Influences of Stimulating Tasks on Reading Motivation and Comprehension

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ABSTRACT One theoretical approach for increasing intrinsic motivation for reading consists of teachers using situational interest to encourage the development of long-term individual interest in reading. The authors investigated that possibility by using stimulating tasks, such as hands-on science observations and experiments, to increase situational interest. Concurrently, the authors provided books on the topics of the stimulating tasks and teacher guidance for reading to satisfy curiosities aroused from the tasks. Students with a high number of stimulating tasks increased their reading comprehension after controlling for initial comprehension more than did students in comparable intervention classrooms with fewer stimulating tasks. Students' motivation predicted their level of reading comprehension after controlling for initial comprehension. The number of stimulating tasks did not increase reading comprehension on a standardized test when motivation was controlled, suggesting that motivation mediated the effect of stimulating tasks on reading comprehension. Apparently, stimulating tasks in reading increased situational interest, which increased longer term intrinsic motivation and reading comprehension.

Key words: intrinsic motivation, reading motivation and comprehension, stimulating tasks

Motivation for reading is an important contributor to students' reading achievement and school success. Researchers have shown that, especially for students in Grades 3–5, motivation for reading predicts reading achievement on standardized tests (Gottfried, 1985) and school grades (Sweet, Guthrie, & Ng, 1998). In those grades, motivation for reading is differentiated from motivation for other subjects, such as science, social studies, or mathematics, and reading motivation is not easily subsumed into motivation for schooling.

Although reading motivation contributes directly to reading comprehension independent of its influence on children's amount and breadth of reading (Wang & Guthrie, 2004), Wigfield and Guthrie (1997) documented that reading motivation correlates with students' amount of reading. That finding is important because students' self-initiated reading, which also has been called *print exposure*, predicts their knowledge about such topics as history, science, and literature (West & Stanovich, 1995), as well as their proficiency in vocabulary and reading comprehension when background variables of past achievement and parent income are controlled (Cunningham & Stanovich, 1998; Guthrie, Schafer, & Huang, 2001; Stanovich & Cunningham, 1993). Therefore, we investigated whether classroom practices and education programs can influence reading motivation and thereby increase reading comprehension.

The engagement perspective on reading comprehension by Guthrie and Wigfield (2000) provided the broad theoretical framework for this study. They proposed that engagement in reading involves interactions with text that are motivated and strategic. They reviewed evidence showing that when students are engaged in reading, they comprehend better and have stronger reading outcomes than when they are not engaged. Guthrie and Wigfield also presented evidence that reading motivation predicts children's amount of reading, which, in turn, predicts reading comprehension (e.g., Guthrie, Wigfield, Metsala, & Cox, 1999), findings that show the important role of reading motivation in reading comprehension. Finally, the authors discussed instructional practices that can increase reading motivation and reading comprehension and focused on the following practices: (a) providing content goals for reading, (b) supporting student autonomy, (c) providing interesting texts, (d) facilitating social interactions related to reading, (e) maintaining warm relations between teachers and students, and (f) using hands-on activities to spark interest. We focused on the relationship of hands-on activities to reading engagement.

An expanding body of research is shedding light on instructional practices that increase elementary and secondary school students' motivation to read. Drawing on a meta-analysis of 22 investigations (Guthrie & Humenick, 2004), book-length treatments of that issue (Stipek, 2002), qualitative studies of motivating teachers (Dolezal, Welsh, Pressley, & Vincent, 2003), and the synthesis of research on characteristics of engaging schools (Stipek, 2004), we

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identified seven major instructional practices that increase motivation for reading and reading comprehension.

1. Using content goals for reading instruction expands students' interest and motivation. Interested students focus on gaining meaning, building knowledge, and understanding deeply, rather than on learning skills or gaining rewards. For example, when fifth graders received content-learning goals for reading, they increased their reading comprehension more than when they received performance goals of scoring well on tests (Grolnick & Ryan, 1987).

2. Affording students choices in the classroom is a well-supported motivational practice. When students can choose (a) the texts they read, (b) the tasks they perform with the texts, or (c) their partners during instruction, their intrinsic motivation for reading increases (Reynolds & Symons, 2001), as well as their time spent on reading activities (McLloyd, 1979).

3. Properties of texts increase interest. When a topic is rated as interesting (Schiefele, 1999), when the format is appealing to students (Schraw, Bruning, & Svoboda, 1995), and when materials are relevant to students' purposes in knowledge-development activities (Schraw & Dennison, 1994), interest and motivation increase.

4. Social goals or cooperative-learning structures in reading activities improve students' motivation and achievement (Isaac, Sansone, & Smith, 1999; Wentzel, 1993).

5. Teacher involvement, which refers to students' perception that the teacher understands them and cares about their progress, is associated with intrinsic motivation for academic activities (Skinner, Wellborn, & Connell, 1990; Wentzel, 1993).

6. Extrinsic rewards and praise include such activities as reading for Pizza Hut prizes or working for recognition in reading (Nolen & Nichols, 1994). Extrinsic rewards for reading are controversial, and, under some circumstances, undermine intrinsic motivation, which energizes long-term reading activities.

7. Emphasizing mastery goals in the classroom is a practice supported by most motivation theorists (Ames, 1992). When students read for mastery, they seek to (a) gain knowledge from text, (b) understand stories fully, and (c) grasp the essence of literary texts, such as legends or poetry. When teachers emphasize such goals, students internalize them and become more self-determining learners, which increases their achievement in the long term (Ryan & Deci, 2000).

A motivation-enhancing instructional practice that has received little research attention is the use of stimulating tasks to arouse interest. In an extended literature review, Hidi and Harackiewicz (2000) argued that educators should attempt to increase motivation for academic activities through increased situational interest. They stated that "situational interest is generated by certain conditions and/or stimuli in the environment that focus attention and that represent the more immediate affective reaction that may or may not last" (p. 152). The authors suggested that "by focusing on the enhancement of situational interest in classrooms, educators can find ways to foster students' involvement in specific content areas and increase levels of academic motivation" (p. 153). They proposed further that "creating environments that stimulate situational interest is one way for schools to motivate students and help them make cognitive gains in areas that initially hold little interest for them" (p. 156). If we accept the recommendations of Hidi and Harackiewicz, then our next issues of concern are "(1) identifying educational interventions that can trigger situational interest and (2) identifying interventions that will promote maintenance of situational interest over time" (p. 156). Our challenge is to identify classroom practices or activities or both that will evoke situational interest related to reading.

To garner insight into classroom practices that may influence situational interest, several investigators have surveyed teachers. In an assessment of 178 elementary school teachers, Nolen and Nichols (1994) found that the teachers rated use of stimulating tasks as the best way to maintain student motivation. The teachers also reported that providing stimulating tasks was among the most highly rated practices that increased motivation for unmotivated students. The meaning of "stimulating tasks" was not clearly defined by Nolen and Nichols, but it referred generally to teachers giving students tasks that stimulated them to think in new ways. According to elementary and secondary school teachers, a stimulating task consisted of providing a hands-on activity.

In a survey in which 65 teachers composed extended essays about their motivational practices, they all chose hands-on activities as the most popular practice (Zahorik, 1996). According to Zahorik, *hands-on activities* consisted of a range of interactions in which students used manipulatives, role-played, or engaged in projects such as growing seedlings in science or making television commercials in Spanish. A majority of Grade 8 teachers concurred by noting that providing hands-on experiences and projects resulting in the creation of concrete products was their principal practice for motivating students to learn (Hootstein, 1995). Consistent with those findings was a survey of 68 teachers in Grades 3–6, who reported that motivational activities related to reading comprehension instruction were needed more often for unmotivated students than for motivated students. The teachers reported that the motivation of low-achieving students increased when books were connected to activities in which these students participated and enabled the students to read about a specialized extracurricular activity (Sweet et al., 1998).

One prominent type of stimulating task is the hands-on activity. However, that practice has not been studied experimentally for an examination of its effect on students' reading motivation or reading comprehension. Although Hidi and Harackiewicz (2000) suggested that the practice appears to be promising for increased situational interest, the question arises of how the stimulating task of hands-on activities can be transferred from the immediate, temporary effect of arousing interest to long-term, lasting effects on reading motivation and reading comprehension.

Our theoretical perspective on the relationship between situational interest and reading comprehension is that for stimulating tasks to have lasting effects on motivation and comprehension, they must be connected conceptually to further knowledge. That view is illustrated in the following scenario:

Event 1: The teacher enables students to perform a stimulating task, such as a hands-on interaction in the classroom.
Event 2: The stimulating task arouses situational interest in the students.
Event 3: Immediately following the performance of the stimulating task, and during the occurrence of situational interest, the students read texts and gain knowledge that is intimately related to the stimulating task.

In this scenario, Events 1–3 may be termed an interest-based reading episode. We propose that the frequent occurrence of such episodes is related to improved reading comprehension. Next, we describe each of the three phases and their relationships in detail.

Our conceptual framework contains the phrase *stimulating task,* proposed by Nolen and Nichols (1994), to refer to a classroom activity that elicits situational interest from students. Stimulating tasks may serve the function of increasing situational interest; one task that teachers use frequently is a hands-on activity. Zahorik (1996) and others suggested that hands-on activities consist of students physically interacting with a concrete object or event. That activity might include students dissecting an owl pellet, observing and drawing the moon, performing a reenactment of early explorers, building a model of colonial life, or experimenting with aquatic bugs. In all cases, the students are using multiple senses of hearing, seeing, touching, and smelling to describe an object (e.g., the moon) or an event (e.g., the Vikings discovering North America).

During such hands-on interactions, students are not passive; the teacher expects them to actively address such questions as, "What is it? What are its parts? How are they related to each other? Can I draw this? Can I explain how it is related to the conceptual theme?" Although a hands-on activity may increase situational interest, it might not be associated with a longer term conceptual theme and series of content goals for learning, and, thus, will not lead to increased reading comprehension. For example, dissecting an owl pellet is exciting because students may find the skulls of mice or voles. If the owl pellet is linked to the ecology of birds, the hands-on activity will be meaningful and may lead to increased reading comprehension. However, if the owl pellet dissection is not a manifestation of a major phenomenon in the network of knowledge that students need to learn, it will not promote deep conceptual learning.

If the stimulating task is provided in the context of an extended conceptual theme in a subject, one can assume that situational interest will occur for a majority of students. The occurrence of such situational interest refers to several affective and cognitive processes. Usually high, positive affect is accompanied by focused attention and curiosity (Schiefele, 1999). In a situational-interest activity, several important cognitive processes also occur. Students are highly attentive to the object or event and will spontaneously express their background knowledge. If they observe and draw the moon during the day, students often will recall other times that they have seen the moon and how it looked. Coincident with the priming of background knowledge is the occurrence of spontaneous questioning (Ross, 1988).

After students' situational interest has been elicited by the stimulating task of performing hands-on interactions, the next step is for students to connect directly the situational interest to deeper knowledge and conceptual themes. An approach to achieve that outcome is for students to read texts on the objects or the events in the hands-on activity with some teacher guidance. For example, after dissecting an owl pellet, students should read intently to learn about owls and their survival. After building a model of a colonial New England house, they should read closely about houses or life in different colonies. Schiefele (1999) showed that students process information in text deeply if they possess a high level of situational interest for the topic of the text. Reading comprehension of text is relatively high when students are curious or excited about the topic because of situational interest generated from performing a stimulating task, such as a hands-on activity. Book reading often will expand the background knowledge that the stimulating task primed or address questions that developed when the students performed the task. Thus, the third phase of the interest-based reading episode fostered relatively effective reading comprehension for texts in that topic domain.

An important assumption for the third phase is that books are accessible and that teachers provide support for reading the books in conjunction with a hands-on activity. Without books that are accessible, topically related to the hands-on interaction, and pitched at an appropriate difficulty, the book-reading phase of the interest-based reading episode cannot occur.

It is possible to view the interest-based reading episode as an individual difference variable. Such an interest-based reading episode is an individual difference variable because some students may experience more episodes than others during a specified period of time in a classroom. For example, a student may dissect one owl pellet, be interested in it, and read about it briefly. Another student may dissect two owl pellets that differ in place of origin, be interested in both of them, and read about the survival of owls in both regions. The second student experienced two interest-based reading episodes, whereas the first student experienced one episode. Our expectation is that students who experience more interest-based reading episodes will have a greater increase in reading comprehension than will students who experience fewer interest-based reading episodes. In other words, interest-based reading episodes may be viewed as an individual difference variable that one expects to influence reading comprehension.

Inherent within the interest-based reading episode is an expectation. We expect that the interest-based reading episode, as an individual difference variable, will correlate with students' development of generalized motivation for reading. As students experience situational interest more frequently, in ways that are associated with book reading, their intrinsic motivation for book reading is likely to be enhanced. For instance, students who experience 25 interest-based reading episodes in a classroom during a 2-week period will likely have a higher rate of motivation than will students who experience 1 interest-based reading episode during that period. If those motivation processes do not increase, then students will not be likely to improve their reading comprehension. In other words, students' reading motivation is a mediator that links the interest-based reading episode to the outcome of improved reading comprehension.

We tested whether motivation mediates the effect of stimulating tasks on reading comprehension. Our hypotheses were that (a) students who were given a high number of stimulating tasks related to reading would have higher reading comprehension scores than would students given a low number of stimulating tasks related to reading, controlling for prior comprehension and quality of task performance; (b) students who were given a high number of stimulating tasks related to reading would have higher reading motivation scores than would students who were given a lower number of stimulating tasks; and (c) the effect of reading-related stimulating tasks on reading comprehension would be mediated by students' reading motivation.

Method

Participants

Participants included 98 students in Grade 3 of an elementary school in a mid-Atlantic state. The students were located in four classrooms of two Title 1 schools; 53% were boys and 47% were girls. The students' ethnicity was 53% Caucasian, 24% African American, 6% Asian, 6% Hispanic, and 11% Other. Eighteen percent qualified for special education, and 3% were enrolled in English-as-a-second-language classes. The two intervention groups compared in this study were students in classrooms that provided a high number of stimulating reading activities and students in classrooms that had a low number of stimulating reading activities. The two groups did not differ significantly on any demographic variables.

Instruction Conditions

We identified two instruction groups. Two teachers provided a high number of stimulating tasks related to reading, and two teachers presented a low number of stimulating tasks related to reading. The teachers from four different, self-contained classrooms in two schools participated and showed natural variations in the number of stimulating tasks that they afforded their students. All four classrooms participated in an intervention intended to increase reading comprehension in Grades 3–5. In the intervention, known as Concept-Oriented Reading Instruction (CORI), teachers linked reading fiction and nonfiction books to science activities (Guthrie, Wigfield, & Perencevich, 2004). Science observations and experiments provided hands-on interactions that were exciting to students. The number of stimulating activities, in the form of hands-on interactions, varied between the four classes participating in the intervention, allowing us to create two groups of classes within the larger intervention.

All classes participated in one to four science investigations that included an owl pellet dissection, observation of guppy behavior, an experiment on guppy defense, and an observation of a predatory diving bug. Differences between the high- and low-stimulating task groups were the number and variety of observations, drawings, questions, hypothesis formations, and interpretations of findings. The two groups worked toward the same content goals from a science inquiry that focused on survival of animals in their habitats, especially owls in a terrestrial biome and predatory diving bugs in a freshwater, aquatic biome. In the science inquiry, both groups posed questions based on background knowledge, formulated hypotheses, observed the phenomenon (the owl pellet or the diving bug), designed an investigation, identified important variables, collected data, represented data in tables and graphs, and drew conclusions accompanied by explanations containing survival concepts. The science processes were highly similar to those used in a variety of science education studies (Linn & Thier, 1975; Smith & Welliver, 1990).

The teacher initiated the owl pellet investigation by introducing students to a diversity of biomes throughout the world and by taking a habitat walk near the school to experience a sample of woodland in a temperate zone. Students read and discussed how birds survive in various habitats and biomes. The teacher emphasized the ecological processes of feeding, predation, defense, locomotion, reproduction, communication, respiration, competition, niche, adjustment to habitat, and habitat conservation. After discussing owls briefly, students observed an owl pellet, made drawings of it, formed predictions about its contents, and wrote related questions. Then they dissected the owl pellet and used charts to classify the bones and other contents of the pellet. The questioning, dissecting, and classifying took place over 1 week. Students simultaneously read about owls, their habitats, and their survival processes. Furthermore, they read stories such as *Owl Moon* (Yolen, 1987) and native North American legends about owls. Continuing their science inquiry, they created tables and graphs to describe their findings from the owl pellet dissection and drew conclusions about the feeding and predation of owls in comparison with other birds in a temperate forest. The high-stimulating task group observed more owl pellets, wrote more questions, formed more classifications of the contents, and drew more conclusions from their findings than did the group in the low-stimulating task condition.

In the predatory diving bug investigation, students studied adaptations to aquatic environments that the teacher initiated by a field trip to a local pond. They made observations, drew pictures, and posed questions about what lives in a pond. In addition to collecting pond insects, students observed guppies and a predatory diving bug. They wrote questions and hypotheses about when the bug would hunt and how fish (guppies) would defend themselves by hiding in grasses or by forming groups. Students designed an experiment to test a hypothesis and to collect data; they used tables and graphs to represent their data. Finally, they drew conclusions that explained their results of the diving bug predation experiment with concepts of ecological processes. The high-stimulating task group performed approximately twice as many of those activities, including more observations, questions, and experiments than did the low-stimulating task group, and they drew more conclusions than did the low-stimulating task group. The teachers provided an ample supply of books on aquatic plants and animals and the ways that they survive in ponds and lakes. The reading material included nonfiction books in a variety of grade levels appropriate to the students, narrative stories, and chapter books relevant to the theme of survival in wetland environments.

Instructional Context

All teachers and students in both intervention groups participated in a program that included the same reading goals, text materials, strategy instruction, and support for reading motivation and engagement. The time of instruction in all classrooms was 90 min daily for 12 weeks, and it was constant across the two intervention groups. All teachers participated in the same professional development activities in preparation for the instruction (see Guthrie, Wigfield, Barbosa, et al., 2004).

The group with the high number of stimulating tasks in the form of science processes participated in more activities of each type of science process than did the group that experienced the low number of stimulating tasks related to science processes connected to reading.

Table 1 shows that the high-stimulating task group performed a mean of 6.38 observations per student (as indicated by the number of drawings of the science objects); the low-stimulating task group had a mean of 3.64 observations (as indicated by the number of drawings of science objects). The number of science questions posed by the high-stimulating task group was higher ($M = 20.10$) than was the number of science questions asked by the low-stimulating task group ($M = 13.23$). The high-stimulating task group ($M = 3.02$) posed a larger number of hypotheses than did the low-stimulating task group ($M = 1.21$). Furthermore, the high-stimulating task group ($M = 4.56$) drew more tables and graphs to represent their data than did the low-stimulating task group ($M = 2.02$). Each of those differences was statistically significant.

In addition, the total average number of stimulating tasks performed by the high group was 34.20, whereas the number of tasks performed by the low group averaged 20.44, which was a statistically significant difference with an effect size of 1.74. Although the nature of the tasks was identical for both groups, the high-stimulating task group performed tasks under the teacher's guidance. That is, the high-stimulating group performed more science observa-

TABLE 1. Numbers of Tasks Performed by High and Low Groups

Variable	Group	*n*	*M*	*SD*	*SEM*
Number of observations	LST	47	3.64	1.82	.27
	HST	42	6.38	3.50	.54
Number of questions	LST	47	13.23	6.04	.88
	HST	41	20.10	6.75	1.05
Number of hypotheses	LST	47	1.21	.88	.13
	HST	41	3.02	.91	.14
Number of tables and graphs	LST	46	2.02	1.36	.20
	HST	41	4.56	1.91	.30
Number of conclusions	LST	34	5.47	.71	.12
	HST	39	6.13	1.08	.17
Total number of stimulating tasks	LST	46	20.44	7.86	1.16
	HST	40	34.20	9.41	1.49

Note. HST = high number of stimulating tasks; LST = low number of stimulating tasks.

tions, asked more questions, drew more graphic representations of their data, and more actively used their sensory systems of seeing, touching, and manipulating the science object (e.g., an owl pellet) or the science event (e.g., the predatory diving bug hunting for fish and snails in an aquarium).

Reading goals and materials. For both groups, the reading goals emphasized comprehension of information text and literary text. Teachers provided support for students' reading fluency in 15-min sessions every other day, and they provided explicit vocabulary instruction daily. However, the emphasis was on gaining content knowledge from information texts and increasing literary understanding from narrative texts and poetry. All classes used the same texts, which included information books on the conceptual theme of animal survival habitats and the subthemes of "Birds Around the World" and "Life in Freshwater Habitats." Approximately 48 information books on the conceptual theme were available, and the majority of students read approximately 4 fiction chapter books.

Strategy instruction. To facilitate development of reading comprehension, teachers provided explicit instruction in six comprehension strategies that have been emphasized by the National Reading Panel (2000) and other sources (Block & Pressley, 2002; Duke & Pearson, 2002). Those cognitive strategies for reading comprehension include activating background knowledge, questioning, searching for information, summarizing, organizing graphically, and structuring stories. The teachers emphasized each strategy for 1 week during the first 6 weeks. Then they systematically integrated the strategies and combined them during the second 6 weeks of the 12-week intervention. The instruction enabled students to gain command of strategies and use them actively in conjunction with each other. The strategies facilitate deep processing of text and the integration of text with prior knowledge and experience (see Taboada & Guthrie, 2004).

Support for reading motivation. For the majority of students, improving reading comprehension requires effort and persistence. That cognitive engagement requires motivational support, which the teachers explicitly provided in several ways (see Guthrie, Wigfield, & Perencevich, 2004). The teachers afforded students a certain amount of autonomy over the topics of study and the specific texts that the students used to learn information on the conceptual theme. Such choices facilitate investment in gaining knowledge and in comprehending text (Guthrie & Humenick, 2004). Teachers provided support for students' collaborative activities in learning from text by employing reading in pairs and writing chapter books on the conceptual theme in teams of 4–6 students. In addition, teachers provided the hands-on activities of science observations and experiments related to the conceptual theme of "Survival of Life on Land and Water," which generated situational interest and curiosity for reading.

Professional Development for Teachers

All teachers in both intervention groups received the same professional development activities to help them implement their interventions. The professional development workshop consisted of 10 days during the summer and half-day follow-up sessions from early September to early December during the program's implementation. To determine the quality of the program's implementation, we videotaped each teacher for two 1-hr lessons and interviewed the teachers as they viewed the tape to establish their rationale for their classroom practices. We coded the tapes and interviews to determine the level of stimulating tasks in the form of hands-on activities in the science portion of the intervention. (For a description of the quality of implementation monitoring, see Guthrie, Wigfield, & Barbosa, 2004)

We described teacher practices in terms of the extent to which they showed high quality and quantity of instructional support for students' performing stimulating tasks in the form of hands-on science activities. The scale was 1 (*low*) to 4 (*high*). For the use of stimulating tasks, the low-stimulating task classrooms had a mean of 2.5, and the high-stimulating task classrooms had a mean of 4.0, showing a clear distinction between the two groups on the extent that the teacher supported a large number of stimulating activities. Four additional teaching practices described in the quality implementation included (a) use of knowledge goals for reading instruction, (b) use of interesting texts for reading instruction, (c) support for students' learning choice, and (d) support for collaboration in learning from text. Teachers in the high- and low-stimulating task groups were highly similar on those practices. The high-stimulating task group had a mean of 3.25, and the low-stimulating task group had a mean of 3.37; these were highly comparable. Therefore, the motivational practices of using content goals for reading instruction, drawing on interesting texts in language arts instruction, providing choice, and supporting students' collaborative activities were similar across the two groups. However, the use of stimulating tasks was more evident in the high group than in the low group.

The teachers expected students in both groups to complete portfolios throughout the intervention to provide records of their participation in stimulating tasks related to reading. We collected the portfolios during the middle and end of the 12-week intervention period, and then photocopied and returned them to the teachers for redistribution to the students. We coded the portfolios for the quantity and quality of a set of science processes, including (a) observations, (b) questions, (c) hypotheses, (d) table and graphic representation, and (e) conclusions. Researchers have found that those processes are empirically valid indicators of children's expertise in the scientific method.

For example, Allen (1973) and Smith and Welliver (1990) reported that drawing observations is a sensitive measure that predicts general science achievement. Questioning about a science phenomenon is viewed widely as integral to the science process (Allen; Davis, Raymond, Rawls, & Jordan, 1976). According to many science educators, forming hypotheses to test is a central, measurable process (Davis et al.; Linn & Thier, 1975; Smith & Welliver). Especially important is identifying variables in experimental or observational designs (Bowyer & Linn, 1978; Burns, Okey, & Wise, 1985; Linn & Thier; Smith & Welliver). Representing data with tables and graphics is a science process (Bowyer & Linn; Burns et al.; Smith & Welliver). Finally, drawing conclusions from data and explaining results are often merged (Bowyer & Linn; Burns et al.; Smith & Welliver). Three coders evaluated the portfolios using a coding rubric that is described in the following paragraphs.

Measures

Coding rubric for the drawings. We first analyzed student portfolio drawings to determine whether they were science drawings, which were drawings that were generated either as the result of an observation before or during an experiment or to display science knowledge. Drawings that were created for illustrating a book were not considered in this analysis. Once we determined that a drawing served a scientific purpose, we coded it in terms of two dimensions: features and quality. We gave each science drawing a feature score ranging from 1 to 3, on the basis of the extent of the labeling of the features in the drawing. A drawing that had a minimum of zero-labeled features and a maximum of one-labeled feature was given a feature score of 1. Drawings that contained 2 to 5 labeled features were given feature scores of 2. Drawings that had six or more labeled features received a feature score of 3. Each drawing also received a quality score from –1 to 1, which was based on the accuracy of the representation of the object being drawn. We summed the feature and the quality scores for each drawing to create a single final score for each drawing, ranging from 0 to 4, which we recoded to range from 1 to 5.

Rubric for questions. We initially categorized student questions found in the portfolios as either a science or a reading question; only science questions were coded. Science questions were then separated into either science process questions or science reading questions. Science process questions were questions generated from an observation, a science experiment, or another hands-on classroom activity. Science reading questions addressed animals or aspects of animals that were prompted by a text. We coded samplings of one third of the science process questions for each student.

We coded each science process question with a four-level questioning rubric (Taboada & Guthrie, 2004). We coded simple science process questions that requested factual or trivial information as Level 1 questions. Level 2 questions requested global information about a general ecological concept or an aspect of survival. Questions that probed for a more elaborated explanation about a specific ecological concept and contained evidence of an animal survival trait or characteristic were Level 3 questions. Level 4 questions inquired about the complex interactions among multiple survival concepts or across multiple organisms.

Rubric for hypotheses. We first sorted student hypotheses into four categories according to the type of science activity for which we created each hypothesis. We coded hypotheses associated with three types of science investigations (guppy behavior observation, guppy defense experiment, predatory diving bug experiment) according to one rubric. We coded hypotheses for the fourth science activity, the owl pellet investigation, according to a slightly different rubric because students expressed them as predictions.

We coded all hypotheses in terms of the presence or absence of two components of hypotheses: (a) identification of the variables and (b) description of the expected response of the organism or the object to the variable. With respect to the first component, the identification of variables, each hypothesis received a score of 0 or 1. A score of 1 indicated that the student had identified the variable in the experiment and had generated a description of the two different environmental conditions that were to be contrasted as a result of the variable; otherwise, the student received a 0.

We coded the second component, the response of the organism or the object to the variable, on a 5-point scale, ranging from 0 to 4. The code for that component was based on the description of the response that was expected to occur in the organism and the evidence given to support this claim with ecological concepts. For example, we gave a score of 1 to a hypothesis that simplistically described the change the student expected to occur in the organism, without giving an explanation. We gave a score of 4 to an elaborated description of the expected effect with a reason consisting of the core survival concepts taught in the CORI classroom. For the owl pellet, we gave a score of 1 to a hypothesis that included one or two items that were reasonable expectations and a score of 4 to an owl pellet hypothesis that included a conceptual explanation. In each type of hypothesis, we summed the scores for each of the two components, resulting in a final score with a minimum of 0 and a maximum of 5.

Rubric for tables and graphs. We coded each table and graph in the students' portfolios on a 2-point scale. On the basis of the analysis of the teacher-given or task-specific instructions, we gave a score of 2 to a table or a graph that appeared to be complete. We considered tables that were missing data and graphs that were missing elements to be incomplete, and we gave them a score of 1.

Rubric for conclusions. Student conclusions were available for the guppy experiment and were coded on scale, in terms of four components: (a) a qualitative or quantitative representation of the experiment's results (Scale 1–3), (b) an explanation of results by means of variables (Scale 1–4), (c) a description of a cause-and-effect relationship between the variables (Scale 1–2), and (d) an elaboration of any aforementioned component (Scale 1–2). Each conclusion received a total score that resulted from totaling the scores from each of the four components. Conclusion scores ranged from a minimum of 4 to a maximum of 11.

The high- and low-stimulating task groups differed significantly on each task that we measured from the portfolios. The tasks included number of observations, questions, hypotheses, tables and graphs, and total number of stimulating tasks (see Table 1). Data confirmed that the high-stimulating task group participated in a larger number of hands-on activities in the science inquiry aspect of the intervention than did the low-stimulating task group. The data also confirmed the design intended to contrast the two groups and the videotape coding of the extent that teachers provided stimulating tasks in the classrooms.

Reading comprehension. We used two measures of reading comprehension: (a) a comprehension measure developed for this project and (b) the Gates-MacGinitie Reading Comprehension Test. In September, students received a reading comprehension pretest. Classrooms were randomly assigned a 1,000-word passage on one of four animals (bat, shark, polar bear, or wolf). After reading the passage on the life and survival of one of the four animals, the students performed a rating task to show their text comprehension. The response format of the assessment consisted of rating the relatedness of key words and terms in the text. For example, in the polar bear text, students rated the relatedness of hunt and seal (highly related), as well as hunt and fur (less highly related) to show their understanding of key concepts and relationships in the text. Researchers have shown that this task has high reliability (Cronbach's $\alpha > .85$) and correlates significantly with standardized achievement tests and experimental reading comprehension tasks. The reading comprehension measure administered in September correlated significantly with the standardized test (Gates-MacGinitie) administered in December, $r(82) = .25$, $p < .02$. The comprehension section of the Gates-MacGinitie test (Form S) given in December required 45 min; reliability exceeded .90.

Reading motivation. We used two measures of reading motivation: (a) student self-report measure and (b) teachers' ratings of student motivation. The Motivation for Reading Questionnaire (MRQ; Wigfield & Guthrie, 1997), which teachers administered as a preassessment in September and as a posttest assessment in December, required children to respond to Likert-type items on a 4-point scale. The MRQ measures intrinsic reading motivation, extrinsic reading motivation, and reading self-efficacy (Wigfield & Guthrie). We combined the intrinsic motivation subscales of curiosity, involvement, and preference for challenge to form an intrinsic motivation composite for this investigation (Cronbach's $\alpha = .76$). Table 2 shows that the intrinsic motivation composite administered in December correlated significantly with teachers' ratings of intrinsic motivation in December, $r(85) = .26$, $p < .02$, but not teachers' ratings of extrinsic motivation, which indicates convergent and discriminate validity for this measure.

In December, teachers rated the students individually with regard to their intrinsic motivation, extrinsic motivation, and self-efficacy for reading. We gave the teachers a definition of each construct and asked them to rate all their students. We summed the intrinsic motivation and the self-efficacy ratings to form a composite motivation variable because they correlated significantly.

Results

The means and standard deviations of all variables entering regressions are shown in Table 1, and the correlations among variables are given in Table 2. An instructional condition consisting of a high or low number of stimulating tasks in the form of hands-on science activities correlated with all of the outcome variables with which it was theoretically expected to be associated, including reading comprehension, $r(81) = .36$, $p < .01$, and motivation (teacher rating), $r(86) = .36$, $p < .01$.

The correlation of the instructional group variable and number of stimulating tasks was significant, $r(86) = .63$, $p < .01$. That correlation signifies that the instruction group

TABLE 2. Correlations Among Variables in Study of Stimulating Tasks for Reading

Variable	1	2	3	4	5	6	7	8
1. Reading comprehension posttest[a]								
2. Motivation (teacher ratings) posttest	.66**							
3. Motivation (self-rating) posttest	.19	.26*						
4. Science process number	.47**	.61**	.24*					
5. Science process quality	.38**	.46**	.03	.65**				
6. Reading comprehension pretest	.23**	.16	–.08	.17	.19			
7. Motivation (self-rating) pretest	.00	–.06	.46**	.05	–.05	–.35**		
8. Instruction groups[b]	.36**	.36**	.15	.63**	.30**	.02	.13	

[a]The standardized test was Gates-MacGinitie (ESS; extended scale score) given after the intervention. [b]The instruction groups were: 2 = *high-stimulating activities* and 1 = *low-stimulating activities*.
*$p = .05$. **$p = .01$.

that we expected would have a high number of stimulating tasks was provided a higher number of hands-on activities, according to the students' portfolio records. The mean for the low-stimulating tasks group was 20.44, and the mean for the high-stimulating tasks group was 34.20, which provides partial confirmation of the efficacy of the instructional conditions.

The variable of number of stimulating tasks, based on portfolios, also correlated with the expected outcome variables of reading comprehension, $r(79) = .47$, $p < .01$, intrinsic motivation (teacher rating), $r(84) = .61$, $p < .01$, and intrinsic motivation (self-report), $r(75) = .24$, $p < .05$. (See Table 3.) Those correlations are slightly higher than the correlations of the instructional group and the outcome variables because there were within-classroom contributions to the associations, as well as between-classroom contributions.

The reading comprehension pretest significantly correlated with the outcome variable of reading comprehension, $r(76) = .23$, $p < .01$. Because the correlation was positive, we used reading comprehension as a controlling variable in the regression analyses. Entering the reading comprehension pretest as the first variable reduced preexisting differences in reading comprehension before we examined the effects of the variables of instruction groups or number of stimulating activities on reading comprehension. The variable of science process quality also correlated significantly with the reading comprehension posttest, $r(81) = .38$, $p < .01$. Therefore, we used science process quality as a controlling variable to examine the effect of number of stimulating tasks (science processes) on reading comprehension.

Our first hypothesis was that the instruction group with the high number of stimulating activities related to reading would show higher reading comprehension than would the instruction group with the low number of stimulating activities related to reading. We tested that hypothesis (Analysis 1, Table 4) in a multiple regression with reading comprehension by using the Gates-MacGinitie comprehension test (extended scale score) as the dependent variable. We entered the reading comprehension pretest first, the science process quality score second, and the instructional group variable third. Results shown in Table 4 were that the first variable, the reading comprehension pretest, was significant, $F_{change}(1, 74) = 4.14$, $p < .04$, the science process quality was significant, $F_{change}(1, 73) = 8.60$, $p < .004$, and the instructional group's variable was significant, $F_{change}(1, 72) = 5.56$, $p < .02$. The mean of the reading comprehension posttest for the low-stimulating tasks group was 467.51, and the mean for the group with high-stimulating tasks was 495.75, with an effect size of .71. Therefore, the first hypothesis was confirmed, according to those measures.

In another procedure for testing Hypothesis 1 (Analysis 2, Table 4), we used the variable of number of stimulating tasks measured at the individual level, rather than the instructional group as the independent variable. That alternate way to operationally define the independent variable captures individual differences in number of stimulating tasks performed related to reading, but it is less realistic as a representation of educational contexts than is the instructional grouping as a definition of the variable. We conducted a multiple regression with the Gates-MacGinitie comprehension test (extended scale score) as the dependent variable. The reading comprehension pretest entered first as an independent variable; science process quality entered second as an independent variable; and number of stimulating tasks was the third independent variable. Results showed that the three variables were significant: for the first variable, $F_{change}(1, 73) = 3.99$, $p < .05$; for the second variable, $F_{change}(1, 72) = 8.32$, $p < .005$; and for the third variable, $F_{change}(1, 71) = 12.12$, $p < .001$. The number of stimulating tasks accounted for 27% of the variance in reading comprehension after accounting for the students' pretest comprehension, which confirmed the first hypothesis with these measures.

Our second hypothesis was that the instruction group with the high number of stimulating tasks related to reading would show higher motivation in reading than would the instruction group with the low number of stimulating tasks related to reading. The first test (Analysis 3, Table 4) was a multiple regression with motivation (teachers' ratings) as the dependent variable. The first controlling variable was the students' self-reported motivations in the

TABLE 3. Means and Standard Deviations of Low-Stimulating Task and High-Stimulating Task Groups

Variable	Low-stimulating task group				High-stimulating task group				Total			
	n	*M*	*SD*	*SE*	*n*	*M*	*SD*	*SE*	*n*	*M*	*SD*	*SE*
Gates-MacGinitie grade equivalent	41	3.90	2.02	3.15	40	5.28	1.96	.31	81	4.58	2.09	2.33
Gates-MacGinitie extended scale	41	467.51	41.17	6.43	40	495.75	32.44	5.13	81	481.46	39.53	4.39
Motivation posttest	46	7.17	2.39	.35	40	8.73	1.60	.25	86	7.90	2.19	.24
Motivation pretest	45	26.36	5.54	.83	39	27.64	4.65	.74	84	26.95	5.15	.56
Reading comprehension pretest	45	.19	.35	5.16	38	.20	.28	4.60	83	.19	.32	3.48
Science process quality	47	11.34	3.98	.58	42	13.60	3.33	.51	89	12.41	3.84	.41

TABLE 4. Multiple Regression Analyses for Stimulating Tasks, Motivation, and Reading Comprehension

Variable		R	R^2	R^2_{change}	F_{change}	Significance F_{change}	Final β
Analysis 1							
Dependent:	Reading comprehension (posttest)[a]						
Controlling:	Reading comprehension (pretest)	.23	.05	.05	4.14	.04	.17
Controlling:	Science process quality	.39	.17	.10	8.60	.004	.22
Independent:	Instruction condition[b]	.46	.22	.06	5.66	.02	.27*
Analysis 2							
Dependent:	Reading comprehension (posttest)[a]						
Controlling:	Reading comprehension (pretest)	.23	.05	.05	3.99	.05	.15
Controlling:	Science process quality	.39	.15	.10	8.32	.005	.09
Independent:	Science process number	.52	.27	.12	12.12	.001	.42**
Analysis 3							
Dependent:	Motivation[c]						
Controlling:	Motivation (pretest)[d]	.06	.00	.00	.32	*ns*	–.07
Controlling:	Science process quality	.46	.21	.21	20.49	.000	.37**
Independent:	Instruction condition[b]	.51	.26	.05	4.62	.03	.23*
Analysis 4							
Dependent:	Motivation[c]						
Controlling:	Motivation (pretest)[d]	.07	.00	.00	.42	*ns*	–.10
Controlling:	Science process quality	.46	.21	.20	19.67	.000	.08
Independent:	Instruction condition[b]	.65	.40	.21	28.55	.000	.60**
Analysis 5							
Dependent:	Reading comprehension (posttest)[a]						
Controlling:	Reading comprehension (pretest)	.23	.05	.05	4.14	.04	.17
Controlling:	Science process quality	.39	.15	.10	8.60	.004	.22
Controlling:	Motivation	.67	.44	.29	37.78	.000	.56**
Independent:	Instruction condition[b]	.68	.46	.02	2.69	*ns*	.16
Analysis 6							
Dependent:	Reading comprehension (posttest)[a]						
Controlling:	Reading comprehension (pretest)	.23	.05	.05	3.99	.05	.10
Controlling:	Science process quality	.31	.09	.04	3.35	*ns*	.08
Controlling:	Motivation[c]	.66	.44	.35	44.45	.000	.53**
Independent:	Science process number	.67	.45	.01	1.47	*ns*	.14

Note. [a]Gates-MacGinitie. [b]Total number of stimulating tasks. [c]Teachers' rating of intrinsic motivation. [d]Student self-report of intrinsic motivation. *$p < .05$. **$p < .01$.

pretest, which we entered to reduce any differences attributable to motivation prior to instruction. The second controlling variable was the science process quality, and the third variable was the instructional condition of stimulating tasks. The first variable was not statistically significant, but science process quality was significant, $F_{change}(1, 78) = 20.49$, $p < .001$, and the treatment variable had a significant effect on motivation, $F_{change}(1, 77) = 4.62$, $p < .03$. The mean for the high number of stimulating tasks group was 8.72, and the mean for the low group was 7.17, with an effect size of .71.

We further tested the second hypothesis with the variable of number of stimulating tasks measured at the individual level, rather than the instructional group as the independent variable. We conducted a multiple regression (Analysis 4, Table 4) with motivation (teachers' ratings) as the dependent variable, the student motivation prescore as the first independent variable, science process quality as the second variable, and number of stimulating tasks as the third independent variable. Results showed that the first independent variable, initial motivation, was not significant but that the second variable, science process quality, was significant, $F_{change}(1, 77) = 19.67$, $p < .001$, and the number of stimulating tasks had a significant effect on motivation, $F_{change}(1, 76) = 28.55$, $p < .001$. Number of stimulating tasks accounted for 22% of the variance in students' motivation after accounting for students' initial motivation and science process quality. That method of analysis also confirmed Hypothesis 2.

We expected that students' motivation for reading would be associated with their reading comprehension, making it consistent with other research (Gottfried, 1990; Wang & Guthrie, 2004). That finding was shown in Table 2 (teachers' ratings) where motivation correlated significantly with the reading comprehension posttest, $r(81) = .66$, $p < .01$, and the instructional condition was correlated with motivation, $r(86) = .36$, $p < .01$. Therefore, one can reasonably ask whether the effect of stimulating tasks on reading comprehension is mediated fully or partially by students' motivation.

To examine that issue, we conducted a multiple regression with reading comprehension as the dependent variable (Analysis 5, Table 4). The first independent variable was the pretest of reading comprehension. The second independent variable was the science process quality, and the third variable was students' motivation (teachers' ratings) at the end of the intervention. The fourth independent variable was the instruction groups of high-stimulating tasks or low-stimulating tasks. If the effect of stimulating tasks on reading comprehension is mediated by motivation, then there will be a lower contribution of stimulating tasks to reading comprehension after the contribution of motivation to reading comprehension is accounted for. We found that the first variable of the comprehension pretest had a significant effect, $F_{change}(1, 74) = 4.14$, $p < .04$, the second variable of science process quality was significant, $F_{change}(1, 73) = 8.60$, $p < .004$, and motivation had a significant effect, $F_{change}(1, 72) = 37.78$, $p < .001$. The variable of instruction groups did not have a significant effect.

To examine the issue using a different representation of the independent variable, for example, the number of stimulating tasks, we conducted a multiple regression with reading comprehension as the dependent variable (Analysis 6, Table 4). The first independent variable was the pretest of reading comprehension. The second independent variable was science process quality, and the third variable was students' motivation (teachers' ratings) at the end of the intervention. The fourth independent variable was the number of high-stimulating tasks measured at the individual level. Results were that the first variable of the comprehension pretest had a significant effect, $F_{change}(1, 73) = 3.99$, $p < .05$; the second variable, science process quality, had no significant effect; but motivation had a significant effect, $F_{change}(1, 71) = 44.45$, $p < .001$. The instruction groups variable had no significant effect. The results confirm the previous analysis that stimulating tasks did not increase reading comprehension directly after we accounted for student motivation.

Discussion

Our findings can be summarized by referring to Figure 1. As the figure depicts, the instructional conditions consisted of the number of stimulating tasks related to reading that teachers provided in the classroom. Two classrooms provided a relatively high number of stimulating tasks related to reading, and two classrooms provided a relatively low number of stimulating tasks related to reading during 12 weeks of integrated reading and science instruction for Grade 3 students. As an independent variable, number of stimulating tasks increased students' motivation at the conclusion of instruction when student motivation at the outset of instruction was controlled statistically.

As Figure 1 shows, the motivation variable predicted students' reading comprehension on the Gates-MacGinitie test when their reading comprehension at the beginning of the year was statistically controlled. When the two pathways are combined, it is evident that number of stimulating tasks increased motivation for reading, which was associated with increased reading comprehension on the standardized test. That result indicates an indirect effect of number of stimulating tasks on reading comprehension but no direct effect of number of stimulating tasks on students' reading motivation. Figure 1 also shows that number of stimulating tasks did not influence reading comprehension at the end of the intervention when students' motivation and quality of their science processes were controlled. The main mediator was motivation, which accounted for a high amount of variance in reading comprehension. The number of stimulating tasks measured at the individual level had a stronger effect on comprehension than at the class level as "operationalized" in instructional groups, which we discuss later in this section. Therefore, we confirmed the basic expectations of this study—that a high number of stimulating tasks would increase motivation and that motivation would increase reading comprehension.

Our findings are consistent with suggestions from previous investigators regarding the development of interest and the acquisition of intrinsic motivation. For example, Hidi and Harackewicz (2000) proposed that *situational interest,* which refers to positive but temporary affective responses to a stimulus or activity, can expand into *individual interest,* which refers to a more permanent, strong predisposition for participation in activities or for pursuit of certain goals. Hidi and Harackewicz suggested that two sets of conditions are important to their formulation: (a) Conditions needed to evoke situational interest should be established and (b) conditions

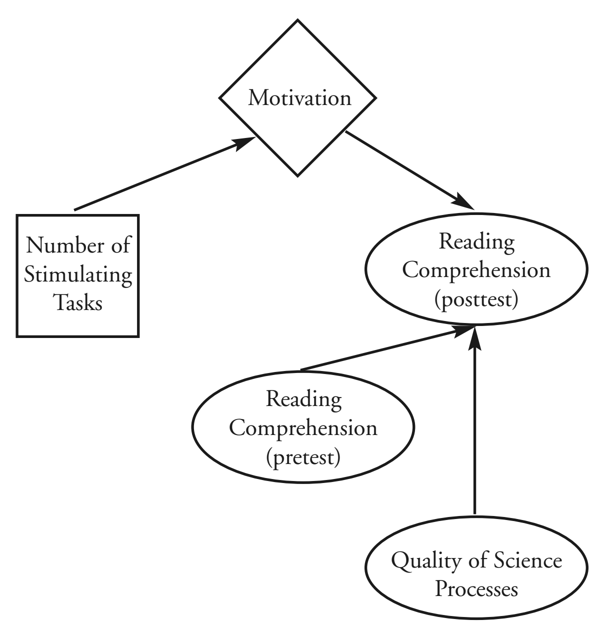

FIGURE 1. Model of effects of stimulating activities on motivation and reading comprehension.

required to enable situational interest to be transformed into individual interest should be specified and established.

Mitchell (1993) said that environmental conditions necessary to catch the students' interest should be identified, as well as the conditions required to hold the students' interest. However, Hidi and Harackewicz (2000) did not specify characteristics of those conditions and examples of variables that represent the conditions in classroom settings. Therefore, their model proposed phases of change in interest, but not in environmental conditions or processes necessary for the change to occur. Expanding on that view, Krapp (2002) suggested that "the central psychological mechanisms that support [the change from situational interest to individual interest] are internalization and identification" (p. 398). He said that "this means that the person has identified with the goals, actions, and topics related to this interest and, therefore, will not change his/her penchants easily and develop an entirely new pattern of personal interest from one day to the next" (p. 400). Krapp continued by suggesting that

> With respect to interest development, the need-related qualities of experience are important because they provide permanent, emotional feedback on the micro level of behavior regulation . . . and that a person will only engage continuously in certain tasks if he/she assesses these engagements as sufficiently . . . important, and if she experiences the course of interactions as positive and emotionally satisfactory. (p. 403)

Krapp said that environmental supports for competence, autonomy, and social relatedness, as described by Ryan and Deci (2000), represent conditions for internalization and identification that enable a situational interest to become transformed into an individual interest. However, Krapp did not present empirical evidence to test his hypothesis or present other empirical support.

To investigate empirically how situational interest occurs and expands to become individual interest, four specifications must be made beyond those provided by previous theorists. The first specification refers to the nature of the interest. In the present investigation, we examine the phenomenon of interest in reading. That is of special significance because we are further dedicated to examining whether the interest in reading leads to improvements in reading comprehension. Consequently, we are interested in situational interest in reading, such as the situational interest that could be evoked by a book. A particular book with a magnificent cover, lavish illustrations, and appealing text may entice a young student. The child's attraction to a specific book does not mean that he or she is motivated for reading in general nor even that he or she will read the entire book. However, the attraction represents a temporary, positive affective response to a text, which we describe as situational interest in reading.

We propose that situational interest in reading also could be evoked or increased by offering stimulating tasks related to the particular text being considered. For example, in the present investigation, students dissected owl pellets as a science activity. The owl pellet was arousing and commanded students' attention. They enjoyed looking at it, manipulating it, and dissecting it. When the stimulating task of dissecting an owl pellet is intimately related to a book on owls, owl pellets, and owl survival, the students' situational interest in reading this book is high. The book may contain pictures of owl pellets, photographs of owls, and text about the uniqueness of owls and their predatory behaviors, which are fascinating to children. Therefore, we propose that a stimulating task (e.g., dissecting an owl pellet or observing a stuffed owl), combined with the presence and accessibility of an interesting book on the identical topic, evokes situational interest in reading that book. The student's interest in reading is limited to that book, at that time, on that topic, and is not automatically generalized to other books and topics. We suggest that the source of situational interest, in this case the stimulating task, is an important specification to this study and to theoretical considerations surrounding development of interest.

Specifying environmental conditions that facilitate the development of interest from situational interest to individual interest also is valuable. The engagement perspective that provides the theoretical framework for this study gives such specifications. Classroom practices that foster the development of students' perceived competence, autonomy, and positive relations with others associated with a specific interest facilitate the development of intrinsic motivation related to this interest (Krapp, 2002; Skinner, Zimmer-Gembeck, & Connell, 1998). According to our classroom observations, as students read a book that evoked situational interest, in this case a book on owls, they may have become identified with reading about owls. As students formulated their questions for further reading (e.g., Why do owls hunt at night?), they became invested in finding the answer to their question. If the answer was available through text interaction, the students became identified with the answer, as well as the question. They took pride in the reading required to generate their new knowledge.

As students gained knowledge about the owls' locomotion, predation, competition, communication, and other survival processes that were initiated by reading about the owl pellet, they gained a sense of competence as experts on owls. In the classrooms in which we conducted this research, students received support for their competence, autonomy, and relatedness during reading instruction (see Guthrie, Wigfield, & Perencevich, 2004). The support linked to the situational interest in reading and the stimulating tasks afforded by the science observations of owl pellets. Therefore, the conditions suggested by Krapp (2002) as valuable for transforming situational interest to individual interest were present within the classrooms of this investigation.

There is an additional, important specification in our formulation of the development of interest in reading. We define the process of increasing interest in reading as dependent on the frequency of experiencing situational interest in reading in a context that continually facilitates long-term intrinsic motivation (or individual interest) in reading. It seems obvious that one 20-min experience of situational interest in reading a particular book is not sufficient to enable a student to become an intrinsically motivated reader. Multiple experiences of situational interest that are supported with multiple classroom practices to facilitate motivation are needed. When students experience multiple situational interests in reading, accompanied by perceived competence, autonomy, or relatedness in reading activities, then students increase their intrinsic reading motivation.

Likewise, students who have fewer experiences of situational interest in reading will have fewer opportunities for experiencing competence in gaining valued information, fewer occasions for directing their learning, and fewer interactions with peers. Consequently, the number of occasions in which students perform stimulating tasks related to reading will be a major contributing variable that influences their acquisition of intrinsic motivation for reading. The mechanism for change from situational interest to individual interest is specified as the frequency of experiencing situational interest in an engagement-supporting environment with an emphasis on knowledge goals, hands-on activities, choice, interesting texts, and collaboration.

The role of stimulating tasks for the development of reading interest has several important characteristics. Although researchers have hypothesized that stimulating tasks could lead to long-term motivation, they have not provided empirical support for the hypothesis nor specified the nature of the stimulating tasks (Hidi & Harackewicz, 2000; Nolen & Nichols, 1994; Pintrich, 2003). We suggest that the stimulating task must be intimately associated with the psychological process being developed. Hootstein (1995) noted that many classrooms contain stimulating tasks that are not academically significant, and, consequently, do not lead to enhanced motivation for academic activities or competencies. If the educator's goal is to increase motivation for solving mathematics problems, then the stimulating task must necessarily be a part of the mathematical problem-definition or problem-solving process.

Similarly in reading, to facilitate interest development, stimulating tasks must be integrally connected to the contents of texts and the students' activities to derive meaning from texts. In our investigation, texts contained pictures of owl pellets, illustrations of the contents of owl pellets (such as shrew skulls), and illustrations of owls with detailed information about owl predation, feeding, and reproduction. Therefore, the object of the reading (learning about owls) and the purpose of performing the stimulating task (learning about owls) contained many common elements that enabled students to identify the stimulating task with the target educational activity; in this case, developing conceptual understanding about owls. Under those conditions, the stimulating task must not be too time consuming, distract from the mainstream curriculum, or be restricted to a limited number of students.

From an educational perspective, stimulating tasks are egalitarian. All students in the classroom can perform the stimulating task, connect it immediately to books, and experience situational interest for reading. Stimulating tasks are proactive because teachers do not need to seek the preexisting interest of each child in the classroom and attempt to tailor literacy activities in myriad ways to all individuals, which often is impractical. Even for students with low initial interest in reading, participation in a stimulating task will foster reading interest, and the teacher can actively promote reading interest rather than wait for motivation to occur.

Additional research into the nature and type of stimulating tasks that are most effective and efficient in facilitating interest development is needed. The types of teacher support for competence, autonomy, and motivation that facilitate long-term interest among students who have experienced situational interest in reading should be studied. Finally, researchers should continue to explore reading comprehension and reading interest to identify their reciprocal relationships.

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