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Scaffolding for Engagement in Learning:

An Observational Study of Elementary School Reading Instruction

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Abstract

We used a new, multidimensional coding scheme to assess student engagement in learning during three Grade 4 reading lessons. Students in three classes, two that received integrated reading-science instruction and one that received traditional instruction, demonstrated moderate to high engagement in learning. However, the integrated instruction classes gained more in reading comprehension and reading strategy-use during the 12-week course of the study than did the traditional instruction class. Analyses of task complexity and practices that teachers used to scaffold students' cognitive processes and motivation suggested that measuring student engagement in conjunction with these variables may be critical to developing a deeper understanding of how academic gains are made.

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Student engagement in learning at school is an important and well-documented predictor of academic achievement in general, as well as in specific subject areas including reading (see Fredricks, Blumenfeld, & Paris, 2004; Guthrie & Wigfield, 2000). For the purposes of our study, we define engagement in learning as students' behavioral, cognitive, affective, and social involvement in instructional activities with their teachers and classmates. An example of this involvement is the student who is highly engaged on a regular basis. This student might be described as someone who is always looking at the appropriate book at the appropriate time, provides thorough responses to thought-provoking questions, becomes excited by or takes pride in learning new things, and willingly discusses ideas with other students.

Despite linkages of engagement in learning with positive academic outcomes, like good grades, strong standardized test scores, and high school completion (Fredricks et al., 2004), many questions remain unresolved that might be addressed through continued research based within an engagement framework. For example, Fredricks et al. asserted that to develop a fuller understanding of the dynamic relations among student engagement, academic performance, and teacher practices in the classroom, researchers needed to develop new methods of measuring multiple dimensions of engagement within single studies and to construct rich portraits of the classroom context in which such studies are conducted. The current study represents an initial endeavor toward this aim within the domain of reading instruction, using children's reading comprehension as the performance indicator.

More specifically, this study aligns with the goals set forth by Fredricks et al. (2004) in that it combines the use of observational methods to assess four dimensions of engagement on a microanalytical time scale (Erickson, 1992) with an intensive descriptive analysis of the nature, number, and pattern of teacher practices used to foster engagement in reading instruction in three Grade 4 classrooms. We term these teacher practices *scaffolds for engagement*, and define them as any effort by the teacher to support the functioning of students' cognitive or motivational processes during instructional activities. In addition, we examine how the complexity of the literacy tasks in these classrooms bears on relations between engagement and reading comprehension outcomes. We are particularly interested in comparing how teachers scaffold student engagement in learning during integrated reading-science instruction with how they engage students in more traditional reading instruction using basal readers.

Documenting engagement, as well as scaffolding, through a microanalytic approach is useful because it allows insight into the potentially specific and dynamic relations between teachers' words and actions, and their students' responses. Specifically, our microanalytic approach entailed rating individual student engagement at 30-second time intervals. As further detailed below, this approach contrasts with the method commonly used in observational classroom research of estimating the percentage of students showing on-task behavior every 10 - 15 minutes (e.g., Dolezal, Welsh, Pressley, & Vincent, 2003). It also contrasts with the method of obtaining teacher reports of individual student engagement after several weeks of instruction (Guthrie, Wigfield, Barbosa et al., 2004).

We focus on reading comprehension in the present study because this skill becomes a major focus of reading instruction in the later elementary grades (Sweet & Snow, 2003) and provides the basis for a substantial amount of learning in secondary school (Kirsch, de Jong, LaFontaine, McQueen, Mendelovits, & Monseur, 2002). For students who cannot comprehend what they read and who are not motivated to read to learn, academic progress is limited (Alvermann & Eakle, 2003). Furthermore, a variety of cognitive, motivational, and instructional factors influence the development of children's reading comprehension; engagement in reading activities is one such factor. Thus, we examine variation in children's engagement during reading instruction and how teachers promote or scaffold children's engagement on various reading tasks. We also investigate how these two elements may relate to children's reading comprehension by examining differences in performance on reading comprehension tests and in usage of reading comprehension strategy across classes.

Engagement in What? The Importance of Task Complexity

The National Institute of Child Health and Human Development Early Child Care Research Network (NICHD ECCRN, 2005) recently conducted a study of daily activity and student engagement in 780 third-grade classrooms. One major contribution of this study is the attention it has drawn to the potentially key role of task complexity in promoting engagement and achievement. This study revealed that third-grade students participated in more activities designed to foster basic skills rather than complex tasks designed to hone analytic and inferential abilities at a ratio of about 13:1. In particular, the NICHD ECCRN expressed concern that reading comprehension activities were typically low in complexity, involving, for example, rote vocabulary exercises and

passive listening to stories read aloud by teachers and classmates rather than interpretation of text content. Unsurprisingly, the NICHD ECCRN found that students were ordinarily compliant in completing the relatively simple academic tasks they were assigned, and they very rarely demonstrated enthusiasm or other indicators of high engagement in them.

Indeed, studies conducted in elementary classrooms have suggested that complex tasks facilitate engagement as well as academic achievement. These studies include interventions, such as efforts by Miller and Meece (1997, 1999) to increase the number of complex or high-challenge literacy tasks offered in eight Grade 3 classrooms. They defined the high-challenge tasks as those involving extended reading or writing, lasting for more than a day, and benefiting from peer collaboration. Simple or low-challenge tasks were those involving little reading or writing, lasting a single day, and requiring solitary work. Based on student reports of their interest and attitude toward class activities and their performance on reading tests, Miller and Meece concluded that the intervention increased engagement and achievement, with the greatest apparent effects on low-achievers in classes with the most opportunity to complete complex tasks. In addition, previous research on the type of integrated reading-science instruction investigated in the present study has also associated the regular undertaking of complex and challenging tasks with gains in engagement and comprehension in reading (e.g., Guthrie, Anderson, Alao, & Rinehart, 1999; Guthrie, Wigfield, Barbosa et al., 2004). Such tasks include having students formulate their own questions about scientific concepts based on classroom experiments and their background knowledge, integrate

information from multiple texts to answer the questions, and present their findings in various formats.

Observations of elementary classes not receiving special interventions also support the linkage of complex tasks with engagement and achievement. For example, when Taylor, Pearson, Clark, and Walpole (2000) compared reading comprehension instruction in first- through third-grade classrooms that differed in reading achievement, they found that the classroom teachers with the highest achievement asked students to answer more high-level questions; that is, questions that required students to integrate the text with their own knowledge and experiences. These teachers also asked students to write in response to their reading more frequently than did classroom teachers with lower reading achievement.

Relations Between Teacher Practices and Student Engagement

Guthrie, Wigfeld and colleagues (Guthrie, Wigfield, Barbosa et al., 2004; Guthrie, Wigfield, & Von Secker, 2000) have identified several teacher practices that appear to optimize engagement in reading, particularly when they are implemented in concert with one another. These practices include (a) an emphasis on learning and knowledge goals, (b) a provision of real-world interactions connected to reading topics, (c) comprehension strategy instruction using interesting information and literary texts, (d) support for student autonomy, and (e) support for student collaboration. Two of the three teachers observed in the present study participated in professional development programs that focused on the implementation of these practices during integrated reading-science instruction. We investigate the extent to which these teachers actually employed these practices during their lessons. We also evaluate the extent to which they were evident in the instruction of

a teacher who did not receive this professional development and who used a more traditional reading instruction model.

Stipek (2002), who urged integrating research on practices that promote achievement and research on those that promote motivation, echoed these ideas regarding instructional practices that promote student engagement in the classroom. In particular, she cited the encouragement of challenging, conceptual thinking that fosters self-efficacy development and interest; an emphasis on learning and understanding rather than simply getting correct answers; active student participation and control which supports autonomy development; and authenticity and meaningfulness of activities to life outside of school as recurring themes in the findings of researchers interested in promoting both engagement and achievement. A final practice that appears important in promoting student engagement is that of teachers expressing high expectations to their students that they will consistently be on-task and learning (Pressley, Wharton-McDonald, Mistretta-Hampston, & Echevarria, 1998).

Empirical research has also provided evidence that the amount and variety of practices that teachers employ to motivate student engagement and otherwise support learning are important indicators of quality learning environments (Bogner, Raphael, & Pressley, 2002; Dolezal et al., 2003). Dolezal et al. furthermore demonstrated that the ratio of practices that support motivation to those that undermine it grew increasingly larger as teachers were rated more engaging. Overall, they described 94 different positive practices and 41 undermining practices; the most engaging teacher in the study employed 45 of the former and none of the latter. Thus, they emphasized that the most engaging

teachers seem to be those that "intellectually saturate their classrooms with positive motivation," (p. 256).

Another important point regarding relations among teacher practices, student achievement, and student engagement, made by Guthrie and Wigfield (2000) is that instructional practices do not produce achievement directly, but rather student engagement mediates this relationship. The work of Skinner and colleagues (Furrer & Skinner, 2003; Skinner & Belmont, 1993; Skinner, Wellborn, & Connell, 1990) supports this view. They found, for example, that classroom contexts that fulfill students' basic psychological needs of competence, autonomy, and relatedness by providing, respectively, structure, autonomy support, and teacher involvement, are linked with successful academic performance. The findings of Skinner and Belmont also point to the reciprocal effects of student engagement and teacher practices, as they showed that students who were initially more behaviorally engaged received more structure, autonomy support, and involvement as the year progressed.

In this discussion of research on antecedents of student engagement and achievement, it is also informative to highlight factors that appear not to matter very greatly as predictors of these important outcomes. For example, the NICHD ECCRN (2005) study of daily activity in third-grade reported that structural characteristics of classrooms, such as teacher-student ratios, and teacher variables, such as number of years of experience or education level were only weakly related to indicators of classroom quality. Thus, the NICHD ECCRN called for more in-depth examinations of the mechanisms by which teachers provide strong instructional and emotional support,

features that we consider key to initiating and sustaining children's engagement in learning.

Defining and Assessing Engagement as a Multidimensional and Dynamic Construct

Here we elaborate on the definition of engagement employed in the present study and discuss its implications for the assessment of engagement. We also compare the assessment methods used in this study with those used in previous research.

As stated in our introduction, we define engagement as students' affective, behavioral, cognitive, and social involvement in the learning activities of their classroom; this definition is based closely on Fredericks et al.'s (2004) work reviewing research on the construct of engagement, and builds upon it. Like Fredericks et al., we contend that it is important to view engagement as multidimensional. Specifically, Fredricks et al. defined three dimensions of student engagement in the community at large, as well as in classroom lessons – emotional, behavioral, and cognitive engagement. They viewed emotional engagement as referring to positive affective reactions toward teachers, classmates, and school, and conceptualized it as facilitating students' sense of connection with school and commitment to their schoolwork. We have termed this dimension *affective engagement*, to connote more strongly the physical display of emotion. Physical cues were the indicators of this dimension in the present study since our measure was observational.

Fredricks et al. (2004) viewed behavioral engagement in instruction, as do we, as referring to active participation in academic activities, as demonstrated through attention, persistence, and asking and answering questions. Also, like Fredricks et al., we view cognitive engagement as encompassing mental investment in learning, effortful strategy

use, and deep thinking. As these processes are clearly difficult if not impossible to observe, judgments of cognitive engagement were made in the present study on the basis of the relevance and quality of students' verbal answers as well as inferred from their manner while interacting with their teachers, classmates, and texts. Finally, unlike Fredricks et al., we include social engagement as another dimension of involvement in classroom learning. In line with Guthrie and Wigfield (2000), we view the exchange of interpretations of text and other ideas about reading and writing with peers in a "community of literacy" as important social behaviors of students who are engaged in reading.

A number of studies have explored relations between some of these dimensions of engagement and the antecedents or effects of engagement, but few, if any, studies have simultaneously evaluated more than two dimensions. Also, previous studies have primarily used teacher reports and self-reports of engagement, rather than perhaps more objective "third-party" measures (e.g., Blumenfeld & Meece, 1988; Furrer & Skinner, 2003; Guthrie, Wigfield, Barbosa et al., 2004). Related specifically to literacy learning, Stipek (2002) for instance, found that teacher ratings of second and third-graders' behavioral engagement and these students' self-reports of their affective engagement in reading correlated with their academic achievement. Studies that have used observational measures, on the other hand, have typically sacrificed consideration of the multidimensionality of engagement, instead using a measure indicating general level of engagement. For example, the NICHD ECCRN (2005) used a global measure, which indistinctly considered both behavior and affect, with only three scale points (engaged, highly engaged, or unproductive). The present study is unique in that it employs

observational methods to assess the four dimensions of engagement described above: affective, behavioral, cognitive, and social.

Our perspective on student engagement is also similar to that of Fredricks et al. (2004) in that we take under consideration engagement's inherently dynamic quality. That is, we view levels of engagement as fluctuating over time, even within single lessons, as an interaction of student characteristics and teacher practices. The main implication of conceptualizing engagement in this way is that its units of analysis must be carefully considered, both in terms of the time intervals at which measurements are made, and in terms of whether measurements are made for individuals or for groups of students. Dolezal et al. (2003) and Taylor et al. (2000), for example, estimated the general level of engagement for entire classes every 5 - 15 minutes, whereas the NICHD ECCRN (2005) focused on a single target student during each classroom observation, rating the child's engagement during 80, 30-second intervals across a school day.

Similarly to the NICHD ECCRN (2005) study, we assess individual students' levels of engagement during 30-second intervals. However, in summary of our assessment method for engagement, we focus on four students per classroom rather than one, the intervals represent segmentation of a single reading lesson rather than a mixture of activities, and we assess students on four dimensions of engagement. We developed this alternative method to complement those used in previous studies and hopefully to provide specific insights into how changing features of the classroom context might relate to changing levels of student engagement. The focus on several students per classroom may enable consideration of individual variation in how students respond to scaffolding directed to the whole class or group of which they are a part, as well as how students

respond to individualized support from their teachers. Thus, our method of assessing student engagement is in line with the call from Fredricks and colleagues (2004) for techniques that enable exploration of the potentially additive qualities of engagement in different dimensions and of the interplay between environmental and student dynamics.

Research Questions

The current study examined reading comprehension outcomes, student engagement, task complexity, and teacher scaffolding during integrated reading-science instruction and traditional reading instruction, guided by the following questions: (1) To what extent do the observed classes differ in reading comprehension outcomes? (2) To what extent do the classes differ in the complexity of reading tasks provided during instruction? (3) To what extent does student engagement in the reading lessons differ between classes and across time within each lesson? (4) To what extent does teacher scaffolding vary with engagement? (5) To what extent do low- and high-achievers vary in engagement during one lesson, and how might any variation that they show relate to teacher scaffolding? This fifth question was of interest given the paucity of research on this topic, despite its practical relevance to instruction.

Method

Participants

Three Grade 4 classrooms were the focus of the study. The students and teachers from these classes were all participants in a broader, long-term project involving the implementation and evaluation of integrated reading-science instruction and its effects on reading achievement and motivation in comparison to traditional reading instruction in grades 3, 4, and 5 (Guthrie, Wigfield, Barbosa et al., 2004). As described by Guthrie,

Wigfield, and Perencevich (2004), the schools involved in this project are located in Frederick County, MD, a district with the following ethnic proportions of students: 87% European American, 8% African American, 2% Asian American, and 2% Hispanic American. Thirteen percent of the students qualified for free or reduced lunch.

The teacher of Class 1, which comprised 26 students, was a European American female with more than 10 years of teaching experience. The teacher of Class 2, which comprised 31 students, was a European American male with more than 5 years of teaching experience. Lastly, the teacher of Class 3, which comprised 23 students, was a European American female with more than 10 years of teaching experience.

In each classroom, four children were selected as focal students for the engagement analyses, two students who were relatively high-achievers and two students who were relatively low-achievers in comparison to their peers in their own classrooms. The background characteristics of these students are summarized in Table 1, with the number in the fourth column representing students' grade equivalency on the Gates-MacGinitie Reading Comprehension Test, the primary criterion used to determine children's achievement status. For students in Class 1, the Gates-MacGinitie scores reflect their achievement in December of fourth grade; for students in Classes 2 and 3, who completed the test in both September and December, their scores reflect the higher of their two test performances (unless they were absent on a testing date, in which case we report their only score).

Procedure

Overview. The teachers of Classes 1 and 2 implemented Concept-Oriented Reading Instruction (CORI), a reading program that integrates reading instruction with

science instruction for 90 - 120 minutes per day. Instruction included an emphasis on using reading comprehension strategies to learn about plant and animal survival in different biomes. These teachers had attended a professional development program for two weeks in the summer that focused on the implementation of this type of instruction. They also received a guidebook with lesson plans, an array of non-fiction and fiction trade books appropriate for students at different achievement levels, portfolios for each student with worksheets relevant to the strategies they were learning and the science themes they were exploring, and materials for science experiments related to the science topics they were reading about (for further details, see Guthrie, Wigfield, & Perencevich, 2004). In contrast, Class 3 received traditional reading instruction, as defined by three characteristics: use of a basal reader for instruction, a focus on basic skills rather than comprehension strategies, and no integration of reading instruction with the study of science topics.

Students in all three classes completed assessments of reading comprehension in September and December, before and after the 12-week reading intervention was implemented. These assessments included a measure of use of strategies for reading comprehension and a measure of comprehension of a short nonfiction passage. In addition, in mid-November, project staff videotaped one lesson in each classroom, which the teachers deemed typical of their method of reading instruction. Observer ratings of student engagement, literacy task complexity, and teacher scaffolding were based on these videos.

Measures

Reading comprehension strategy use. Performance on two tasks contributed to the assessment of reading strategy use. As detailed in Guthrie, Wigfield, Barbosa et al. (2004), these tasks were based on students' reading of one of three alternative forms of a packet of nonfiction text containing 75 pages in 22 sections, with 16 sections relevant to the topic of the packet (either Ponds and Deserts, Oceans and Forests, or Rivers and Grasslands) and 6 distracter sections. The sections varied in difficulty of text and inclusion of photographs and illustrations. Each packet contained a table of contents, index, and glossary. In the first task, after browsing the packet, students were given 15 minutes to compose "good" questions about what life is like and how animals and plants survive in the topic biome of their packet. In the second task, students were given two periods (10 minutes one day, 40 minutes the next) to search their packets and take notes on sections describing what organisms lived in each biome, how they survived, and how the biomes compared to each other. The teachers administered these assessments. From performance on these two tasks, a composite score for strategy use was formed for each student, equal to the sum of the number of questions composed and the number of relevant text sections searched.

Passage comprehension. Students received one of three alternative 500-word passages about the survival mechanisms of a particular kind of animal (e.g., snakes). They then completed a computer-based activity, proctored by project staff, in which they were presented 36 pairs of words from the passage and asked to decide whether each pair of words was highly related, moderately related, or not related. Using the computer program Pathfinder, each student's ratings were compared with those of an expert on the

topic to determine the similarity of their knowledge structures. The correlation between the student's and the expert's ratings represented the passage comprehension score for each student.

Segmentation of videos. To prepare for coding task complexity, student engagement, and scaffolding, each video was segmented, in several steps. First, each video was divided into the major activities that comprised it. For example, the video of Class 1 showed a whole class review discussion of the prior day's experiment involving celery plants, team observations of the celery plants, sharing of observations with the whole class, formation of questions about wetland plants in pairs, whole class discussion of the formation of these questions, whole class discussion of how to search information books and instructions for the upcoming search task, independent searching of information texts (consulting with partner as needed), and whole class sharing of answers.

Next, the segment of the video that represented the focus of the day's lesson was selected for the analyses of student engagement, literacy task complexity, and teacher scaffolding. The guidelines for selection were that the segment included the teacher in dialogue with the whole class or large group of students within the class and depicted students in reading and writing activities. Plus, the four focal students in each class needed to be largely visible during the segment. For Class 1, this segment consisted of the 30.5-minute time span in which the students and teacher discussed the students' self-composed questions about wetland plants (including how these questions related to students' prior knowledge about wetlands and what made them good questions), plus the discussion of search techniques and the independent work period during which students

conducted their searches. For Class 2, this segment consisted of a 20 minute time span in which the teacher and a group representing about one third of the students in the class held an integrated discussion about forming questions and searching for answers to them in information books about survival in wetlands. For Class 3, this segment consisted of a 32 minute time span in which students shared definitions of vocabulary words taken from a story in their basal reader, as well as shared sentences that they wrote using the words, which they revised based on general elaboration of the appropriate uses of these words by the teacher and individualized corrective feedback from her. Subsequently, these segments will be referred to as the lesson, with any references to occurrences before or after these segments termed "pre-lesson" and "post-lesson" events.

The lessons were then divided into 30-second intervals, on which the coding of student engagement and teacher scaffolding was based, as described in further detail below. For analysis of the engagement and scaffolding data as well as coding and analysis of task complexity, we also formed interval sets, by dividing the total number of intervals in each class, such that Class 1 was comprised of 10 sets of 6 intervals each, Class 2 was comprised of 10 sets of 4 intervals each, and Class 3 was comprised of 10 sets of 6 intervals each plus one set of 5 intervals. When the intervals were divided into sets, the pre-lesson period was considered the first interval of the first set. (Class 1 had two intervals and Class 2 had one "extra" interval at the end of the lesson that were not included in these sets.)

Literacy task complexity. The authors of this paper collaborated in their ratings of the literacy task complexity during each lesson based on a 13-point rubric, composed of a list of possible literacy task features, such as "requires reading a text of more than 2-3

sentences," and "likely to benefit from vocabulary knowledge." The full rubric is presented in Appendix A. For three sets of intervals for each class, we summed the number of features of task complexity that were evident from observation. The first set coded in each class, Set 4, represented student activity near the beginning of the lesson (once the lesson purpose and task procedure had been established). The second coded set, Set 7, represented the midpoint of student activity. The third coded set, Set 10 in Classes 1 and 2, and Set 9 in Class 3, represented the latter part of student activity.

Student engagement. For each 30-second interval of the lesson segments, we rated each student on the four dimensions of engagement – affective, behavioral, cognitive, and social, on 4-point scales. Indicators for each point, on each scale, were delineated by the study's authors. Through several rounds of independent and mutual viewing of this study's videotapes and several other videotaped lessons, we developed our coding rubric, which is presented in full in Appendix B. For example, affective engagement indicators included, but were not limited to, a rating of 1, representing a display of negative emotion or prolonged yawn; 2, a neutral expression or monotone response; 3, a smile or somewhat expressive tone; and 4, a broad grin or noises (e.g., "Ooh!") suggesting great enthusiasm. Behavioral engagement indicators included, but again were not limited to, a rating of 1, representing a complete distraction by something unrelated to the current task; 2, the student was neither clearly off-task nor actively participating; 3, definite on-task behavior, including writing, speaking, or listening; 4, a hand shooting into the air in response to a question. Based on 80 ratings (five ratings of each of the four students in one class on the four dimensions of engagement), two independent judges had overall exact agreement of 92.5%.

Each student's ratings on the affective, behavioral, and cognitive engagement scales were summed for each interval, to form the variable Total Engagement (TE), with a range of 3-12. This summation was done to simplify the analyses; it does not imply that we believe the dimensions of engagement carry equal "weight" in their impact on learning. That topic awaits further investigation. Social engagement was not included in total engagement because ratings for this variable were largely invariant, especially in Classes 2 and 3, where the activities did not prompt student collaboration

In addition, we calculated the mean TE for each interval in each class across the students in the class (only when there were two or more students' individual TE scores available for the interval). We then calculated the mean TE score for each set of intervals in each lesson, which we will refer to subsequently as the Set Total Engagement (Set TE), which ranged from 6.06 to 9.04.

Teacher scaffolding. Teacher practices providing motivational, cognitive, conceptual, or social support for engagement, which we inclusively consider scaffolds for engagement, were coded for each 30-second interval as well as the pre-lesson period. Based on theory and evidence regarding teaching practices that support student engagement in classroom activities (e.g., Guthrie & Wigfield, 2000), the coding rubric included these 11 categories: (a) strategy instruction, (b) knowledge goals, (c) availability of multiple interesting texts, (d) collaboration support, (e) autonomy support, (f) science process and reading-science connections, (g) competence support, (h) physical materials, (i) hands-on events, (j) lesson integrity, and (k) teacher feedback. The competence support category, for example, included (a) displays student work, (b) affirms student response, (c) personalizes display of student response (e.g., writes student's initials on

chart near their response), (d) handles student's mistake tactfully or positively, and (e) prompts student to read a harder book. We also recorded practices considered to undermine engagement, such as disorganized instructions and conveying a negative expectation that students will succeed at a task. The full rubric of teacher scaffolds and undermining practices is presented in Appendix C. The first author performed the initial coding of each class, and then reviewed and clarified the coding of each lesson in consultation with the second author. We then calculated a scaffold score for each interval of each lesson, equal to the number of scaffolds used in the interval minus the number of undermining behaviors observed. We also determined the mean scaffold score for each set of intervals for each lesson. Finally, in some of the analyses presented below, we distinguished scaffolds supporting the whole class or large group from those directed toward individual students.

Relation of high and low engagement to individual teacher attention. To prepare for an analysis of whether engagement related to specific teacher behaviors, students' highest and lowest points of engagement in classroom activities were identified by inspection of the individual TE scores for each interval. The number of "high points" and "low points" that were identified represented the number of times that each student scored at the extreme ends of their individual range for TE. The number of "high points" per student ranged from 1-6, whereas the number of "low points" per student ranged from 1-7. We then coded whether students' highest and lowest TE scores were preceded immediately by them receiving individual attention from the teacher, that is, the teacher called on the focal student to respond, or provided personal assistance or reminders while the student worked independently.

Results

For all three classes, we compared growth in reading comprehension strategy-use to performance, task complexity, student engagement, and teacher scaffolding, and the relation between engagement and individual teacher attention. In addition, for Class 1, we examined individual differences in engagement and responses to teacher scaffolding for low and high achievers.

Reading Strategy Use and Reading Comprehension Outcomes

Our first research question concerned the extent to which the three observed classes differed in two reading comprehension outcomes: strategy use and passage comprehension.

Strategy use. Paired sample t-tests revealed that the increases in strategy use for Class 1 and Class 2, as seen in Table 2, were significant, $t(17)=-3.91$, $p<.002$ and $t(23)=-5.86$, $p<.001$, respectively. In contrast, Class 3 did not gain significantly in strategy use from September to December. Furthermore, independent sample t-tests (based only on data from students who completed the measure at both test points) revealed that in September, there were no differences in strategy use among the classes. However, in December, Class 1 scored significantly higher than Class 3, $t(31)=1.76$, $p<.1$, but did not differ from Class 2. Class 2 also did not differ from Class 3 in December.

Passage comprehension. Independent sample-t tests (again, based only on data from students who completed the measure at both test points) demonstrated that the three classes did not differ in their Passage Comprehension scores in December (see Table 2). However, in December, Class 1 and Class 2 both performed much higher than Class 3, $t(26)=3.74$, $p<.01$ and $t(32)=-3.05$, $p<.01$, respectively. Class 1 and Class 2 did not differ

at this time point. Based on paired sample t-tests, the difference between September and December scores represented a significant gain for Class 2, $t(22)=-2.94$, $p<.01$, but for Class 1 the gain did not reach significance, $t(16)=-1.67$, $p<.12$. The decline of Class 3 was not significant.

Overall, then, Class 1 and Class 2 showed greater growth in reading strategy-use and reading comprehension across the 12 weeks that the study was conducted than did Class 3.

Task Complexity

The second set of analyses addressed the extent to which the classes differed in the complexity of reading tasks provided during instruction. As depicted in Figure 1, the complexity in each class varied both in that the level of complexity was different across classes and in that task complexity shifted somewhat over time within each class. Specifically, the level of task complexity in Class 1 was very high at the first two measurement points, with a slight decrease in complexity at the end of the lesson. For example, the task evaluated at the first point received a score of 12 for complexity because it included all the text complexity features described in the rubric in Appendix A, except item 7, connections to other texts. In Class 2, task complexity showed a similar pattern, although it was at a slightly lower overall than it was in Class 1. In Class 3, task complexity was relatively low throughout the lesson, with a slight increase at the last measurement point. For example, the task evaluated at the first measurement point included only four features of task complexity; namely, the task was based on a book which itself was complex, the task involved limited writing (i.e., individual sentences), performance of the task was likely to benefit from vocabulary knowledge, and

performance of the task was likely to benefit from interacting with and listening to other students.

To summarize the results attained thus far, it appears that Class 1 and Class 2 showed greater comprehension gains and experienced greater task complexity during the observed reading lessons than did Class 3. Through the next set of analyses, then, we aimed to see how student engagement fit into these developing classroom portraits.

Student Engagement

The third set of analyses addressed the extent to which student engagement in the reading lessons differed between classes and across time within each lesson. First, independent sample t-tests comparing the mean TE scores (based on all students' TE scores in all intervals) suggested that students in Class 3 (n=191 TE scores; M=7.90, SD=1.41) were more engaged in classroom activities than students in either Class 1 (n=161 TE scores; M=7.49, SD=1.41), $t(350)=-2.69$, $p<.01$ or in Class 2 (n=143 TE scores; M=6.82, SD=1.34), $t(332)=7.05$, $p<.001$. TE in Class 1 was also significantly higher than in Class 2, $t(302)=4.22$, $p<.001$.

We also were interested in whether the classes differed in their mean TE for each set of intervals. Figure 2 depicts these mean Set TE scores for each class. A series of ANOVAs with post-hoc comparisons was conducted to determine whether, and if so how, the classes differed in their TE scores for each set. As seen in Table 3, the classes showed no differences in TE for the first five sets. However, of the remaining sets, TE scores were different for all but Set 9. (Since Class 3 consisted of 11 sets, whereas the other two classes consisted of only 10, the final ANOVA for Set TE compares this final set for Class 3 with the final sets for Classes 1 and 2.)

We also conducted within-group ANOVAs to determine whether the level of engagement varied across sets within each class. These analyses revealed no differences in TE across sets in either Class 1 or Class 2. However, the ANOVA for Class 3 was significant using a less stringent value of alpha, $F(10, 49)=1.92$, $p<.1$. Post-hoc comparison tests revealed that students in Class 3 were more highly engaged during Set 6 than they were in Sets 3, 4, 5, 9 or 11, with all *p*-values <.05.

These analyses of student engagement in classroom activities revealed variation in engagement across classes, limited to the second half of the observation sets, with Class 3 typically scoring significantly higher than Class 2 and twice scoring higher than Class 1. Class 1 also scored higher than Class 2 in three sets. Yet, the analyses in the first two sections of results revealed that comprehension gains and task complexity were clearly greater for Classes 1 and 2 in comparison to Class 3, with little apparent difference in the comprehension gains or task complexity for Class 1 versus Class 2.

Teacher Scaffolding and Attention

The fourth question we addressed concerned the extent to which teacher practices related to engagement. To determine this construct, we used the teacher scaffolding of the whole class or a group to which the reading lesson was directed, as well as how the teacher attended to individual students.

Whole class or group scaffolding. To illustrate the differences and similarities in the scaffolding approaches taken by the three teachers, we created a chart showing the scaffolds apparent during the first and fourth interval sets of each lesson; this chart is Appendix D. We chose the first set in order to show how the teachers set up their lessons and the fourth set because students were well-involved in the main tasks of the lesson by

that point in each class. For instance, in the first set, all teachers provided clear instructions and structure for the tasks they set forth for their students. On the other hand, they each employed some unique scaffolds: Teacher 1 highlighted the content goals of the lesson, Teacher 2 reviewed the use of particular reading comprehension strategies (e.g., questioning), and Teacher 3 gave examples to illustrate the typical uses of the vocabulary words presented in the lesson.

As we were interested not only in the kinds of scaffolding employed, but also the pure number of scaffolds used, we conducted two series of ANOVAs and post-hoc comparisons similar to those used to analyze student engagement. The first series aimed to determine whether the classes differed in their mean scaffold score for each interval set. Since a point was subtracted for every undermining teacher behavior that occurred. It is crucial to note that the teacher of Class 1 demonstrated no undermining behaviors throughout the lesson and, therefore, received no deductions, whereas one point was subtracted from three intervals for the teacher of Class 2 and one point was subtracted from 17 intervals for the teacher of Class 3.

As seen in Figure 3, which shows the mean scaffold score for each set in each class, and Table 4, which shows the results of the ANOVA conducted for each set, the scaffolding provided by the teachers of Classes 1 and 2 at the beginning of the lesson was much greater than that provided by the teacher of Class 3. The scaffolding provided in Class 1 was especially greater in Sets 1 and 3. However, in the sets representing the middle segments of the lessons, the amount of scaffolding provided in Classes 2 and 3 was typically greater than that provided in Class 1. At the end of the lesson, the pattern changed again, with the scaffolding in Classes 1 and 3 both being at or near zero, while

the scaffolding in Class 2 continued at a low, but significantly higher level. (Again, since Class 3 consisted of 11 sets, whereas the other two classes consisted of only 10, the final ANOVA for the set scaffold scores compares this final set for Class 3 with the final sets for Classes 1 and 2.)

The ANOVAs and post-hoc comparisons conducted to determine whether the mean scaffold score varied across sets within each class revealed for Class 1 that teacher scaffolding declined significantly in Set 4, and remained near zero throughout the remainder of the lesson, during which time students were working independently and in pairs on the searching for information task that the beginning of the lesson had prepared them to complete, $F(9, 50)=21.36$, $p<.001$. In Class 2, the scaffolding at the beginning of the lesson (Sets 1 and 2) was likewise significantly higher than in the rest of the lesson, during which time the teacher and students continued engaging in dialogue related to the formation of questions about wetland plants and strategies for answering these questions, $F(9, 30)=5.09$, $p<.001$. During this time, the teacher provided some variety in this task, for example, by directing students to engage in choral reading at one point, and in silent reading at another point, as they searched texts for answers to their own and other students' questions. In Class 3, the scaffolding in Set 1 was also higher than in any other set, but since the scaffolding in this class did not start at as high a level as it did in the other two classes, the reduction in scaffolding in the remaining sets was not as dramatic, $F(10, 54)=6.15$, $p<.001$. Furthermore, the nature of the scaffolding and of the students' task did not change during this period; that is, students continued providing vocabulary definitions and sentences in a routine manner, with the teacher providing clarification of definitions as necessary and feedback on students' sentences. The largest decreases in

scaffolding, which occurred in Sets 10 and 11, coincided with the few minutes at the end of the lesson in which the students were directed to work independently at revising their sentences.

In sum, these analyses of teacher scaffolding directed toward the whole class or group demonstrate the patterns of scaffolding in each class. Classes 1 and 2 showed similar patterns of high scaffolding at the outset of the lesson, followed by a large reduction in scaffolding, to a level near zero in Class 1, and a very low level in Class 2. The scaffolding in Class 3 was also somewhat higher at the beginning of the lesson than in subsequent sets, but the decline was not as dramatic as in the other classes; furthermore, the scaffold scores in Class 3 frequently appeared lower due to the relatively high occurrence of teacher behaviors that may undermine engagement.

In the discussion section, we will relate these patterns of teacher scaffolding to the previous results demonstrating greater growth in comprehension outcomes as well as higher task complexity in Classes 1 and 2, yet equal or greater engagement in class activities in Class 3. First, however, we describe the findings concerning the relation of individual teacher attention to student engagement and the individual differences in engagement and responses to teacher scaffolding.

Individual teacher attention and student engagement. We conducted a Chi square test to evaluate whether there was an association between receiving individual teacher attention and showing particularly high or low engagement in class activities. This test was significant, $\chi^2(1, N=84)=7.74$, $p<.01$. Specifically, this analysis revealed that when the teacher directed individual attention toward a student, the probability that the student

was highly engaged was 76%, whereas when the teacher did not give students individual attention, the probability that student showed low engagement was 62%.

Individual Differences in Engagement and Responses to Teacher Scaffolding

Lastly, we address our fifth research question – to what extent do low- and high-achievers vary in engagement during one lesson, and how might any variation that they show relate to teacher scaffolding? We addressed this question by presenting an in-depth examination of individual differences in student engagement and responses to teacher scaffolding in Class 1.

First, we compared bivariate correlations among the four dimensions of engagement across all four students with the correlations among the dimensions for each individual student. As presented in Table 5, when we considered all students together in the analysis, all correlations among the dimensions were significant at $p \leq .01$.

However, examination of these correlations for individual students revealed that ratings on the affective and cognitive dimensions were not correlated for one low achiever (Student A), or for either higher achiever (Students C and D). There was also no relation between cognitive and social engagement for Student A, between affective and behavioral engagement for Student C, or between behavioral and social engagement for Student D.

Next, to show how engagement fluctuated for these individual students during the reading lesson in Class 1, we plotted the TE scores for each student for each interval, as shown in Figures 4 and 5.

We also examined the mean engagement ratings for each student for each dimension and for TE. There was little difference among the students' means on any

dimension. Independent sample t-tests comparing each student's mean TE with every other student's revealed that only the ratings for the two high achievers, Student C (M = 7.14) and Student D (M = 7.69), differed significantly, $t(76) = 2.30$, $p < .05$.

However, the low and high achievers showed different levels of fluctuation. As Figures 4 and 5 show, the ranges for the low achievers (7 for Student A, 8 for Student B) were broader than those of the high achievers (5 for both students). Also, the low achievers had larger standard deviations for TE (Student A, SD = 1.50; Student B, SD = 1.80) than the high achievers (Student C, SD = 1.20; Student D, SD = .90).

To analyze relations among student engagement and the classroom context, we identified teacher practices within the lesson that corresponded with increased, decreased, and sustained engagement. Increases and decreases were defined as changes of two or more points on the TE scale from one interval to the next. A sustained period was defined as having a TE score of 7 or above for at least three consecutive intervals. Since students were not visible or otherwise unable to be rated for 35% of the intervals, the number of changes and length of sustained periods of engagement are likely underestimated. Table 6 summarizes the number of changes and total time of sustained engagement for each student.

Our observations suggested that different practices influenced the engagement of students at different achievement levels. For example, engagement for both high achievers increased when the teacher posed a cognitively challenging question, but for low achievers it did not. In contrast, low achievers increased in engagement when the teacher asked students to share a question they had composed about wetland plants. Increases also occurred for low achievers when the teacher prompted them to continue

reading, but the high achievers needed no such prompts to maintain engagement during independent work. For all students, the practices associated with sustained engagement involved (a) knowledge goals for tasks, (b) availability of multiple texts well-matched to content goals, (c) strategy instruction, (d) choices of texts for reading, and (e) collaborative support (encouraging students to assist peers in answering their questions). Decreases in engagement were associated with the teacher calling on students who gave poor answers and students' fatigue.

As Figure 5 demonstrates, the scaffolding directed to the whole class early in the lesson sustained high achievers' engagement during the independent/pair work period from minutes 30-50 (except one low rating for Student C). In this period, this scaffolding sustained the low achievers for the first 8 minutes, as seen in Figure 4, with individualized teacher prompts needed to maintain engagement for the remaining time.

Discussion

One major finding of this investigation was that the two Grade 4 classes receiving integrated reading-science instruction (Classes 1 and 2) showed similarly strong growth in reading comprehension and reading strategy-use over time, whereas the fourth-grade class receiving traditional reading instruction (Class 3) did not demonstrate growth in these regards. In addition, the complexity of the literacy tasks in which students participated during the observed lessons appeared much greater in Classes 1 and 2 than in Class 3. It is important to note that the teachers of each class deemed these lessons that we observed typical of their daily reading instruction. In regard to student engagement in these lessons, a somewhat different pattern appeared. Overall, the students in Class 3 appeared the most highly engaged in the observed lesson, followed by the students in

Class 1, and then by the students in Class 2. Furthermore, close examination of the engagement of the low- and high-achieving students in Class 1 revealed individual differences in the degree to which engagement fluctuated across the lesson and in how ratings for different dimensions of engagement related to each other. In addition, low achievers' engagement levels spanned a broader range. Finally, different patterns, types, and amounts of teacher scaffolding directed toward the whole class or group appeared in each class.

These findings suggest that in elementary school classes with high reading comprehension two components are evident: (a)at least moderate engagement in learning and (b) high complexity of literacy tasks in which students are engaged. Although previous studies clearly indicate that engagement contributes to achievement (Fredricks et al., 2004), they do not explicitly address the possibility that the task type in which students are engaged may be crucial for producing engagement that leads to achievement gains. Also, in studies that do address how the classroom context relates to engagement (e.g., NICHD ECCRN, 2005), links between that engagement and achievement outcomes are not often investigated (Fredricks et al., 2004). Miller and Meece (1997), however, reported that regularly participating in cognitively challenging, complex reading and writing tasks fostered student learning and motivation over time. Thus, although engagement was not directly measured in their study, from it followed the idea that students should demonstrate engagement in ongoing complex tasks in their classrooms. The present study provides evidence in this regard, because in classes with stronger growth in reading comprehension, students showed engagement in complex literacy tasks. It also presents the interesting case of students demonstrating apparently high

interest and enthusiasm in a lesson involving tasks that were not complex, and not showing comprehension gains over time.

The present study also suggests that the pattern of scaffolding that teachers employ may play a key role in facilitating student engagement in complex tasks that translates into achievement gains. Specifically, in Classes 1 and 2, it appeared that the high initial scaffolding level, followed by large reductions in the amount of scaffolding provided to the whole class as students grasped the task demands, enabled the students to maintain their engagement in complex tasks, with occasional prompts to maintain engagement provided to individual students. These tasks involved the reading of extended texts to extract information that they could integrate with their prior knowledge to answer conceptual questions regarding survival in different habitats, In contrast, the relatively consistent moderate level of scaffolding provided to Class 3 seemed necessary (and seemed to work effectively) to keep the students engaged in the relatively simple task of using the basal glossary to define vocabulary words and appropriately use them in sentences. An issue to examine in future research, therefore, is how students would respond in terms of engagement if their teacher provided little or inappropriate kinds of scaffolding for a complex task.

Furthermore, the finding that the teachers of the two classes that demonstrated greater reading comprehension gains implemented a greater number and variety of scaffolds during the lessons aligns with other research demonstrating that this is a characteristic of effective teachers (Bogner et al., 2002; Dolezal et al; 2003).

As also found by Bogner et al. (2002) and Dolezal et al. (2003), the two teachers in the present study who employed a large diversity of scaffolds exhibited little to no

undermining behaviors, whereas the teacher of the class that did not gain in comprehension frequently appeared to undermine her students' engagement. For example, the teacher of Class 3 exhibited such undermining behaviors as expressing doubt to her students that they would succeed in understanding challenging vocabulary words and forbidding eager students to go ahead in their assigned reading.

In addition to supporting theoretical links among engagement, teacher scaffolds or practices, task characteristics, and academic gains, this study illustrates the value of following Fredricks et al.'s (2004) methodological recommendation of measuring engagement as a multidimensional and dynamic construct. In particular, using a microanalytical observational technique demonstrated that some dimensions of engagement appear to correlate more strongly than others. For example, we found consistently strong, positive correlations between cognitive and behavioral engagement for the four students in Class 1, but a strong, positive correlation between cognitive and affective engagement for only one student. Focusing on individual students in our engagement observations also enabled us to discern individual fluctuations among students, and track how they responded similarly and differently to various types of teacher scaffolding. For example, teacher attention was strongly associated with especially high engagement for all students. Qualitative assessments also suggested that teacher scaffolding influenced high and low achievers differently, with the low achievers more often requiring teacher attention beyond the scaffolding provided to the class as a whole to sustain engagement during independent work time.

Despite the advantages this method of assessing student engagement afforded, it also had some limitations, as did the study in general. First, the intensive procedure of

rating student engagement allowed us to only focus on a few students and single lessons in each class. We have some evidence that the lessons were representative of the teachers' typical instruction, but the students were selected on the basis of their relatively high and low achievement status in their classes in order to discern how well teachers support the engagement of diverse students. Therefore, it is unknown if focusing on average-achieving students would reveal different levels of and variations in engagement. Second, it is also unknown whether observational ratings of student engagement correspond with student perceptions of their own engagement, and, if they do not correspond, if one or the other is more predictive of student outcomes. Third, as described by Fredricks et al. (2004), it may be particularly difficult to disentangle observational measures of cognitive and behavioral engagement, and definition of these constructs needs to be more clearly specified in general. Related to the study on the whole, the involvement of only three Grade 4 classes clearly limits the generalizability of our findings. In addition, we did not use norm-referenced measures to compare gains in comprehension. Future research could address these and other limitations.

In sum, this study provided new insights into relations among student engagement, teacher scaffolding, task complexity, and reading comprehension in elementary school classrooms. The use of intensive videotaped observations for assessing student engagement as a dynamic, multidimensional construct especially facilitated understanding of how teacher scaffolding related to student engagement in the three observed classes. Such detailed portraits of the interactions between teachers and students in highly specified classroom contexts may help researchers construct more complete

models of instruction for promoting diverse students' engagement in learning and academic success.

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Appendix A

Literacy Task Complexity Rubric

To form the complexity score, sum the number of positive answers to the following questions:

1. Does the task involve reading a text of more than 2-3 sentences?
2. Does it require a response of deep comprehension?
3. Is it linked to a large network of literary or content themes?
4. Does it benefit from or require interaction with other students, or listening to them?
5. Does it involve writing at all?
6. Does it involve writing of extended material (i.e., several connected sentences or more)?
7. Does it require making connections to other texts?
8. Does it relate to students' non-literacy activities (e.g., observations, discussions, presentations)?
9. Is it likely to benefit from strategies for reading?
10. Is it likely to benefit from vocabulary knowledge?
11. Is it likely to benefit from background knowledge of a domain or genre?
12. Is it under student control in terms of selecting text, task, or knowledge display?
13. Is it based on a book (including a basal reader) which itself is complex?

Appendix B

Student Engagement Rubric

Affective Engagement

1: Displays negative emotion; sighs; looks very bored; prolonged yawn; head completely down on desk

2: Even expression; head partially down but may still be looking toward teacher/classmates; responds in monotone

3: Smiling (perhaps just briefly); looks pleased; appears interested; tone suggests some pride/interest

4: Grins broadly or suddenly; tone suggests great excitement or interest; makes noises (e.g., "ooh") which suggest great interest

Behavioral Engagement

1: Distracted by something unrelated to task; head completely down on desk (i.e., not participating in task); teacher has to tell student to get to work; prolonged yawn

2: Hard to judge whether student is truly behaviorally engaged; not off-task, but does not appear particularly involved; eyes may or not be on teacher, but does not seem to really be following discussion or actively engaged in activity; may be slouching

3: Clearly on-task, as suggested by eye movement and posture towards speaker; raising hand (perhaps just briefly); writing; speaking; clearly listening (suggesting that student is attentive at least behaviorally)

4: Waving hand; hand "shoots" into air to answer question; making noises that suggest great enthusiasm and eagerness to participate; otherwise seems "super-engaged"

Cognitive Engagement

1: Response reveals student was not paying attention to question or instructions; completely off-task (suggesting that student is not thinking about given task)
2: Hard to judge whether student is truly cognitively engaged; flipping book pages quickly without really looking at any
3: Raising hand; writing; speaking; provides brief answer (e.g., one or two words); reading; eye movement and posture suggest that student is following along with activity; clearly listening (suggesting that student is processing information)
4: Response reveals student was thinking very hard; response is extensive (Note: student must speak in order to receive this rating)

Social Engagement (based primarily on student-student interactions or situation in which response to teacher is public)

1: *Teacher* prompts social interaction and students do not respond; student teases, laughs at, or criticizes another
2: *Teacher* prompts social interaction and interaction that results is minimal; student turns toward classmate that is speaking; student half-raises hand when responses are solicited by the teacher; student is called on without raising hand and responds readily; social interaction not explicitly warranted by current activity and student does not initiate it on his/her own
3: Students exchange activity-related comments; *students* initiate interaction; *teacher* initiates interaction and student interacts positively and/or with eagerness; student fully extends hand, reflecting desire to share response or unsolicited comments
4: Similar to 3, but interaction is extended or marked overall by great enthusiasm/intensity

Appendix C

Teacher Scaffolding Rubric

Strategy Instruction

1-1) Highlights strategy instruction in lesson

1-2) Appropriately scaffolds strategy instruction for whole class/group

1-3) Elicits student-composed questions

1-4) Selects student to serve as strategy use model

1-5) Scaffolds use of knowledge to verify question/answer quality

1-6) Refers to students' previous use of strategy

1-7) Recommends specific strategies for understanding vocabulary

1-8) Reviews strategy use

1-9) Presents cognitive challenge – open question

1-10) Presents cognitive challenge – closed question

Knowledge Content Goals

2-1) Highlights content goals

2-2) Reviews conceptual knowledge related to current lesson

2-3) Expresses high expectations for learning from text

2-4) Selects student to serve as knowledge model

2-5) Presents cognitive challenge – open question

2-6) Presents cognitive challenge – closed question

2-7) Calls on relatively high student to answer content question when other students have given irrelevant answers

2-8) Elaborates or connects response to prior knowledge/experience

2-9) Elaborates meaning or gives example showing typical use of vocabulary word

2-10) Prompts student to elaborate shared response

Interesting Texts

3-1) Matches texts to content goals

3-2) Matches texts to strategy use

3-3) Has diverse levels of text present for all readers

3-4) Displays books in accessible manner

3-5) Prompts whole book reading

3-6) Creates book anticipation

Autonomy Support

4-1) Permits students to make significant decisions (e.g., book choice)

4-2) Renders some control over learning (e.g., questions to ask)

4-3) Encourages negotiation of tasks with regard to interest, procedure, difficulty

4-4) Emphasizes that time on task may vary

4-5) Gives procedural choice

Collaborative Support

5-1) Has students collaborate on complex tasks

5-2) Creates tasks that involve mutual dependency

5-3) Emphasizes cooperation

5-4) Establishes groups that are mixed in ability

5-5) Makes teams accountable for learning

5-6) Specifies how collaboration should proceed

5-7) Encourages students to help each other out as needed

5-8) Encourages indirect collaboration (e.g., asks rest of group to help student out)

Science Process and Reading-Science Connections

6-1) Makes reading and science connections evident and seamless

6-2) Makes explicit book connection to science concepts/processes

6-3) Encourages students to compare and contrast texts and their science observations

Competence Support

7-1) Displays student work

7-2) Affirms student response (e.g., praises, repeats)

7-3) Personalizes display of response (e.g., writes question on chart with initials)

7-4) Handles student's mistake/weak response tactfully and/or positively

7-5) Prompts student to read harder book

Physical Materials

8-1) Uses poster paper to recording student questions

8-2) Refers to core concepts posters related to knowledge goals

8-3) Sits at student tables while assisting students

8-4) Refers to strategy chart

8-5) Gives students special materials for individual use (e.g., post-its)

8-6) Uses worksheets from science portfolios

Hands-on Events

9-1) Includes/refers to hands-on science observations during lesson

Lesson Integrity

10-1) Varies reading activity

10-2) Gives clear instructions/structure for task

10-3) Rephrases instructions

10-4) States secondary purpose of task (e.g., identify words for ecology dictionary)

10-5) Directs question about task progress to whole class

10-6) Rephrases or clarifies question directed to class

10-7) Holds students accountable for making effort to fix/understand work

10-8) Reminds students of overall goal

10-9) Summarizes lesson, with student input

Teacher-Student Interaction/Discourse

11-1) Checks students' understanding of task (e.g., "Any questions?")

11-2) Attends to individual student, with appropriate level of scaffolding

11-3) Asks "Who would like to share their answer?"

11-4) Prompts student to pay attention (e.g., touches arm, says name)

11-5) Complements whole class (e.g., for working hard)

11-6) Prompts whole class to respond to yes/no questions/show thumbs-up/down

11-7) Routinizes student/teacher response interaction

11-8) Provides short, frequent reminders about task process (e.g., "Draw what you see!")

11-9) Handles irrelevant question/comment efficiently/tactfully

11-10) Repeats/re-states student response for clarification purposes (or asks student to make re-statement)

11-11) Expresses hope that students will do well on task

Undermining

12-1) Conveys teacher as audience that needs to be pleased

12-2) Emphasizes performance goal (e.g., vocabulary test)

12-3) Does not permit use of dictionary

12-4) Expresses negative expectation that students will succeed at task

12-5) Expresses dismay when students give inappropriate answers

12-6) Forbids students from going ahead in their assigned reading

12-7) Gives disorganized procedural instructions

12-8) Permits class to move freely around classroom

12-9) Misinterprets student's statement

Appendix D

Teacher Scaffolds Observed During Two Sets of Intervals

	Set 1
Class 1	Strategy Instruction
	1-1) Highlights strategy instruction in lesson
	1-2) Appropriately scaffolds strategy instruction for whole class/group
	1-3) Elicits student-composed questions
	1-4) Selects student to serve as strategy use model
	1-5) Scaffolds use of knowledge to verify question/answer quality
	Knowledge Content Goals
	2-1) Highlights content goals
	2-2) Reviews conceptual knowledge related to current lesson
	2-3) Expresses high expectations for learning from text
	2-5) Presents cognitive challenge – open question
	2-6) Presents cognitive challenge – closed question
	2-8) Elaborates or connects response to prior knowledge/experience
	Interesting Texts
	3-1) Matches texts to content goals
	3-2) Matches texts to strategy use
	3-3) Has diverse levels of text present for all readers
	3-4) Displays books in accessible manner
	3-6) Creates book anticipation
	Collaborative Support
	5-1) Has students collaborate on complex tasks
	5-3) Emphasizes cooperation
	5-4) Establishes groups that are mixed in ability
	5-5) Makes teams accountable for learning

Reading-Science Connections

6-1) Makes reading and science connections evident and seamless

6-2) Makes explicit book connection to science concepts/processes

Competence Support

7-1) Displays student work

7-2) Affirms student response (e.g., praises, repeats)

7-3) Personalizes display of response (e.g., writes question on chart with initials)

Physical Materials

8-1) Uses poster paper to recording student questions

8-2) Refers to core concepts posters related to knowledge goals

Hands-on Events

9-1) Includes/refers to hands-on science observations during lesson

Lesson Integrity

10-2) Gives clear instructions/structure for task

Teacher Feedback/Dialogue

11-7) Routinizes student/teacher response interaction

Class 2	Strategy Instruction
	1-1) Highlights strategy instruction in lesson
	1-8) Reviews strategy use
	Knowledge Goals
	2-2) Reviews conceptual knowledge related to current lesson
	Interesting Texts
	3-1) Matches texts to content goals
	3-2) Matches texts to strategy use
	3-3) Has diverse levels of text present for all readers
	3-4) Displays books in accessible manner
	3-5) Prompts whole book reading
	Autonomy Support
	4-5) Gives procedural choice
	Reading-Science Connections
	6-1) Makes reading and science connections evident and seamless
	6-2) Makes explicit book connection to science concepts/processes
	Physical Materials
	8-2) Refers to core concepts posters related to knowledge goals
	8-4) Refers to strategy chart
	8-6) Uses worksheets from science portfolios
	Lesson Integrity
	10-2) Gives clear instructions/structure for task
	Teacher Feedback/Dialogue
	11-1) Checks students' understanding of task (e.g., "Any questions?")
	11-3) Asks "Who would like to share their answer?"
	11-4) Prompts student to pay attention (e.g., touches arm, says name)
	11-6) Prompts whole class to respond to yes/no questions/show thumbs-up/down

	11-10) Repeats/re-states student response for clarification purposes (or asks student to make re-statement)
	Undermining
	12-7) Gives disorganized procedural instructions
	12-8) Permits class to move freely around classroom
Class 3	Knowledge Goals
	2-4) Selects student to serve as knowledge model
	2-9) Elaborates meaning or gives example showing typical use of vocabulary word
	Autonomy Support
	4-1) Permits students to make significant decisions
	Competence Support
	7-2) Affirms student response (e.g., praises, repeats)
	7-4) Handles student's mistake/weak response tactfully and/or positively
	Lesson Integrity
	10-2) Gives clear instructions/structure for task
	Teacher Feedback/Dialogue
	11-7) Routinizes student/teacher response interaction
	11-8) Provides short, frequent reminders about task process
	11-11) Expresses hope that students will do well on task
	Undermining
	12-1) Conveys teacher as audience that needs to be pleased
	Set 4
Class 1	Autonomy Support
	4-3) Encourages negotiation of tasks with regard to interest, procedure, difficulty
	Collaborative Support
	5-2) Creates tasks that involve mutual dependency
	5-6) Specifies how collaboration should proceed
	Teacher Feedback/Dialogue

	11-1) Checks students' understanding of task (e.g., "Any questions?")
Class 2	Strategy Instruction
	1-2) Appropriately scaffolds strategy instruction for whole class/group
	Knowledge Goals
	2-5) Presents cognitive challenge – open question
	2-6) Presents cognitive challenge – closed question
	2-10) Prompts student to elaborate shared response
	Collaborative Support
	5-8) Encourages indirect collaboration (e.g., asks rest of group to help student out)
	Competence Support
	7-2) Affirms student response (e.g., praises, repeats)
	Physical Materials
	8-4) Refers to strategy chart
	Lesson Integrity
	10-1) Varies reading activity
	Teacher Feedback/Dialogue
	11-10) Repeats/re-states student response for clarification purposes (or asks student to make re-statement)
Class 3	Knowledge Goals
	2-9) Elaborates meaning or gives example showing typical use of vocabulary word
	2-10) Prompts student to elaborate shared response
	Autonomy Support
	4-1) Permits students to make significant decisions (e.g., book choice)
	Competence Support
	7-2) Affirms student response (e.g., praises, repeats)
	Teacher Feedback/Dialogue
	11-3) Asks "Who would like to share their answer?"
	11-7) Routinizes student/teacher response interaction

11-8) Provides short, frequent reminders about task process

Undermining

12-1) Conveys teacher as audience that needs to be pleased

12-4) Expresses negative expectation that students will succeed at task

Table 1

Characteristics of Focal Students for Engagement Analyses

Student	Class	Gender	Ethnicity	Gates-MacGinitie Grade Equivalent	Achievement Status
A	1	M	African American	2.5	Low
B	1	F	Hispanic American	4.3	Low
C	1	F	European American	6.5	High
D	1	M	European American	7.4	High
E	2	M	European American	3.3	Low
F	2	M	Hispanic American	3.8	Low
G	2	F	African American	5.0	High
H	2	F	Hispanic American	5.3	High
I	3	F	European American	3.2	Low
J	3	M	European American	4.0	Low
K	3	F	European American	7.0	High
L	3	M	European American	7.9	High

Table 2

Summary of Reading Comprehension Scores

	Strategy use			Passage comprehension		
	n	Sept. *M* (*SD*)	Dec. *M* (*SD*)	*n*	Sept. *M* (*SD*)	Dec. *M* (*SD*)
Class 1	18	11.83 (4.63)	15.17 (3.09)	17	.41 (.12)	.47 (.14)
Class 2	24	9.13 (4.79)	14.33 (3.19)	23	.35 (.17)	.44 (.16)
Class 3	15	11.73 (4.79)	12.20 (6.34)	11	.37 (.25)	.26 (.15)

Table 3

Comparisons of Set Total Engagement Scores across Classes

Set	*F* (df), *p*	Class comparisons
1	$F(2, 7)=1.24$, $p>.05$	___
2	$F(2, 10)=2.66$, $p>.05$	___
3	$F(2, 12)=.99$, $p>.05$	___
4	$F(2, 13)=.06$, $p>.05$	___
5	$F(2, 11)=1.43$, $p>.05$	___
6	$F(2, 11)=19.55$, $p<.001$	3>2, $p<.001$
		3>1, $p<.01$
		1>2, $p<.05$
7	$F(2, 12)=10.62$, $p<.01$	3>2, $p<.01$
		3>1, $p<.05$
8	$F(2, 10)=4.26$, $p<.05$	3>2, $p<.05$
9	$F(2, 9)=.67$, $p>.05$	___
10	$F(2, 10)=27.35$, $p<.001$	3>2, $p<.001$
		1>2, $p<.001$
Final	$F(2, 9)=5.77$, $p<.05$	1>2, $p<.01$
		3>2, $p<.05$

Table 4

Comparisons of Set Scaffold Scores across Classes

Set	*F* (df), *p*	Class comparisons
1	$F(2, 13)=4.41$, $p<.05$	1>3, $p<.05$
2	$F(2, 13)=6.14$, $p<.05$	2>3, $p<.01$
		1>3, $p<.05$
3	$F(2, 13)=17.75$, $p<.001$	1>3, $p<.001$
		1>2, $p<.01$
4	$F(2, 13)=3.25$, $p>.05$	___
5	$F(2, 13)=19.50$, $p>.001$	3>1, $p<.001$
		3>2, $p<.05$
		2>1, $p<.05$
6	$F(2, 13)=2.5$, $p>.05$	___
7	$F(2, 13)=16.15$, $p<.001$	3>1, $p<.001$
		2>1, $p<.01$
8	$F(2, 13)=5.26$, $p<.05$	2>1, $p<.05$
		3>1, $p<.05$
9	$F(2, 13)=32.95$, $p>.001$	2>1, $p<.001$
		3>1, $p<.001$
10	$F(2, 13)=13.26$, $p<.01$	2>1, $p<.001$
		2>3, $p<.01$
Final	$F(2, 12)=32.40$, $p<.001$	2>3, $p<.001$
		2>1, $p<.001$

Table 5

Correlations among Dimensions of Engagement for Class 1

Correlations among	*r*	*N*
affective-behavioral	.44	162
affective-cognitive	.23	162
affective-social	.47	164
behavioral-cognitive	.72	165
behavioral-social	.49	164
cognitive-social	.39	164

Table 6

Changes in Engagement and Length of Sustained Engagement for Students in Class 1

Student	Number of increases	Number of decreases	Increases plus decreases	Summed sustained engagement (minutes)
A (Low Ach.)	1	7	8	12
B (Low Ach.)	8	2	10	9
C (High Ach.)	3	0	3	9
D (High Ach.)	2	4	6	8.5

Figure 1. Task complexity of reading lessons.

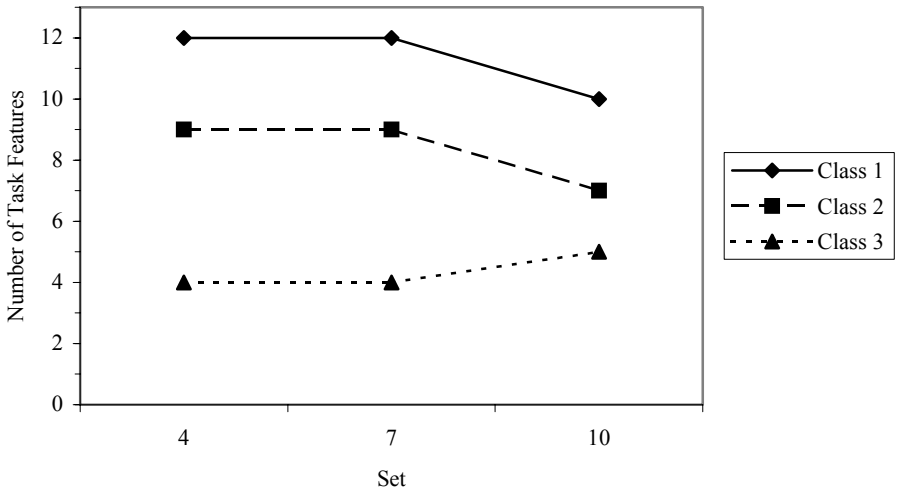

Figure 2. Mean student engagement in reading lessons.

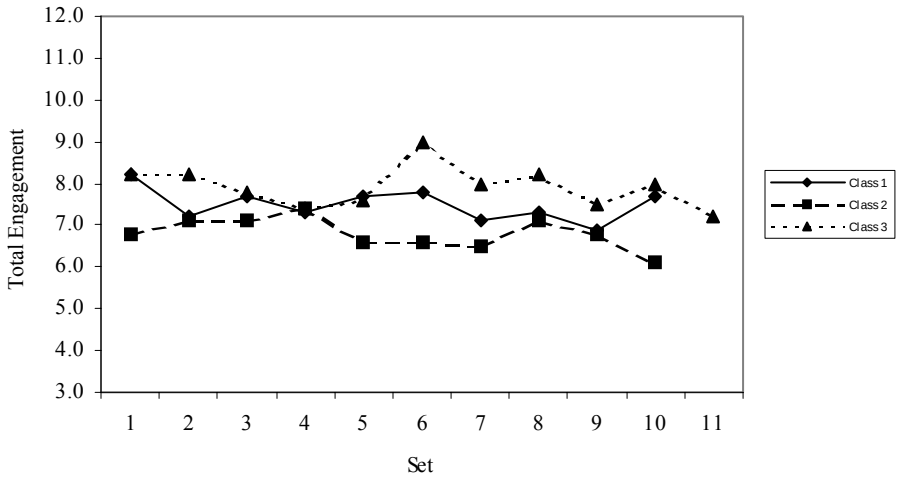

Figure 3. Whole class/large group-directed scaffolding of reading lessons.

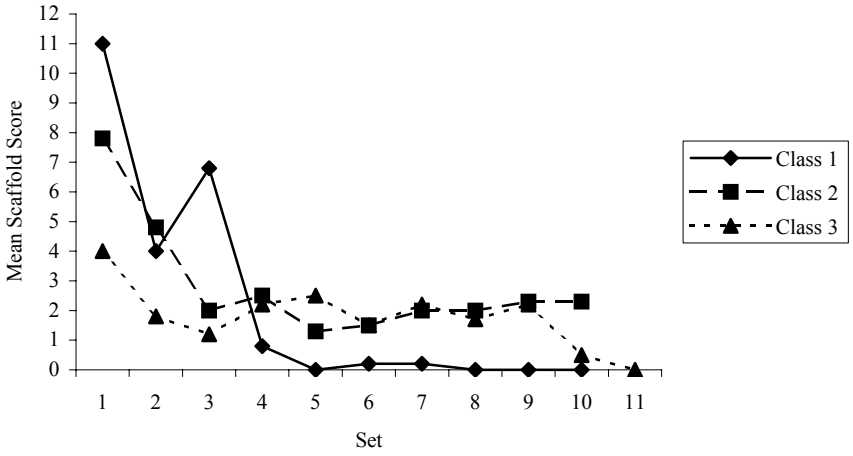

Figure 4. Total engagement of low achievers across time in Class 1.

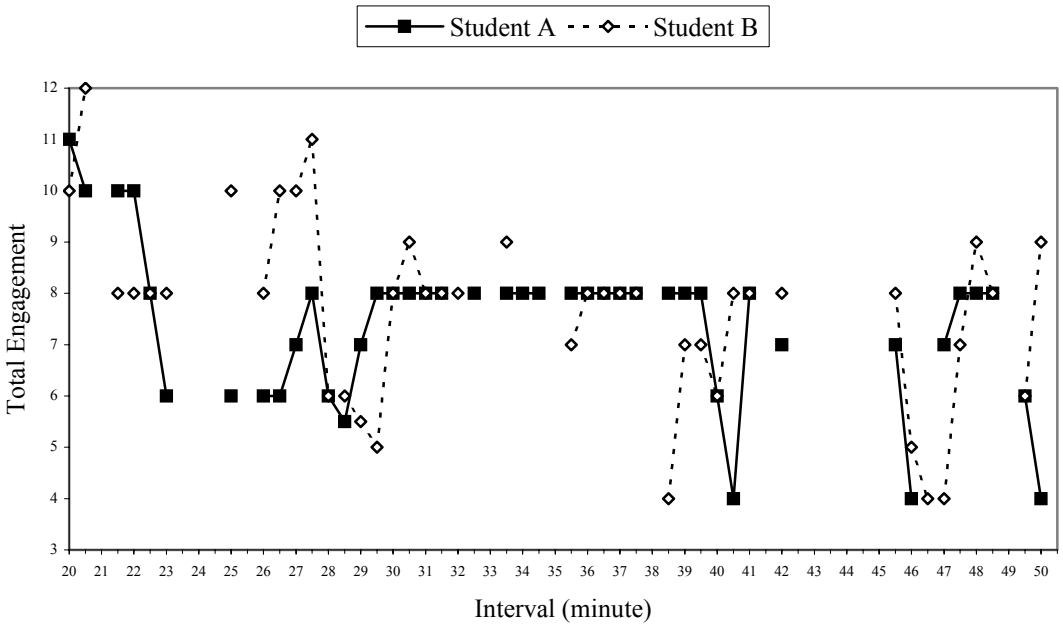

Figure 5. Total engagement of high achievers across time in Class 1.