example, Lloyd was able to associate the term solstice with a character in a movie he was familiar with to help him remember the term much in the same way that Ms. Sand was attempting to get the class to remember penumbra by associating it with a penlight, what Ms. Sand called a way *to help us remember*. However, in the penlight incident, Josh had to develop an alternate explanation for the efficacy of the association because he did not appear to be familiar with a penlight. This was not true for Lloyd in the Transformers incident because he

generated an association that was grounded in his own experiences; therefore, he understood the basis for the association. Sierra's associations also demonstrate the power of everyday funds of knowledge or literate currency in helping students understand concepts. Her connections between lighting a match and the ignition of rocket fuel and rocket launching speeds and the speed of racing cars grounded her understandings of two aspects of rocket launchings. Furthermore, by incorporating an additional mode, drawing, Sierra developed a fairly elaborated conceptual understanding.

Although as noted at the beginning of this section, Gee (2005b) emphasizes the crucial nature of anchor experiences for situating meanings, he also suggests that social practices and language use learned outside of the Discourse of Science can, at times, actually interfere with the acquisition of the language of science because of their imprecision. (Gee, 2005b). An examination of the incidents included in this analysis demonstrates this. For example, Pam and Alice have understood the concept of a crescent moon by equating it with the language they associate with pizza. Unfortunately, this connection does not precisely work to help them understand what a crescent moon looks like or how the phases of the moon occur. Although Lloyd's interest in the Latin root *nox* may have been sparked by a previous encounter with this word outside of school, his attempt to research the word illustrates the difficulty students and their teachers face in interpreting the vast amount of information available through technology. The variety and variablility of this information conflicts with the language precision needed to explicate scientific concepts.

Moreover, these connections were not often public. Students rarely had the agency to introduce topics to the whole group as whole class meetings were conducted by

Ms. Sand in the form of triadic dialogue. While Ms. Sand had the power to model these connections for the students, her own connections were tied to her particular history and as such, were not necessarily meaningful for her students. Only Lloyd asked a question of Ms. Sand in front of the whole class, but in that case, he did not make a public reference to his own background knowledge. Whatever may have prompted his interest was unknown to Ms. Sand and unavailable to his classmates. Despite the fact that Ms. Sand made several connections to her own experiences and acknowledged students' funds of knowledge, students still did not make public these connections. As the incidents centered around the concepts of moon phases and the equinox illustrate, equally as important as the connection itself is a thorough public examination of the limits of such connections if such connections are to avoid creating misunderstandings.

CHAPTER V

CONCLUSIONS

> . . .the crucial question becomes, *what sorts of experiences . . . – in terms of embodied practices and activities, including textual, conversational, and rhetorical ones – has this person had that can anchor the situated meanings of words and phrases of this social language?* (pp. 27-28). (Gee, 2005b)

Summary

This study examined how students who perform poorly on standardized reading tests and have, therefore, been positioned as "struggling" readers use literacy practices to learn in a content area. Such a study was necessary because to date little research of a multifaceted nature focusing specifically on these students has been conducted in the context of actual content area classrooms. The research question addressed in the study is as follows: What are the affordances and constraints in opportunities for participation and learning in literacy events for "struggling" readers in a sixth grade science classroom? These areas were primarily examined by analysis of language in classroom interactions.

There were four foci for the study:

- How struggling readers **interact with the literacy practices** of this science classroom to participate and learn in the discourse of science;
- How **language differences** impact student participation and learning;

- How various **activity structures** impact student participation and learning; and
- How struggling readers use **their social and cultural identities and associated practices and everyday funds of knowledge** to participate and learn in the discourse of science.

Seventeen observations encompassing a unit of study concerned with space exploration and an exam review were conducted in a sixth grade science classroom in the spring of 2010. Students who had been identified as "struggling" readers and who were enrolled in a reading intervention class were the focus of these observations. Over 16 hours of audio and video recordings as well as numerous student work samples were transcribed and analyzed for evidence of student participation and learning. Critical incidents involving students identified as "struggling" readers were identified and examined through the lens of each of the four foci of the study. Analysis of these critical incidents was informed by a theoretical perspective that valued language use in external and internal interactions as an important mediating device for learning.

Analyses of the interactions documented in this study revealed several important affordances available in the context of this sixth grade science classroom. In particular, affordances related to opportunities for speaking and listening, some uses of print texts, and student agency in interactions were identified. However, the opportunities for participation and learning made possible by these particular affordances were limited by several constraints. For example, one constraint on opportunities for learning for these "struggling" readers was a larger national Discourse that emphasizes forms of student learning that can be measured by performance on multiple choice tests. This emphasis

limited the types of literacy events available as well as what counted as learning for the students and teachers in this classroom. Additional constraints for these students were their histories as “struggling” learners, and the complex nature of many of the print texts available in this classroom. More detailed discussion of these affordances and constraints follows.

Discussion

Each of the students identified as a “struggling” reader for the purposes of this study was a unique individual who came to this classroom with a unique social and cultural history, a unique profile of literate currency (Obidah & Marsh, 2008), and a unique set of experiences. For this reason, each of these students engaged with the literacy practices, literacy events, and language of this classroom in unique ways. Moreover, the dimensions of individual engagement varied over time and were also dependent on the particular variables of each event. These differences serve as valuable resources to anyone seeking to understand the particular population of students identified as “struggling” readers and argue against overly simplistic interpretations and solutions. Nevertheless, experiences, or what Gee (2005b) calls “*embodied practices and activities*” do matter to each of these students precisely because such experiences serve as “*anchors*” for individual learning. Therefore, while the discussion that follows seeks to describe the dimensions of the identified affordances and constraints, it does not seek to suggest them as universal across individuals, in all contexts, or at all times.

Furthermore, individuals are active in their environment. Consequently, when individuals perceive they are constrained by particular factors, they actively seek to ameliorate the effects of these constraints. Some of these measures are apparent in social

interactions. For example, one constraint identified through analyses of critical incidents in this study was an emphasis on forms of student learning that can be measured by performance on multiple choice tests. Although this emphasis was not something the teachers or the students had the power to change, they took certain measures to overcome the difficulties associated with this particular constraint. Moreover, these measures made visible the affordances inherent in the context. For this reason, an effective analysis of affordances must examine identified affordances in light of identified constraints on student participation and learning. Therefore, the following discussion will begin by identifying the dimensions of constraints on student learning and then, through analysis of identified dimensions, uncover the particular affordances apparent in the actions of the students and teachers in this particular classroom.

What counted as science learning.

Numerous contexts act in the space of a classroom. Some of these contexts can be considered macro-contextual (Bloome, et al., 2005), that is, they are social and cultural structures that exist in the larger society. As Cazden (2001) has suggested, contexts can be thought of as nested. Therefore, microcontexts (Bloome, et al.), inherent in specific events or situations are nested within these larger macro-contexts. According to Cole's (2008) model of macro and micro contextual influences (see *Figure 1.* Macro and Micro Contextual Influences on page 25), national and state educational authorities are a macrocontextual influence on local authorities in the community who in turn influence school authorities. School authorities exert influence on the teachers in individual subject matter classrooms. This chain of influence then affects the decisions teachers make about

what it is important for their students to know and about what counts as success in each particular classroom.

The decisions Ms. Sand made about what was important for her students to know about science were subject to this chain of influence. In particular, the national Discourse that emphasizes forms of student learning that can be measured by performance on multiple choice tests directly influenced the local district administration as it reacted to the imperative to avoid having schools in the district identified as failing by state and federal educational authorities. The content of state multiple choice tests used to evaluate school and district performance is based on standards developed by state educational authorities. These standards indicate what students should know to perform well on these tests. Local administrators have acted to ensure the school system meets these standards by developing curriculum frameworks, pacing guides, and assessments that are based on the content of the state standards and the format of the state assessments. Textbooks were also selected based on the alignment of their content with the state standards. Ms. Sand was, in turn, held accountable by the school administration and the district administration for using the district pacing guides to plan her instruction. Furthermore, the school administration considered her students’ performance on these district tests as a part of their evaluation of her teaching, and 20% of the students’ final grades were based on their scores on these tests. Therefore, it was most important for students to learn the information that would be on the district tests, and this information was limited by the format of the tests. What counted as evidence of learning in this science classroom were the scores on these tests.

This situation was further complicated because Ms. Sand did not participate in the development of these tests and was, in fact, not allowed to see them until shortly before they were to be administered. For this reason, when Ms. Sand presented the information to her students from the district pacing guide, everything on it could potentially be assessed on the quarterly test. Therefore, it was incumbent upon Ms. Sand and the students to place a high value on particular types of information that could be easily assessed using multiple choice questions. An absolutist view of science prevailed as Ms. Sand and the students navigated the topics addressed on the pacing guide by attempting to determine which facts were most likely to appear on the tests. Ms. Sand also relied on the textbook materials, including the multiple choice tests included in the teacher materials, to assist her in determining what was likely to be tested on the quarterly tests.

The vast majority of class time was devoted to answering factual questions. Students read to locate these facts, completed worksheets and wrote answers to questions about these facts, and read these answers aloud during external text dialogue events or answered questions based on what they remembered from seatwork and group work events during triadic dialogue structured events. For example, Ms. Sand determined that her students should know specific facts about comets so she asked a number of questions designed to elicit these facts. These macro-contextual factors constrained the depth of student learning, the amount of time available for specific literacy practices and activity structures, opportunities for using language, and the perceived validity of student funds of knowledge as legitimate.

Moreover, this pressure influenced not only what both the teachers and the students thought was important to know but also how they defined a "good" student. As

Alice suggested, "being smart" meant remembering the answers. In addition, to the "struggling" readers in this study for whom reading the available texts to locate information could be problematic, it often appeared as if the teachers and the other students in the class simply knew more of the important facts than they did. Because of their difficulty in accessing print, the "struggling" readers tended to depend more on other students and the teachers to tell them these facts. Because of this dependence, their interaction with text was minimal, therefore, the source the other students and teachers used to obtain the facts was often invisible to them. For example, Clyde depended on Sam to give him the answers when he partnered with him, and when Sam left before the work was completed, Clyde begged him to return. He appeared to feel that he had no other avenue for obtaining the answers he needed.

Literacy Practices.

Speaking and listening.

Although the depth of student learning was constrained by the focus on the learning of facts that could be tested in a multiple choice format, "struggling" readers were able to participate and learn some science content. Because most of the print texts available to them were inaccessible, speaking and listening were the literacy practices that afforded these students the greatest opportunities to participate and learn. The only time Ms. Sand mandated silence in the classroom was during tests. Therefore, "struggling" readers had many opportunities to talk with other students and the teachers in the classroom when they were completing written work. Furthermore, students spent a significant amount of time engaged in group work. Struggling readers in these situations

were often able to obtain answers to questions that they would have been unable to find if they had been left on their own to locate information in the textbook.

Ms. Sand believed that her students were good listeners. Therefore, her primary method for test preparation was to go over science facts orally in a whole class setting. Although “struggling” readers did not volunteer to answer questions as often as nonstruggling readers in whole class structures, Ms. Sand chose them to answer questions nearly as often as she chose nonstruggling readers to answer. Although they did not answer correctly as often as other students, there was some evidence that even when they gave wrong answers, “struggling” readers were later able to correctly answer these same questions on tests. Furthermore, even when they were not answering questions, these “struggling” readers had multiple opportunities to listen and learn from the responses of other students in the class. Therefore, Ms. Sand’s reliance on activity structures centered around the use of speaking and listening was a particular affordance for both opportunities for “struggling” readers to participate and to learn in this classroom.

Print texts.

The participation and learning of the “struggling” readers in this study was significantly constrained by the difficulty of most of the publisher produced texts in this classroom. These texts were dense with both academic and scientific language that was sometimes difficult for the “struggling” readers to decode and often difficult for them to comprehend. “Struggling” readers avoided participating in class discussion when they might be asked to read aloud from the text. When they did read aloud, they frequently were noted to stumble over multisyllabic words. For example, Sam repeatedly tried to take over the job of reading the questions when Lloyd stumbled over a number of words

in several questions. Javon often appeared hesitant or lowered his voice when he had to read text in front of the class.

Student learning was also constrained by the text difficulty. Because “struggling” readers had difficulty comprehending the information in these complex texts, they also had difficulty answering questions about these texts. At times, they also had difficulty reading the questions themselves because the publisher produced workbook and tests contained the same complex texts and difficult vocabulary as the textbook itself did. Furthermore, even the nonstruggling readers and the teachers in the classroom struggled to locate important information in the text on numerous occasions. At times, the answer to a particular question was not clear and the teachers would have to refer to the teachers’ guide to determine the correct answer. No one in the classroom used any particular strategies such as reading text headings or using the table of contents very often when attempting to locate information.

New topics were introduced by oral reading of a section in the textbook. Although the “struggling” readers at least had the opportunity to listen to someone else read the text, the difficulty of the academic and scientific vocabulary in the text often made it difficult for them to understand the content. Because the text was not discussed extensively as it was read, the students then had little more than the text itself available when it came time to answer questions. The nonstruggling readers appeared to comprehend the text better the first time it was read and, consequently, appeared better able to independently locate answers to questions. The “struggling” readers did not refer to the text in order to answer questions. They depended on the other students in the classroom and the teachers to either tell them what to write or to point out which part of

the text they should copy to answer questions. As a result, they could not answer these questions as quickly as the nonstruggling readers, and they were not equipped to complete their work at home. This would, in turn, constrain their participation in whole class discussions because they would not have answered all of the questions. Their relatively low rate of participation in these learning events would, in turn, constrain their learning. Both the teachers and the students expressed frustration when they used the textbook, and "struggling" readers did not use print text as a resource even when Ms. Sand urged them to.

However, there was some evidence that "struggling" readers had internalized a strategy for locating answers in text that involved matching phrases in the questions to phrases in sentences in the text. For example, in Alice's interactions with Pam, she located the majority of the answers for both of them using this strategy, despite the fact that, in the eyes of the school authorities, Pam was positioned as the more capable reader. Although a particular affordance of written texts was the close alignment in wording between the text and the questions students had to answer, this characteristic was a constraint to learning. Because students could easily determine which words to copy for an answer, at times, they wrote answers they could not read or understand. Because of these significant difficulties with text, classroom talk, spoken and heard by the students, was a major mediating device (Holland and Lachicotte, Jr., n.d.) for both participation and learning.

Alice's interactions in group work with Pam illustrate how "struggling" readers could be less constrained in both participation and learning with the use of less complex texts. In that particular instance, Pam and Alice were not using the main science text but

were using supplementary materials which were designed to be easier to read and to highlight only essential vocabulary and concepts. Both the student workbook for the science text and the materials produced by It's Elementary!, Inc. (2006) also actually indicated a page number or a specific paragraph to read to locate the answer. Alice took the lead in reading this text and locating the answers to the questions despite the fact that Pam was ostensibly the more capable reader. Although the questions to accompany this text could be easily answered by locating key words or phrases so it was, therefore, not possible to determine how well Alice understood the key concepts in the selection, she was certainly able and willing to read the text and questions and locate answers on her own.

Students had the opportunity to produce their own texts on several occasions. When students were able to produce their own texts, verbal or written, and were allowed some choice, they participated to a greater degree. Many of the "struggling" readers in this class, particularly the girls, were enthusiastic participants in producing original written texts. In fact, several times during one particular literacy event, they frequently held up their writing so others could admire how much text they had produced. Furthermore, not only did they produce several pieces of original writing, they also had at least one opportunity to read their text to their classmates. Therefore, a particular affordance of allowing students to produce original text is that it can allow students at least two opportunities to interact with text at their reading level, thereby increasing their overall participation in text interactions, their opportunity for reading practice, and their opportunities to use complex academic and scientific vocabulary.

In these instances, students were afforded the opportunity to participate and learn using text that, because they produced it themselves, was not so complex as to be hard for them to understand. For example, when students wrote to explain what they saw when viewing rocket launches, they were able to use some content vocabulary and to solidify what they learned. Later, when these same "struggling" readers had the opportunity to read their own text to the class, they did not experience the same difficulties as they did when reading from the textbook. Students also produced drawings that demonstrated their underlying learning and conceptual understanding. Sierra was able to produce a detailed drawing of a rocket launching including many of the major parts of the rocket. When students drew the Earth's orbit around the sun, quite a few students demonstrated the limits of their conceptual understanding of this orbit. However, the frequency with which Ms. Sand could allow students to produce their own texts was constrained by the imperative to get students ready to identify the facts on the upcoming multiple choice assessment. Nevertheless, opportunities for students to produce their own texts afforded them the most meaningful forms of participation as well as the most significant learning experiences. Sierra's detailed drawing of a rocket launch likely solidified as well as effectively demonstrated her understanding of launching rockets. Moreover, the drawings students produced of the moon's orbit revealed a number of specific misconceptions held by individual students. Therefore, a particular affordance of student-produced drawings and written text are their potential to reveal student thinking.

Language Differences.

Analyses of student writing revealed the "struggling" readers in this study did not incorporate academic or scientific language in their writing as often as nonstruggling

readers when they produced their own texts. A number of key incidents also demonstrated the "struggling" readers had limited understandings of a number of academic and scientific terms. These limitations constrained both their participation and learning. Because the answers to the majority of workbook questions were explicitly stated in the text, it was possible for "struggling" readers to copy words and phrases directly from the text without actually understanding what they were copying. This, in turn, limited the depth of student understanding concerning the topics under study. Furthermore, although students could sometimes provide the correct answer, in these activities, they did not have the opportunity to use the academic and scientific vocabulary associated with the topic under study in new and meaningful ways. Furthermore, students spent much less time composing original texts or writing extended explanations than they did answering questions on worksheets.

Activity Structures.

The absolutist view of science, which focused the learning in this classroom, narrowed the available activity structures. Because Ms. Sand and the students were focused on learning specific facts, the majority of class time was spent in activities meant either to optimize opportunities to obtain these facts or meant to solidify student knowledge of these facts. For example, the class began the study of the moon by reading the textbook section about the moon aloud. Students then answered questions and completed worksheet pages on this topic which were also produced by the publishers of the textbook. They reviewed for the publisher-produced multiple choice test on this topic using an alternate publisher-produced test. Students answered the questions on the practice test alone and in groups and the class then went over the correct answers.

Although “struggling” readers could not access information easily in the available print texts, Ms. Sand’s reliance on activity structures necessitating the use of oral language afforded these students a number of opportunities to participate and to learn science facts. However, “struggling” readers did not always have to depend on others to simply tell them answers. At times, the teachers would assist them in navigating the available texts in order to locate the facts needed to answer questions. For example, Ms. Jones would point out the words in the text and provide explanations of some of the terms. “Struggling” readers were also supported in whole class activity structures by prior participation in group work. For example, Jack partnered with Daniel to answer questions and was then able to provide correct answers during a whole class activity. In essence, science facts were made public in the activity structures in this classroom (See Figure 3. *Vygotsky Space* Model). Students were then able to appropriate this information and then make it public later either in answer to a subsequent question in a class discussion or on a test (Harré, 1984). Ultimately, “struggling” readers were successful in answering questions correctly in whole class activity structures more often than they were unsuccessful. Therefore, Ms. Sand’s reliance on activity structures centered around the use of oral language was a particular affordance for both opportunities to participate and to learn in this classroom.

However, participation in group work afforded “struggling” readers the opportunity to learn content and had the potential to afford “struggling” readers the opportunity to participate in whole class activity structures, nonstruggling readers were not necessarily capable of or willing to adopt the role of teachers for these students. For example, Daniel appeared uncomfortable and somewhat confused about his role when

Ms. Jones recruited him to help Sierra. Sam appeared impatient with Lloyd's difficulty reading the questions and made multiple attempts to take over this job. On another occasion, Sam demonstrated embarrassment when he failed to produce the correct answer for Clyde.

Because there was an aide assigned to this classroom specifically to provide assistance to the special education students, the"struggling" readers received more assistance than the other students in the classroom. Ms. Jones often provided assistance in locating correct answers in text to all the "struggling" readers during seatwork activities whether or not they were identified for special education services. These same students then depended on the nonstruggling readers during group work activities to locate the answers for them in the same way as Ms. Jones did during seatwork. So strong was this positioning of these students that Jack, who was not a special education student, even asked if he was supposed to leave with these students for testing.

Social and Cultural Identities and Everyday Funds of Knowledge.

Bloome, et al. (2005) define identity as "social positions that people take up or are manuevered into by the actions of others" (p. xx). Most of the "struggling" readers identified for this study were positioned as struggling learners in this science classroom. However, this does not mean that they were recognized as poor readers by everyone or even by the "struggling" readers themselves. For example, Lloyd did not think reading was as important as listening for learning science. Nevertheless, everyone in the classroom, including the "struggling" readers themselves, recognized the students that did not learn information as easily as other students. For example, Ms. Sand commented that the stronger students usually partnered with weaker students. Sometimes when a student

gave a correct answer, the rest of the students in the class applauded. During the course of this study, only Alice, Lloyd, Niah, and Sierra were applauded for their correct answers, an indication that a correct answer from these students was a noteworthy event. Jack commented that he couldn’t “work fast” when he attempted to work with Daniel to answer questions. As McDermott and Varenne (1995) suggest, these “struggling” readers had been positioned as struggling learners in this classroom,and, furthermore, at least some of them had internalized this view.

Schunk and Zimmerman (1997), Morrison-Sadder (2007), and Guthrie, Wigfield, Metsala, and Cox (1999) all found a relationship between students’ sense of self-efficacy and their participation in learning events. A similar relationship was found in this study. Student histories as “struggling” readers constrained opportunities for participation which in turn constrained opportunities for learning. For example, Alice rarely spoke in whole class activity structures. She often remained silent even when Ms. Sand called on her to answer a question. Jack sometimes made multiple attempts to leave the classroom during a single class period while Javon often simply put his head down on his desk. Sierra and Jack were frequently absent during the course of the study. Furthermore, even when these students participated in classroom activities, the way in which they participated often differed from that of other students. Sierra, Javon, Alice, and Clyde often waited for the assistance of a teacher or another student before attempting to answer questions. Both Jack and Clyde depended on their partners to answer questions in group work situations because they did not believe they could find the answers on their own.

However not all of the “struggling” readers in this study were willing to be positioned as struggling learners at all times in this classroom. Snow, Tabors, Porche,

and Harris (2007) found students who scored as low as the 30^{th} percentile on literacy assessments went on to college if they were goal oriented and highly motivated. In particular, two of the "struggling" readers identified for this study exhibited these characteristics. For example, Niah literally positioned herself in a section of the classroom where there were no other students who were struggling readers. She did not seek help from the teachers, and she was not observed to seek help from other students when she had to write answers to questions. She answered only a small number of questions during whole class discussions and only volunteered when she knew the correct answer. Although, according to Ms. Sand, she often partnered with Tara during group work, the observation of them working together revealed that they actually found the answers independently. Their talk was unrelated to the work at hand. Furthermore, when Niah participated in group work with Ashley and Pam, she kept the answers in front of her the entire time and took pride in answering the questions that Pam couldn't. Although she expressed some difficulty with the classroom texts in her interview, she never made these difficulties apparent in the classroom. Furthermore, despite these difficulties, she was always prepared with the correct assignments and textbooks. In addition, Niah completed almost all of her assignments without receiving any significant amount of help from the adults in the room. Although she answered few questions in whole class formats, she almost always answered correctly using work she had completed previously. Ultimately, she did not score as well as the nonstruggling readers on the two tests the students took, however, she never indicated any difficulty with the assignments in the classroom setting.

Lloyd was very interested in, and therefore very highly motivated to learn science. He always participated in class discussions and he assumed the lead role as the question reader when he participated in a group work event with Clyde and Sam. Lloyd believed that he would probably get a B in the class at the end of the nine weeks, and he explained that it was important to listen to be a good science student. Furthermore, Lloyd resisted the prevailing absolutist view of science extant in the classroom and interrupted whole class question and answer discussions on a number of occasions to ask questions of his own. Moreover, when Ms. Sand complimented Josh in front of the class, Lloyd immediately contributed more information to the class discussion. He appeared to be attempting to seek a compliment for himself. Indeed, Lloyd was the student in this study who appeared to most actively seek to connect his science learning with youth culture and with his own everyday funds of knowledge.

On the other hand, students who were sincerely interested in phenomena associated with the topics under study had limited opportunities to express their thinking. For example, Lloyd asked a number of questions during whole class formats based on his own curiosity about space exploration. Although Ms. Sand recognized Lloyd as a good student and considered his questions legitimate, these questions could not become the focus of any extended forms of inquiry because of the pressure faced by everyone in the room to optimize student performance on the upcoming tests. Furthermore, Lloyd's questions were not actively solicited by Ms. Sand but rather were spontaneous and occurred as interruptions to either external text dialogue or triadic dialogue events. After, at most, several minutes of discussion, Ms. Sand signaled an end to these events

with a marker such as *alright* prior to resuming the previous format by asking a new question of her own.

Although these two students exhibited agency in many of their interactions as they sought to enact the identity of a good science student, several of the other "struggling" readers also attempted to position themselves as good science students only in certain instances. Although Alice very rarely participated in whole class discussions and often did not reply when Ms. Sand selected her to answer questions, she took the lead in both reading the questions and locating the answers when she partnered with Pam. It was clear that Alice had internalized the process enacted for her by her teachers for locating answers in text even when she could not easily comprehend the content. Furthermore, she and Pam also argued against being positioned as struggling learners and both declared that they were much smarter than others realized. Clyde attempted to enact the identity of a good student when he mimicked Adam in checking his answers. Jack was very persistent when he partnered with Daniel and even attempted to engage Daniel in the work when Daniel lost interest. Therefore, although students' histories as "struggling" readers constrained their learning in that they were positioned as struggling learners in this science classroom, these same students were able to demonstrate agency in some interactions in order to negate the overall perception of them as learners. All of the "struggling" readers in this study were, at least on some occasions, seeking ways in which they could be successful and ways to enact the identity of a good student. In some cases, their histories as "struggling" readers constrained their participation because they were frequently absent from school or because they were reluctant to participate. However, at other times these same students exhibited agency in attempting to position

themselves as sucessful learners. In these instances, their increased participation afforded them more opportunity to learn the content. Indeed, although Niah and Lloyd, the two students with the highest level of participation, did not score as well as the nonstruggling readers on the class tests, they scored better than many of the other "struggling" readers.

Implications

Throughout this paper, the word *struggling* has been used to refer to the particular population of students of interest in this study. However, this word has always been enclosed in quotation marks as a means of demonstrating that this is a contested term. Clearly the particular students described in this study have struggled in numerous ways. They have struggled to read the science textbook and to answer questions based on this textbook. In addition, they have also struggled in a number of other important ways. They have struggled against being identified as students who are not capable of learning. They have struggled to learn the answers to their authentic questions about scientific concepts. They have struggled to maintain a postive self concept despite being constructed as poor learners. Finally, they have struggled to learn science facts so that they can correctly answer multiple choice questions and earn good grades.

However, it is also apparent that these same students have harnessed the affordances available in the environment of this classroom. Alice has successfully internalized the process for locating the answers to questions in text that has been demonstrated so often for her by her teachers. Lloyd has an intellectual curiosity that cannot be dampened by unforgiving text or the absolutist view of science extant in his classroom as he actively seeks the answers to his questions. Clyde assumes a position of power in his interactions with Sam despite the fact that he depends on Sam to answer the

questions. Jack demonstrates persistence and a desire to succeed even when Daniel gives up. Sierra makes detailed drawings to demonstrate her learning. Despite less than optimal conditions and the fact that these students never scored as well on assessments as the other students did, all of these "struggling" readers continued to attempt to participate and learn in this classroom. However, despite the affordances for participation and learning identified in this classroom, it is also apparent that these students are operating under a number of constraints to their participation and learning. Taken together, these affordances and constraints point the way to conditions under which the learning of students who are positioned as struggling readers could be optimized.

Macrocontextual influences (See *Figure 1.* Macro and Micro Contextual Influences on page 25) pressured both Ms. Sand and the students to construct a classroom culture in which as Alice said, "being smart" was remembering the answers. However, because Ms. Sand was not privy to the content of the assessment by which her teaching was judged, she had to include all available facts related to each concept her students studied. This made it difficult for all the students in the class to determine what it was most important to know. Furthermore, their underlying conceptual understandings about the topic they studied were sometimes incomplete or erroneous. For students such as the students in this study who have limited command of academic and scientific vocabularies, such broad coverage of science content can be overwhelming. It would be preferable to have a more limited number of target concepts so students could develop deeper understandings. This recommendation would by no means limit the exposure of a certain population of students to appropriate content as this recommendation would benefit all of the students in the classroom. Often these students learned three or four

facts about a large number of different concepts when only a few of them actually appeared on the exam. It would benefit all students to learn fewer things well rather than to have only a surface understanding of a large number of things. This is especially true in the content area of science which is dense with technical vocabulary and complicated concepts. Therefore, a focus on the essential knowledge needed for a deep understanding of important concepts as well as a focus on outcome objectives from the outset of a unit would be beneficial for the "struggling" readers and for all of the students in science class.

Second, "struggling" readers benefit from opportunities to use language in meaningful ways. Although the "struggling" readers in this study did not have the opportunity to explain ideas orally or in writing often, there was evidence that these students benefitted from opportunities to speak about science and to listen to others speak about science. Unfortunately, these opportunities were limited by the absolutist view of science and the necessity to cover a large body of content. Students were often limited to providing brief answers to factual questions rather than lengthier explanations of concepts. This limited their opportunities to practice using science vocabulary to explain ideas or ask their own questions about new concepts. For example, when Lloyd posed questions to Ms. Sand, he often had difficulty articulating his questions well enough to make himself understood. The "struggling" readers in this study were, for the most part, willing writers when they had the opportunity to write about personal experiences such as those involved in interactions with media. Although they were not able to incorporate academic and scientific language into their original compositions to the degree that some of the other students in the class were, they were often able to express a similar idea in

everyday language. Gee (2005b) suggests students have the opportunity to engage in "monodialogical discussions" in which they have longer turns and are expected to express clear reasoning and make connections to others. More frequent opportunites to speak and write about personal experiences which required the use of academic and scientific language would afford "struggling" readers the opportunity to encounter and practice using this language in personally meaningful contexts.

Students also had the opportunity to produce graphic representations of some science concepts. Clearly, many important science concepts such as the orbits of the planets are more easily understood by means of graphics than when explained in words. Futhermore, as the student drawings in this study demonstrated, asking students to produce their own representations also makes apparent the limits of their understandings. Sierra, one of the least engaged of the "struggling" readers in this study, was able to produce a detailed drawing of a shuttle launching after watching a video of a launch. Not only do student-produced images reveal student misunderstandings, they also afford teachers the opportunity to see what students like Sierra, who are disengaged from the classroom texts and possess a limited store of scientific terms, actually understand about important concepts. Furthermore, activities in which students like Sierra can apply new scientific terms to their own depictions of concepts would enable such students to link these new terms to their current understandings. Moreover, three of the "struggling" readers interviewed for this study commented that one of their favorite aspects of science class was the opportunity to engage in experiments. Such opportunites to engage in authentic experiences naturally lend themselves to opportunities to use newly encountered oral and written language in meaningful ways.

Finally, although all the "struggling" readers in this study demonstrated a willingness to participate and learn in this class, their opportunities were constrained by the complex nature of the available texts in this classroom. This fostered a dependence on the teachers and other students in the class that was not present in the interactions of the nonstruggling readers in this classroom. Although text difficulty was not recognized as a major impediment to learning by Ms. Sand or by the "struggling" readers themselves, it was apparent both in their interactions and, ultimately, in their grades, that this was indeed the case. In addition, it was not only the "struggling" readers in this study who experienced difficulty using these texts. Everyone in this classroom, including the two teachers, experienced significant difficulty locating information in the science textbook on a number of occasions.

Suggestions for Future Research

O'Brien, Stewart, and Moje (1995) suggested researchers should study the content area literacy strategies students and teachers actually use and attempt to determine why they use them from multiple theoretical perspectives. As the findings of this study indicate, often the greatest influences on teacher and student strategy use originate not from the choices teachers and students make in individual classrooms but from macrocontextual factors over which they have little control. Therefore, it is imperative that future researchers are cognizant of the real conditions under which teachers and students operate. Research designs should be grounded in the real life of the classroom and include careful analysis and consideration of both macro and micro contextual factors influencing actual teachers and their students. For example, a study of the effects of introducing considerate texts in science classrooms, while perhaps indicating this to be an

effective strategy to promote both literacy and science learning, would not provide meaningful information if, due to macrocontextual influences, teachers and students do not value texts as a means for learning.

Nevertheless, carefully designed studies of how to promote effective use of appropriate texts in content area classrooms have the potential to benefit students who have been identified as "struggling" readers. As this study demonstrates, older students who have experienced difficulty with classroom texts have learned to negotiate the available resources in order to comply with the requirements in their content area classrooms. Unfortunately, these measures are not as effective in promoting learning of content as meaningful interactions with considerate text. The "struggling" readers in this study were not able to demonstrate achievement on the multiple choice assessments in this class commensurate with that of the nonstruggling readers. However, simply introducing considerate texts into a content area classroom is not likely to promote learning if the "struggling" readers and teachers in the classroom do not value interactions with texts as efficacious for science learning. Moreover, the "struggling" readers in this study who had been positioned as struggling learners, not only did not connect their struggles to learn content with their reading skills, they did not value reading as an important avenue for learning content. Further research is needed to determine the best methods for making such a connection for students. Such research could lead to the development of appropriate tools for assessing the dimensions of student histories, attitudes, and beliefs and proceed to uncovering the most effective strategies for promoting these connections within the framework of the specific literacy demands and strategies unique to each content area.

Further research is also needed to determine the dimensions of appropriate text use for supporting conceptual understanding in science. Although the students included in this study interacted with a textbook which contained numerous detailed graphics, their own drawings revealed gaps in their conceptual understandings. The reasons for these gaps are not clear. Do "struggling" readers have difficulty understanding such illustrations because the labels and other written text are a barrier to complete understanding? What are the best uses of such illustrations in content area classrooms? How much time should be devoted to presentation and discussion of publisher produced texts compared to the amount of time allotted for students to create their own illustrations and written text?

Finally, future research is needed to more fully describe the variations in students who struggle with the literacy demands of their content area classrooms. More complete detailed descriptions are needed of how socioeconomic status and racial differences affect struggling readers. This study clearly demonstrates that these students differ in significant ways. For example, although some of the "struggling" readers in this study demonstrated little interest in science and poor self-concepts as learners, this was not true of all of them. Research is needed to determine how to optimize the success of students like Lloyd and Niah. Lloyd, the "struggling" reader in this study who exhibited the greatest degree of genuine interest in science content learned more as demonstrated by his test scores than did several of the other "struggling" readers included in this study. Additional research is needed not only to determine how to spark such interest in students who have a history of struggling with grade level literacy demands but also to determine how to connect this interest, once it is developed, to an interest in the development of the

literacy skills necessary to navigate and learn the content. Niah, on the other hand, did not demonstrate a specific interest in the science content, but rather positioned herself as a successful student despite her admitted difficulties with the classroom texts. The best methods for building a connection between interest and literacy skills with such students are unclear. Future long-term case studies of individual students similar to Niah and Lloyd would help to identify affordances of science classrooms that could be recruited to help many "struggling" readers who have the desire, if not the skills, to succeed in content area classrooms. In addition, fine grained descriptions of the ways individual students identify and make use of available affordances in the environment of content area classrooms could point the way to additional pedagogical methods that educators could build on to optimize learning for this population of students.

This study has several limitations. Because one of the major purposes of this study was to provide a thick description of actual classroom interactions, this study did not include assessments of students' prior interest or knowledge of the science content presented during the time period of the study. Therefore, it is not possible to accurately quantify student learning during the course of the study. For example, it may be that the struggling readers in this study were less interested in science than the other students in the classroom or knew less of the science content at the beginning of the study than the nonstruggling readers did. It may be that the nonstruggling readers did not manage to master more of the content presented than the "struggling" readers did but rather that they simply knew more to begin with. An additional limitation of this study is that the "struggling" readers in this study were not observed in other content area classrooms. Therefore, it is not possible to determine if these students behaved differently or learned

more in other contexts during a typical school day and if their positioning as struggling learners was somehow unique to the context of this particular science classroom. It may be that in a different context, for example, with a different teacher or different students, particular affordances for learning that were not apparent in this classroom could be identified that would also be helpful to "struggling" readers in this science classroom.

The limited duration of this study is an additional limitation. This study was conducted over a period of six weeks near the end of the school year. Because the class was not observed over the course of the entire school year, some of the activities the students engaged in such as completing projects and performing experiments were not observed. Although the completed projects and reflections about the experiments were captured during the course of the study, it is possible that certain affordances and constraints of the activity structures, texts, and interactions associated with these activities were not apparent in this study. Moreover, future studies should be of longer duration so changes in student interactions and learning can be described.

Finally, a limitation of this study is that it was conducted by a single researcher. Although, as a practicing literacy professional who is familiar with both learning theories and schools, I could be considered an expert observer, I was limited in what I could observe at one time. I was sometimes able to capture multiple simultaneous events in the classroom using both my laptop and my camera as recording devices, nevertheless, much that transpired between the teachers and the students during any one period of time remained invisible to me. For example, it was not apparent until I reflected on the transcripts and artifacts after the conclusion of the study that Niah had been relatively successful in many activities over the course of the study. However, because she rarely

answered questions in whole class activity structures and did not usually position herself in proximity to the other focal students, many of her interactions were not documented during this study. It remains unclear what additional supports enabled her to be moderately successful despite her documented difficulties on literacy assessments.

Nevertheless, this study does present a detailed description of the ways adolescents who have been identified as "struggling" readers interact with the literacy practices in a content area classroom. Furthermore, this description makes apparent a number of affordances in this context, among them the oral language, student created texts, and agency of the "struggling" readers themselves. Although the students and teachers in this classroom were constrained by both macro and micro contextual factors, it was clear in both the transcripts and artifacts documented in this study that these individuals acted in purposeful ways to counter the identified constraints on student learning. Although more research to identify the most effective methods for affording this particular population of students the most effective opportunities to participate in content area classroom activities and, at the same time, to learn complex vocabulary and develop deep conceptual understandings is clearly needed, it should be multidimensional, grounded in observations conducted in actual classrooms, and should take into consideration both the macro and micro contextual factors extant in these classrooms. As this study demonstrates, a great multiplicity of factors interact to create conditions for learning that can both constrain and serve as affordances in individual content area classroom interactions.

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APPENDIX A

SEATING CHART

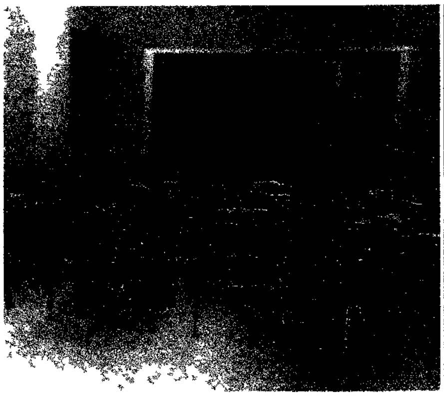
Sam	Ms. Sand's desk
Niah	Daniel
	Pam
Ashley	
Cam	
Josh	Jack

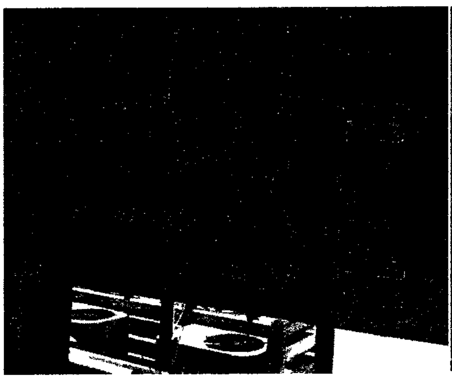
	Javon
Adam	
	Sierra
Lloyd	

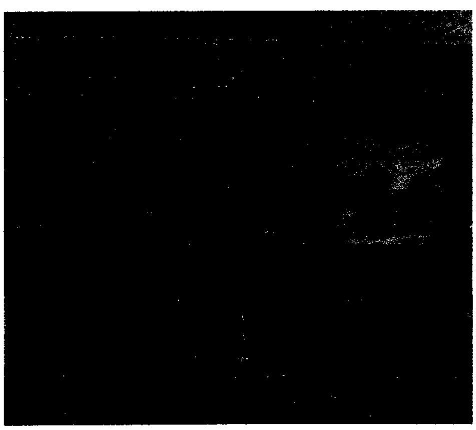
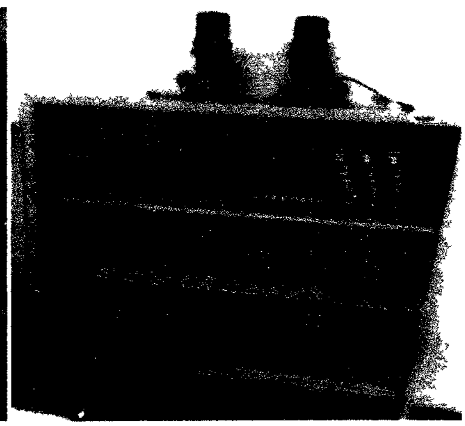
Alice	Clyde		
			Tara

APPENDIX B

ROOM PHOTOGRAPHS





APPENDIX C

INTERVIEW PROTOCOLS

Teacher Interview 1

1. What do you believe to be the major purpose of public schools?
2. What do schools do well?
3. What are the most pressing problems in schools today?
4. What do you believe are the most important reasons for students to learn about science?
5. What skills do students need to learn about science?
   a. Probe – Reading
      i. Writing
      ii. Scientific vocabulary
      iii. Logical reasoning
6. How could we improve science instruction?

Teacher Interview 2

1. What made you decide to become a teacher?
2. How would you characterize your style of teaching?
3. Tell me about your educational background.
4. Which of your past experiences have had the most influence on your teaching methods and why?
5. How do you feel about this class so far this year? How do these students compare to classes you have had in the past or other classes you are teaching now?

6. What do you feel are the strengths of your students?
7. What areas of improvement do you see for the students in this class?
8. What are the most essential skills these students need to be successful in this class?

a. Probe – literacy, reading, vocabulary, reasoning skills

Teacher Interview 3

1. _What are the most typical instructional strategies you employ?
2. What are some of the most frequently occurring activities in your science class?
3. In your opinion, how well are the students in this class progressing in meeting the goals you set for them at the beginning of the year?
4. What factors do you believe contribute to their progress or lack of progress in meeting these goals?

a. Probe - reading

5. What strategies do you employ to help students who are not progressing towards your goals?
    a. Probe - strategies
6. What materials do you find to be the most valuable for this class?

Student Interview 1

1. Which subjects do you think are the most important: Science, History, Math, English? Why?
2. How can attending school help students?
3. What are some positive things teachers do?

4. What are some negative things teachers do?

5. Tell me what school has been like for you before this year?

6. What experiences have you had in school that affect how you feel about school now?

7. What type of student do you consider yourself to be?

a. Probe – Do you like reading?

b. Probe- Do you like science?

8. What would you like to be when you grow up?

Student Interview 2

1. How do you feel about science class so far this year?

2. How does this class compare to other science classes you have had?

3. How does this class compare to other classes you are taking now?

4. What do you think is the easiest part of this class for you?

5. What is the hardest part of this class for you?

6. What do you need to know how to do well in this class?

7. What kinds of things do you like to do when you are not in school?

Student Interview 3

1. How do you think your teacher usually goes about trying to teach this class?

2. What types of activities do you participate in most frequently in this class?

3. What types of activities help you to learn the most in this class?

4. What materials like books or computers help you the most to understand science?

5. Why is it important to be a good reader to do well in this class?

6. Why is it important to be a good writer to do well in this class?

7. What grade do you expect to get in this class at the end of the year?

8. What study skills do you think are the most important?

9. What is the most interesting thing you have learned in this class so far this year?

10. What changes would you make in this class if you were the teacher?

APPENDIX D

OBSERVATION PROTOCOL

Actions	Students	Teacher	Elapsed Time
Materials			
Text type			
Student/teacher talk type			
Peer talk			
Oral reading			
Silent reading			
Writing			

Activity type (Lemke, 1990, pp. 215-217):

Other documentation: (audio, video, photo)

APPENDIX E

OBSERVATION CALENDAR

		May19 Day1 Students locating information about space shuttles on the web (missed first 30 mins.)	May 20 Day 2 Paragraph/text reading/writing "your launching experience" (missed first 30 mins.) Ashley absent	May 21 Day 3 Video "One Giant Leap" Absent: Ashley, Lloyd
May 24 Day 4 Substitute: Mr. Patton Oral reading Section 4 Review 1-4 Workbook pg. 210-211	May 25 Day 5 Independent writing assignment for students not out of classroom doing English assignment	May 26 Day 6 Class going over workbook pages 210-211 Work on study guide Lloyd in ISS	May 27 Day 7 No class Math SOL testing	May 28 Day 7 Students working with a partner on study guide Ipod Jefferson lab review Absent: Adam
May31 School holiday	June 1 Day 8 Test review: Quiz bowl	June 2 Day 9 Chapter 18 test Absent: Niah	June 3 SOL Testing	June 4 Day 11 Movie *October Sky* Writing activity Absent: Adam, Daniel, Jack
June 7 Day 11 SOL test preparation Benchmark test Absent: Sierra, Alice	June 8 Day 12 SOL test preparation Benchmark test Absent: Sierra	June 9 Day 13 Exam review Study Guide Interactive note taking packet Absent: Sierra at beginning	June 10 Day 14 Exam review Whole group going over study guides	June 11 Day 15 Oral exam review Group work on study guide Absent: Sam
June14 Day 16 Going over answers on exam study guides Absent: Sam, Jack	June 15 Day 17 Filling in missing answers on study guide Absent: Jack			

APPENDIX F

TRANSCRIPTION CONVENTIONS

ALL CAPS: stated with emphasis

"" Reading from text

[]:Nonverbal communication

XXXX: Unintelligible

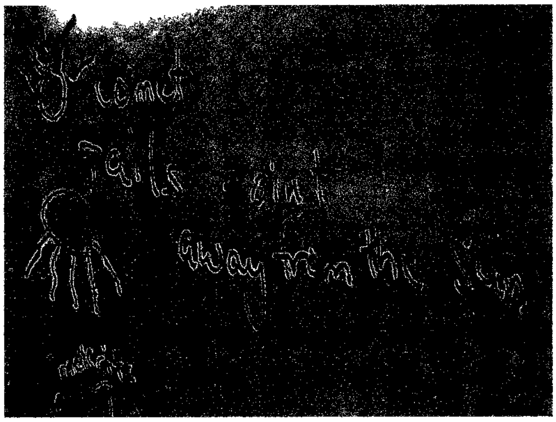
(.) : number of seconds of pause

When a line of transcript is not left justified, it should be read as occurring simultaneously with the line above it (Lemke, 1990).

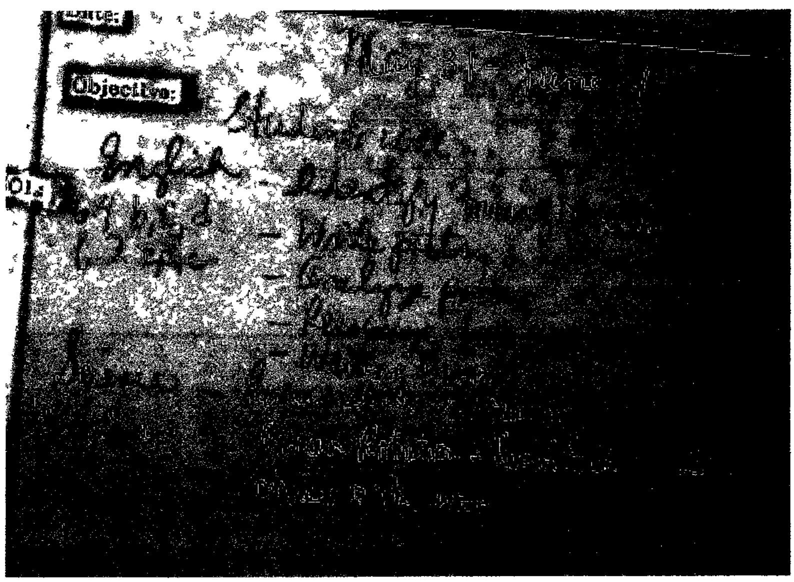
APPENDIX G

INFORMATION ON THE BOARD

G1. Comet drawing

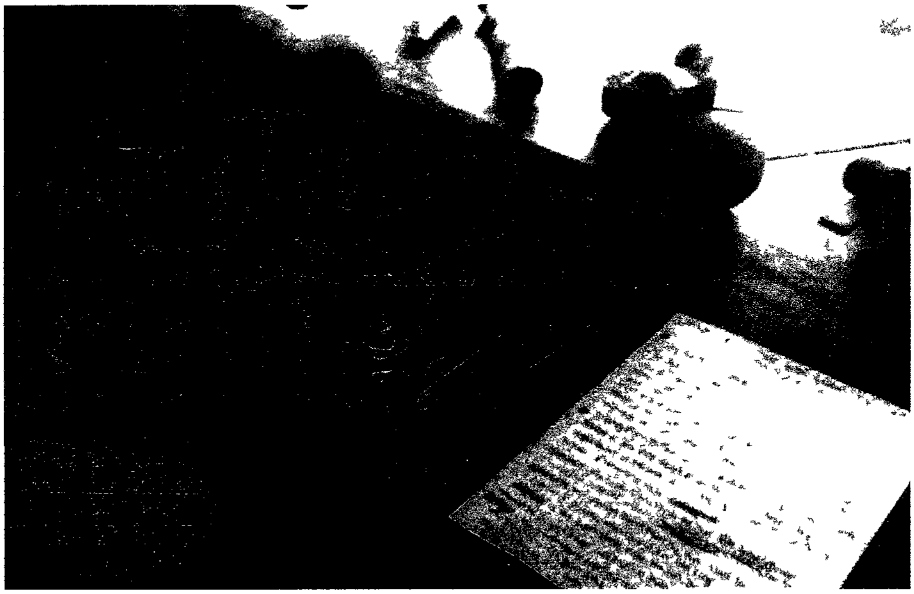


G2. Weekly Objectives



APPENDIX H

SIERRA'S SCIENCE PROJECT



APPENDIX I

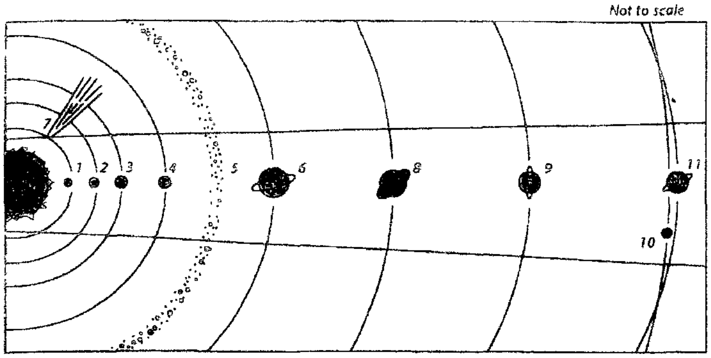
EXAM REVIEW NOTES

I1. Jack's exam review notes

Jack th Nine Weeks Exam Review

Use the illustration to answer the following questions.

The Solar System



The item labeled 9 is the planet

The item labeled 1 is the planet

The item labeled 5 is the planet

Which inner planet rotates so slowly that its "day" is longer Than its "year"?

The "Great Red Spot" is a large storm on which planet?

Which body is at the center of the solar system?

One complete rotation of the moon takes about one

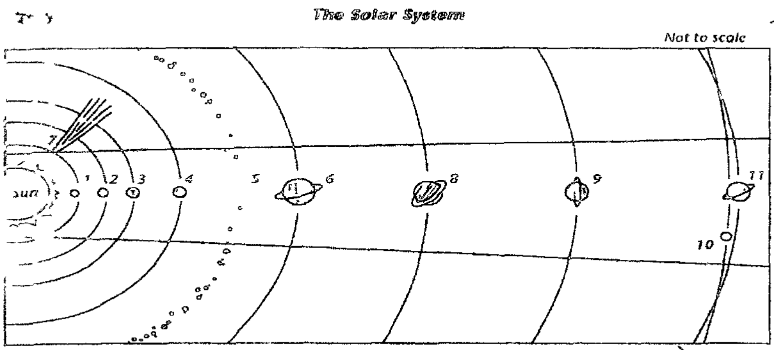
The tilt of the Earth's axis is ________ degrees.

I2. Pam's exam review notes

12

12 4th Nine Weeks Exam Review

Use the illustration to answer the following questions.



comments
are
chunks

The item labeled 9 is the planet -----

The item labeled 1 is the planet -----

The item labeled 5 is the planet -----

Which inner planet rotates so slowly that its "day" is longer Than its "year"?

The "Great Red Spot" is a large storm on which planet?

Which body is at the center of the solar system?

One complete rotation of the moon takes about one

The tilt of the Earth's axis is ________ degrees.

APPENDIX J

FREQUENCY OF ACTIVITY STRUCTURES

Activity Type	Days and Time Periods	Time
Triadic dialogue	Day 2 (19:43-25.29)	5:46
	Day 6 (6:46-7:43)	0:57
	Day 9 (0:00-15:26)	15:26
	Day 11 (2:51-6:54) (29:30-30:24) (51:13-51:47)	5:31
	Day13 (0:00-12:15)	12:15
	Day 14 (5:48-11:14) (12:14-15:53) (16:49-18:32) (20:20-27:22)(31:55-33:24) (37:18-38:30) (43:01-47:12)	24:42
	Day 16 (1:09-5:48) (6:09-19:54) (21:01-26:18) (26:32-28:37) (30:17-33:10)	28:39
	Day 17 (0:00-10:00 estimate) (0:00-2:09) (2:36-9:43) (25:03-27:45)	21:58
		Total = 1: 55:14

Appendix J continued

Activity Types	Days and Time Periods	
External text dialogue	Day 2 (3:50-19:42) (25:30-38:30)	28:52
	Day 4 (0.00-10.31) (45:59-49:30)	14:02
	Day 6 (3:16 – 6:12) (6:21-6:46)	
	(10:01-19:53)	13:13
	Day 7 (29:30-40:51)	11:21
	Day 8 (23:10-56:21)	33:11
	Day 9 (0:00-15:26)	15.26
	Day 11(46:59-49:12)(50:08-51:14)	
	(53:46-1:00:38)	10:11
	Day 12 (57:41-1:00:10)	2:29
	Day 14 (2:18-4:39) (18:32-20:20)	
	(27:22-31:35) (33:25-37:17)	
	(38:30-43:01) (47:12-49:29)	
	(51:24-59:38)	27:16
	Day 15 (5:25-10:04)	4:39
	Day 17 (10:06-16:13) (16:43-21:26)	
	(22:24-24:36) (28:16-29:42) (29:47-	
	30:31) (32:34-38:36)	21:14
		Total: 3:01:54

Appendix J continued

Activity Types	Days and Time Periods	
Student questioning	Day 6 (6:12-6:21) (6:42-6:48)	0:12
dialogue	Day 9 (8:47-8:51)	0:04
	Day 11 (15:32-16:38) (59:37-59:56)	
	(1:00:38-1:00:39)	
	Day 15 (12:18-12:52)	1:26
	Day 16 (19:54-21:01)	0:34
	Day 17 (0:30-0:35) (2:09-2:34)	1:07
	(16:13-16:43) (30:31-32:34)	
		3:03
		Total= 6:26
Teacher-student debate	Day 16 (26:18-26:32) (28:40-30:17)	1:51
	Day 17 (29:42-29:47)	0:05
		Total=1:56
True dialogue	Day 6 (6:03-6:21)	0:18
(teacher-student)	Day 14 (15:53-16:41)	0:48
	Day 17 (21:26-22:24) (27:45-28:16)	1:29
		Total = 2:35

Appendix J continued

Activity Types	Days and Time Periods	Time
Cross discussion	Day11(51:50-52:38)	0:48
	Day 14(11:14-12:49)	1:35
		Total = 2:23
Media presentation	Day 3 (32 mins.)	32:00
	Day 10 (12:10-1:15)	1:05:00
		Total = 1:37
Seatwork	Viewing rocket launch/laptop computer (length unknown)	
	Day 2 (0-3:40)	3:40
	Day 4 (11:15 -45:59) (49:30-1:04:54)	50:08
	Day 5 (length not specified; varies across students)	
	Day 7 (length not specified; varies across students)	
	Day 11 (6:54-46:59)	40:05
	Day 12 (6:58-57:22)	50:24
	Day 15 (1:14-4:42)	3:28
		Total = 2:27:45

Appendix J continued

Activity Types	Days and Time Periods	Time
Group work	Day 4 (55:06-59:40)	4:34
	Day 6 (23:52-1:02:56)	39:04
	Day 7 (0.00-29.30)	29:30
	Day 8 (6:38-21:25)	14:47
	Day 13 (12:15-56:08)	43:53
	Day15 (12:52-46:59)	34:07
		Total = 2:45:55
Testing	Day 9 (12:36-1:10)	47:46

APPENDIX K

SIERRA'S ANSWERS

K1. Group work Sierra's Answer Question 11

11. That one Small step for a man meaning himself but in his exciment he never Said the a.

K2. Group work Sierra's Answer Question 12

12. When Surveyor space craft landed ~~landed~~ on the mun they didnt sink in

APPENDIX L

LITERACY EVENTS WITH TRIADIC DIALOGUE FORMAT

Day	Time	Absent	Purpose
Two	19:43-25.29	Ashley	Introducing reading
Six	6:46-7:43	Lloyd	Explaining in response to student question
Seven	29:30-40:51	Adam	Going over answers to study guide: *Chapter 18 Test*
Eight	23:10-56:21		Quiz bowl game
Nine	0:00-15:26	Niah	Review questions prior to test
Eleven	2:51-6:54	Sierra Alice	Introducing workbook activity
Eleven	29:30-30:24	Sierra Alice	Ms. Jones is demonstrating calculating volume
Eleven	51:13-51:47	Sierra Alice	After David reads his summary of October Sky
Thirteen	0:00-12:15		Going over the exam study guide
Fourteen	5:48-11:14		Going over the exam study guides: Textbook fourth nine weeks Exam Review Chapter 18 Test

Appendix L continued

Day	Time	Absent	Purpose
Fourteen	12:14-15:53		Going over the exam study guides: Textbook fourth nine weeks Exam Review Chapter 18 Test
Fourteen	16:49-47.06		Going over the exam study guides: Textbook fourth nine weeks Exam Review Chapter 18 Test
Sixteen	1:09-5:48	Jack	Review for final exam
Sixteen	6:09-19:54	Jack	Review for final exam
Sixteen	21:01-26:18	Jack	Review for final exam
Sixteen	26:32-28:37	Jack	Review for final exam
Sixteen	30:17-33:10	Jack	Review for final exam
Seventeen	0:00-10:00 (estimate)	Jack	Review for final exam

APPENDIX M

LITERACY EVENTS WITH EXTERNAL TEXT DIALOGUE FORMAT

Day	Time	Absent	Texts
Two	3:50-19:42	Ashley	Students reading paragraphs about "Your launching experience"
Two	25:30-38:30	Ashley	Reading aloud pp. 583-585 textbook
Four	0.00-10.31		Reading aloud pp. 586-588 textbook
Four	45:59-49:30		Reading questions p, 588 and student-written answers
Six	3:16 – 6:12	Lloyd	Reading questions and answers Science workbook p. 210-211
Six	6:21-6:46	Lloyd	Reading questions and answers Science workbook p. 210-211
Six	10:01-19:53	Lloyd	Reading questions and answers Science workbook p. 210-211
Seven	29:30-40:51	Adam	Study Guide Chapter 18 test
Eight	23:10-56:21		Quiz bowl/Questions from study guides
Eleven	46:59-49:12	Alice Sierra	Reading student movie summaries

Appendix M Continued

Day	Time	Absent	Texts
Eleven	Time	Sierra Alice	Virginia SOL Test Preparation Workbook p. 1-3
Eleven	53:46-1:00:38	Sierra Alice	Virginia SOL Test Preparation Workbook p. 1-3
Twelve	57:41-1:00:10	Sierra	Virginia SOL Test Preparation Workbook Benchmark Test B
Fourteen	2:18-4:39		4th Nine Weeks Exam Review
Fourteen	18:32-20:20		Science textbook
Fourteen	27:22-31:35		Chapter 18 Test from 6/2; Science textbook
Fourteen	33:25-37:17		Science textbook
Fourteen	38:30-43:01		Chapter 18 Test from 6/2
Fourteen	47:12-49:29		Science textbook
Fourteen	51:24-59:38		Chapter 18 Test from 6/2
Fifteen	5:25-10:04	Sam	Exam Study guide Test questions
Seventeen	10:06-16:13	Jack	Exam study guides
Seventeen	16:43-21:26	Jack	Exam study guides

Appendix M continued

Day	Time	Absent	Texts
Seventeen	22:24-24:36	Jack	Exam study guides
Seventeen	28:16-29:42	Jack	Exam study guides
Seventeen	29:47-30:31	Jack	Exam study guides
Seventeen	32:34-38:36	Jack	Exam study guides

APPENDIX N

PERMISSIONS

Order History

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Results: Items 1 of 1 matching item for **Order Detail ID: '59891301'**

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VITA

Kristin Cartwright Palmer received a BS in Secondary Education from the University of North Carolina at Chapel Hill in 1975, an MSEd in Reading from Old Dominion University in 1990, and a PhD in Literacy Leadership from the Darden College of Education, Old Dominion University, Norfolk, Virginia in 2011. She has worked as a high school English teacher and both a Title I teacher and a reading specialist at the elementary and middle school levels for over twenty years.